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Independent Telephone Exchange at Wilkesbarre.

The city of Wilkesbarre, Pa., is situated in a district favored by nature with beauty as well as with treasures buried beneath the earth's surface. Wilkesbarre and Scranton are the largest cities in the anthracite-coal region, which accounts for the great business transacted by the aid of the telephone. A year ago the Kellogg Switchboard and Supply company of Chicago installed a central-station equipment for 1,200 subscribers for the People's Telephone company of Wilkesbarre, but this equipment soon proved too limited for the business to be transacted, and therefore the Kellogg company is hard at work to provide a 600-line extension to give service by the first of August. The ultimate capacity of the exchange is to be 5,000 lines.

The Wilkesbarre exchange has been a success from the first day of its opening under the brilliant management of Mr. S. E. Wayland, who is also the general manager of the new Scranton exchange, which will be in operation by the first of September.

The accompanying illustrations show that the installation is of excellent material of a late type and, more than that, that it is well taken care of.

The switchboard (Fig. 1) at present consists of four sections of the multiple type. It is built of mahogany, and provided with the most modern two-lamp supervisory clearing-out system, by which the operator has complete control over each of the two subscribers and can supervise the conversation from start to finish without ever speaking to either of the two subscribers, except to ask the number of the person desired.

The current required for lighting the lamps, as well as for the relays which work the lamps and the relays that cut off the line drops from the line during conversation, and also the current for the automatic signal given by the subscriber by simply taking the telephone off the hook, is provided by a storage battery, consisting of 11 cells of type F 9 Chloride accumulators (Fig. 4, page 2.) The storage battery is kept in a separate room, so as to prevent the acid fumes attacking any of the telephone apparatus.

The storage battery is charged by Crocker-Wheeler motor-generators (Fig. 3), taking their primary current from the city mains. Crocker-Wheeler motor-generators are also installed for providing ringing-generator current.

The lines in the exchange are all metallic, and enter the building from the underground system, terminating upon Cook terminal heads (Fig. 2). From the Cook terminal heads they are carried to the main distributing frame, on which they are connected by so-called jumper wires to switchboard cables, terminating again in the answering jacks and drops at the switchboard.

The answering jacks and drops are so distributed that 300 appear in each section. All 1,200 lines are multiplied in each section, so that each operator can reach all subscribers. The multiple cables, running all the length of the switchboard in the rear, form a compact mass, but, nevertheless, each single cable is easy of access. These cables, being laid on a horizontal plane, give very attractive appearance to the visitor, and are shown with pride by the telephone company's employes.

The installation of the Wilkesbarre telephone plant, though not very large, has become a well-known factor in the Independent telephone field for its remarkable freedom from all kinds of troubles since the first day of its operation. It may be cited that all the troubles experienced during the first two weeks of operation in the whole plant, i. e., switchboard troubles, line troubles and subscribers' instrument troubles, combined, amounted to 16.

After six months' operation the wire chief told a casually visiting telephone man that he was afraid of losing the ability to "shoot" troubles, as there were none for him to keep practicing on.

As previously mentioned, the subscriber calls the exchange automatically by taking the telephone off the hook. This action throws a drop at the exchange and signals to the operator that the subscriber wants a connection. The falling of the drop at the same time lights a large red pilot lamp mounted in the upper part of the section for the purpose of notifying the operator that a call came in, in case she should not have noticed the falling of the drop. The operator then inserts her answering plug into the calling subscriber's jack, which operation energizes the cut-off relay, which cuts off the drop from the subscriber's line and connects this subscriber's line to her cord circuit. She then cuts in on the line with her listening key and asks the calling subscriber for the number of the desired line. Having received the number, she lifts her connecting plug and tests whether the line of the called-for subscriber is busy or not, by touching the tip of her plug to the test ring of the multiple jack of the called-for subscriber's line. If she receives a click in her ear, the line is busy, if not, the line is free, and she inserts her connecting plug into the multiple jack, letting go of the listening key. As soon as she has inserted her connecting plug, the called-for subscriber's telephone being still on the hook, the lamp supervising the called-for subscriber will light and remain lighted until the called-for subscriber takes his telephone off the hook, then the lamp will go out and thus indicate to the operator that the called-for subscriber is ready for conversation. Simultaneously with inserting the connecting plug the operator had pushed the ringing-key button to ring the subscriber, who has now answered. Now communication between the two subscribers is established, both plugs being in the jacks, and both supervisory lamps being extinguished.

As soon as the conversation is finished the subscribers will hang their telephones on the hooks. As soon as one of the subscribers hangs up, the lamp supervising his line will light, but the operator will not disconnect until both lamps are lighted, as the lighting of one lamp only indicates that one of the subscribers has hung up his telephone; the other subscriber may have left the telephone for some purpose or other, intending to return to take up again the conversation.

The supervisory system is very rapid, and, in connection with the well-trained and attentive operators at Wilkesbarre, brings it about that the service given is of the best kind; the subscriber has hardly removed the telephone from the hook before the familiar question, "Number?" sounds in his ear.

Among all the Independent exchanges the Wilkesbarre installation deserves the credit of being as neat, as efficient and as well managed as any.

FIG. 1. INDEPENDENT TELEPHONE EXCHANGE AT WILKESBARRE.—SWITCHBOARD AND CHIEF OPERATOR'S DESK.

Luminous Effects on Wires.

A metallic wire which is not covered by an insulating layer becomes covered with a luminous aureole when it is inserted in the circuit of an induction coil containing a spark gap or a vacuum tube. J. Borgman has further invested this phenomenon by means of wires sealed into cylindrical tubes and traversing their axes. The tubes were several feet long and three to six centimeters wide. Some of the tubes were traversed by capillary glass tubes containing liquid conductors. As exhaustion proceeds the luminous phenomena show a peculiar development. The aureole decreases in intensity and is gradually replaced by a series of equidistant stars, around which luminous disks are formed with their planes at right angles to the wire. The number of stars and disks increases, until the latter touch each other and fill the whole tube with a luminosity having a slightly stratified aspect. These effects are the same whether the tube is attached to the positive or the negative terminal of the secondary. When a spark-gap is inserted in parallel with it, and the wire is attached to the negative terminal, there is only a continuous luminous envelope, which broadens out as exhaustion proceeds and finally detaches itself from the wire. The stars reappear on attaching the wire to the positive terminal, and at a certain pressure the disks reappear also, their diameter increasing with the length of the spark gap. As exhaustion proceeds, the number of disks decreases, some of them remaining, while others disappear. Finally, they are transformed into nebulæ with a starry nucleus. The approach of a magnet has the effect of inclining the plane of the rings.

These observations are reported by Mr. Borgman in an article in Comptes Rendus. The abstract was made by Mr. E. E. F. d'Albe for the London Electrician.

A London firm of electricians, it is stated, has patented a novel decorative system of lighting rooms. The main idea is the insertion of transparent panels faced with negatives of well-known photogravures, through which filters subdued electric light, the effect being somewhat the same as the light of a church and eminently becoming. There is no glare and the pictures can be chosen according to the taste of the owner of the room.

Storage Batteries for Small Stations.[1]

By Louis A. Ferguson.

The adoption of storage batteries for use in central stations will depend upon the character of the load curve of the station, and the principles which apply to the use of batteries in large stations will hold true, to a large extent, in the stations of moderate or small capacities.

In considering the question of the use of a storage battery we must take into account, first, the relative cost of the battery as compared with that of engines, boilers and dynamos to provide for equal capacity. The cost of capacity in steam and electrical generating equipment is dependent solely upon the maximum power to be generated at any one time, and is not dependent upon the number of hours of use per day of the equipment. In the case of the storage battery, however, the cost is dependent not only upon the maximum energy to

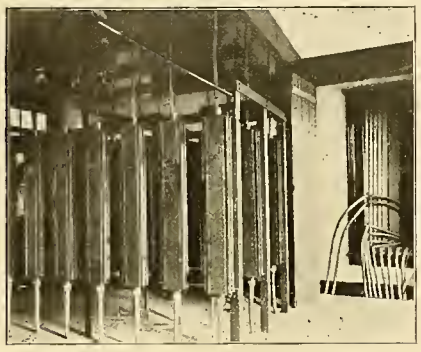


FIG. 2. INDEPENDENT TELEPHONE EXCHANGE AT WILKESBARRE.—TERMINAL HEADS.

be supplied at any one time, but also upon the length of time that the battery is required to do this maximum work. In other words, the cost of steam and electrical generating equipment is dependent upon the maximum kilowatt capacity, whereas the cost of a storage battery is dependent upon the kilowatt-hour capacity.

This being the case, we must consider carefully the load curve of the station, and if the characteristic of the curve is such that the average width of its peak is more than 1½ hours, then the initial cost of steam and electrical generating equipment to provide capacity for this peak will be less than that of the necessary storage-battery equipment, at the present market prices, to do the same work. If the curve has an average peak width of less than 1½ hours, then the initial cost of the storage battery will be less than that of the steam and electrical generating equipment to take care of this peak.

In Fig. 1 (page 3) is a curve which shows the capacity of a battery at various rates of discharge. This curve represents the discharge capacity, at from one to eight hours, of a battery having a capacity at the eight-hour rate of 11,200 ampere-hours. The discharge capacity of this battery at the eight-hour rate is 1,400 amperes, while at the one-hour rate it is 5,600 amperes, or, in other words, the discharge capacity of the battery in amperes at the eight-hour rate is one-quarter of what it is at the one-hour rate, the total capacity in ampere-hours of the battery at the one-hour rate being equal to one-half of its capacity at the eight-hour rate. The

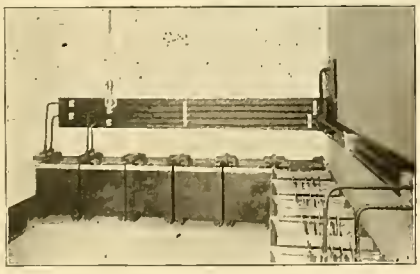


FIG. 4. INDEPENDENT TELEPHONE EXCHANGE AT WILKESBARRE.—STORAGE BATTERY.

curve shows the rate of discharge for various hours' use of the batteries of other sizes, following the same general characteristics.

The cost of a storage battery of moderate size, taking, for instance, one having a capacity of 500 amperes at the one-hour rate, would be, at the various rates of discharge, approximately as follows: One hour, $80 a kilowatt; two hours, $116 a kilowatt; three hours, $160 a kilowatt; five hours, $240 a kilowatt; eight hours, $320 a kilowatt. These figures include switchboard, end-cell switches and the battery erected complete, not including building investment.

The cost of a steam and electrical generating plant will, of course, vary widely with the class of apparatus employed. Assuming, however, $100 a kilowatt as a reasonable price for boilers, engines, steam piping, generators, stack and switchboard, we find, by referring to the curve of costs (see Fig. 1 also) that, as I before stated, where the average width of the peak of the load which is to be taken care of by the storage battery is 1½ hours, the cost of installation is the same for the storage battery as for the steam plant.

In these figures the cost of the building has been excluded, as it may be assumed to be the same for either installation.

The question of first cost, however, is not the only thing to be considered. The question of depreciation on the two classes of apparatus, economy of operation and the value of each class of apparatus as a reserve or guarantee to the customers of uniformity and reliability of service must also be taken into account.

We have all had sufficient experience in the use of steam and electrical generating equipment to determine to our own satisfaction what might be considered a reasonable depreciation on this class of apparatus. This, however, is perhaps not as easily determined in the case of the storage battery, as the question of its life in central-station use is as yet to some extent uncertain. The principal battery companies, however, have guaranteed to maintain some batteries sold by them up to the original standard of capacity and efficiency for a term of years, upon payment by the purchaser annually of a sum equal to a certain percentage of the original cost of the battery. I am not certain, however, that these battery companies are prepared to make such guarantees in all cases, as there are many conditions surrounding the use of the battery which must be considered; and the effect of these various conditions upon the life of the battery is perhaps as yet undetermined.

The operating expenses incident to the use of the storage battery are comparatively small. In very large and important installations it is desirable to have in charge a special man thoroughly experienced in the maintenance of a storage battery, but in moderate-sized stations it is unlikely that any additional labor would be required on account of the use of a battery beyond that ordinarily employed in the station. The amount of material necessary is almost negligible. Distilled or filtered water is the principal item, and perhaps once or twice a year additional acid will be required.

A storage battery operated under favorable conditions would show upon test an energy efficiency of 75 per cent. and an ampere-hour efficiency of 90 per cent. The yearly energy efficiency of a storage battery operated under ordinary central-station conditions, would, in all probability, not exceed 65 per cent.

Fig. 2 shows the work done by a storage battery on a summer's day. This battery is kept floating on the system at all times during the 24 hours, and is charged between midnight and seven o'clock in the morning, at the time when the generating capacity of the station is only partially needed to provide for the current required by customers.

The curve of the station on an ordinary summer's day would have no decided peak, but the curve which I show, as you will see, has a peak between 11 and 12 o'clock in the morning. This peak is due to a thunderstorm, which overclouds the city at that time. As you will see from the curve, the load has come on very suddenly, perhaps so quickly that it would be difficult to get additional engines and generators on the system before a reduction in the pressure was effected by the sudden increase of load. The storage battery, however, being connected to the system, immediately takes up the demand and carries this peak until the storm is over.

Fig. 3 shows the use of a storage battery on a winter's day, the battery being charged at the same hours as in summer, from midnight until 7 a. m., and being discharged at a high rate during the time of peak, which comes between the hours of four and six o'clock in the afternoon. This curve, as you will see, shows the battery discharge, not only at the time of the maximum peak, but also for an hour or more after the peak has begun to fall, and this illustrates one advantage of the battery which I have not so far mentioned.

It very often happens in any system of distribution that feeders are of unequal length and carry unequal loads. The pressure, therefore, which is maintained on the bus-bar of the station is limited by the safe carrying capacity of the shortest feeders. When the short feeders are fully loaded the long feeders will be overloaded, and if the bus-bar pressure is raised sufficiently to load the long feeders, then the short feeders would be overloaded. To obviate this difficulty, the storage battery is exceedingly useful, and in determining the relative cost of storage battery and steam and electrical generating equipment, this important advantage of the storage battery must be considered, and reduced to its equivalent in money value and credited to its original cost.

In order that the battery may provide for the equal or economical loading of feeders, it is equipped with two or more end-cell switches, so that it may be operated at two or more potentials. The short feeders are then connected to the main bus and the long feeders to the auxiliary bus. One end-cell switch of the battery is connected to the main bus of the system, and the other end-cell switch to the auxiliary bus. In this way the battery provides two potentials, one at perhaps five to 10 volts higher than the other, and during the time of peak of the load on the system the long feeders are operated from the auxiliary bus, the battery supplying all the current required by these long feeders, and the pressure throughout the system is maintained at equality.

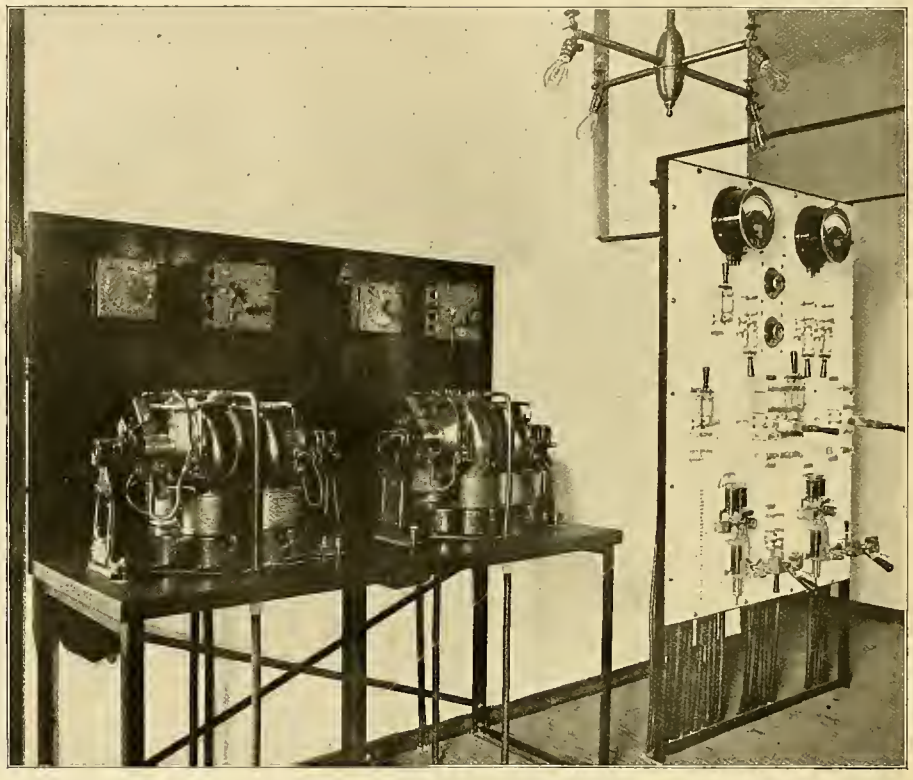


FIG. 3. INDEPENDENT TELEPHONE EXCHANGE AT WILKESBARRE.—GENERATING PLANT AND POWER SWITCHBOARD.

Fig. 3 illustrates this point very well, the battery being kept on both main and auxiliary bus from 4:15 until 5:45 o'clock in the evening, at which time it is disconnected from the main bus and retained on the auxiliary bus until 6:30 o'clock, the long feeders during all this time being kept at full load, and the investment in copper required to do this work being entirely saved, the work being accomplished with a comparatively small initial investment in end cells and end-cell switches.

Of course, the loss of pressure by this means is somewhat greater than if the feeders were connected to the main bus, but as the loss of energy occurs during a very short period of time, the actual loss of money in operating represented thereby is practically negligible.

Conditions may exist also in certain stations where it is desirable to give a 24-hour service and where the load is appreciable only during the time from dusk until midnight, and during the remaining 16 hours of the day the load is so small that

1. Paper read before the Northwestern Electrical Association at Waupaca, Wis., June 27 1900. Mr. Ferguson is the general superintendent of the Chicago Edison company, which has the largest storage battery in the world.

the cost of operating expenses for steam and electrical equipment would be so high as to make the use of the storage battery to take care of this long period of minimum load very desirable. In this case the generating plant would be started in time to charge the battery fully, so that it might take care of the station's load during the entire period of minimum load.

It has been my belief for a long time that combination generators, giving out direct and alternating current from the same armature, would find a very extended field, not only in large stations, but especially in small stations, where sub-stations might be necessary for supplying certain outlying or distant districts. In such cases, where the peak of the load in the districts supplied by the sub-stations comes at a different hour from that of the main station, the storage battery might be economically employed. In this case the storage battery would be installed in the sub-station and the conversion apparatus in the sub-station would be shut down at the time of the peak in the district supplied by the main station, and the combination generator would be operated as a direct-current machine, the storage battery in the sub-station being discharged at a high rate for the period of time during which the maximum peak of the load remains in the district supplied by the main station. (This use of a sub-station battery is shown in Fig. 4.)

As soon as the peak in the district supplied by the main station is over, the combination generators would then feed out alternating current to the sub-station, the conversion apparatus would take the load and the discharge of the battery would be cut down.

With such an arrangement it is possible, with proper relative conditions of load between sub-station and main station, to use the same generating investment to carry the maximum load of both

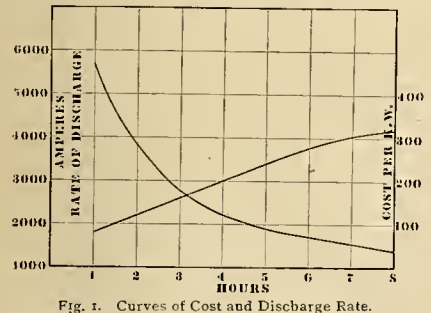


Fig. 1. Curves of Cost and Discharge Rate.

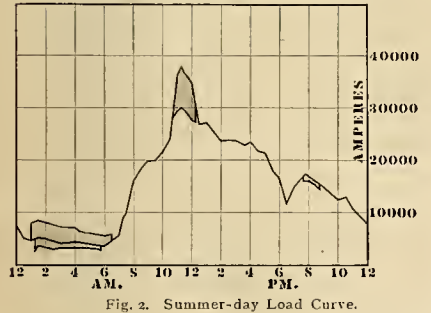


Fig. 2. Summer-day Load Curve.

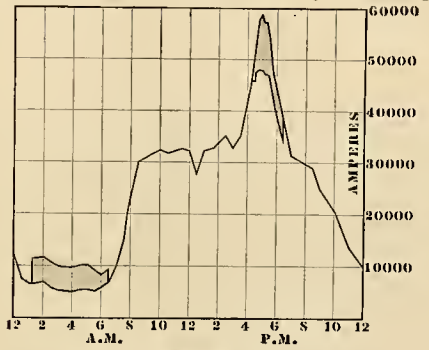


Fig. 3. Winter-day Load Curve.

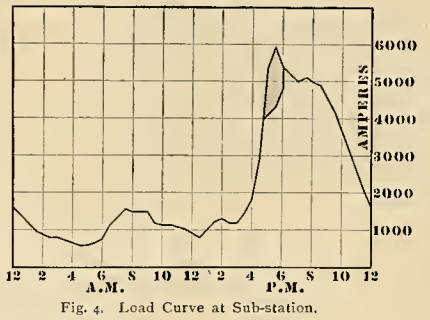


Fig. 4. Load Curve at Sub-station.

STORAGE BATTERIES FOR SMALL STATIONS.

districts, and enjoy at the same time the other advantages which are gained by the use of a storage battery.

The advantages in the use of storage batteries, assuming that they have been determined by calculation to be economical for the conditions in which they are to be applied, are the guarantee of reliability of service which the central-station companies are able to give their customers, and the uniformity of pressure and freedom from fluctuations due to short-circuits on the line.

The battery when charged is always ready for service, and should a sudden demand be made upon the station in case of accident to generators, engines or boilers, the battery is always prepared to take the load instantly, up to the limit of its capacity.

The battery is exceedingly useful in small stations where the load on the station at certain times is very light and where motors are supplied from the same system of mains. Under these conditions generators are extremely sensitive, and do not maintain the pressure constant under the varying conditions of load, while the use of a storage battery keeps the pressure on the lines constant at all times, and variations which would otherwise come from short-circuits and sudden variations in motor load disappear absolutely under the influence of the battery.

The advantage of uniformity of pressure is especially desirable in small central stations, where the cost of lamp renewals is an important feature, since by the use of the storage battery the life of the lamps is prolonged and the cost of lamp renewals thereby largely reduced.

In large central stations, where the storage-battery capacity forms a moderate proportion of the total-output capacity, it should be used as a reserve to the boiler plant, being kept floating on the system continuously, and being used to keep the boilers working under economical load at all times, avoiding the necessity of keeping boilers banked or spare boilers under full pressure.

It is difficult to lay down a set of laws which might be used in the determination of the usefulness of a storage battery, for there are conditions other than those of pure theoretical economy which must be considered, but it is probably safe to say that there is no economical advantage, although there may be sentimental advantages, in the use of a storage battery in a lighting system where the average width of the peak of the load is more than from 1½ to two hours in width, although the battery may have a commercial advantage in insuring the customers of the central-station company a thoroughly reliable service, with uniform quality of illumination.

Discussion.

Mr. Ferguson: I have taken the diagrams from our stations in Chicago and from our batteries in Chicago. In the case of small towns, all you have to do is to drop off a zero or two zeros, and you will have the same result as we have in the large station.

President Norcross, Janesville, Wis.: What is the relative cost of a steam plant and a battery plant for use in a small station?

Mr. Ferguson: The cost of a storage battery depends not on the maximum capacity of the station, but upon the number of hours for which it is to discharge its maximum capacity. The capacity of the battery at different rates of discharge is shown on the first figure. At the highest rate of discharge shown you only get half the capacity of the battery out, but at the low rate you get the full capacity of the battery.

Mr. Norcross: In other words, you discharge it slowly more economically than when you discharge it rapidly?

Mr. Ferguson: Yes.

Mr. Norcross: I understood you to say that the cost of a steam plant and the cost of a storage battery had a relation. Will you kindly state what that is?

Mr. Ferguson: The cost of a steam-generating equipment and storage battery to do the same work is the same, provided the work does not extend for more than two hours. The fact is, that very few small stations can use storage batteries.

F. A. Copeland, La Crosse, Wis.: I had fully made up my mind, not long ago, to put in a storage battery, 350 amperes on a side for one hour, or 700 amperes, but I found that it would cost not less than $20,000 to get it all in running order. The battery itself would cost $16,000, and it would cost $4,000 to put it in place. I estimated that a generator of the capacity to carry 350 amperes an hour would not cost to exceed one-half of that. You have in that case only got interest to pay on one-half the investment, the deterioration is less, and then we would have to run 30 horsepower eight hours to recharge the battery. Therefore I have made up my mind that it would be cheaper where you have an hour or an hour and a half load to put in a generating plant rather than a storage battery.

Mr. Norcross: Two or three years ago, in Milwaukee, I was offered a storage-battery plant as a special favor for $30,000. That settled the matter of storage battery for me.

Mr. Ferguson: As I have shown in my paper, the battery has no place, from an economical standpoint, in a small station which has a long peak. The figures that I have given of the cost of battery for five hours, which is about the average length of the peak of a small lighting station (railway business is somewhat different), viz., $240 a kilowatt, enable you to see at once that the cost is prohibitive. The figures for generating plant that I have given are based on new apparatus, and I have taken $100 a kilowatt as the total cost of everything, engines, boilers, dynamos, auxiliaries of all kinds, and all constructional expense of a first-class station, and on that basis, as you will see from the paper, at 1½ hours, you come out about even—$80 a kilowatt for one hour and $116 for two hours—so that two hours is the absolute limit. Two years ago, when lead was cheaper than it is now, two hours was the time at which the two curves of cost crossed each other, but lead has gone up, so that the batteries, instead of costing $60 a kilowatt, as was the case three years ago, now cost $80 a kilowatt.

Professor Swenson, Madison, Wis.: I would like to ask what you figure as the depreciation in a small plant, operated under ordinary conditions.

Mr. Ferguson: If you have a guaranty from the storage-battery company, nine per cent., probably. On large installations, where the batteries are nursed, they have been willing to guarantee them as low as five per cent., but in most cases six per cent. But I doubt very much whether any such guaranty could be obtained for a small station.

Chicago's Proposed Street-railway Subway.

The street-railway commission appointed by the Chicago City Council has been considering plans for a system of street-railway subways to relieve the congestion of traffic in the down-town streets of Chicago. The general idea it to construct something along the line of the Boston subways. The latter, it will be remembered, are but a short distance below the surface of the streets and run under some of the most crowded thoroughfares. Trolley cars enter and leave the subways at the edge of the congested district, and no traffic is allowed in the subway save the cars.

At a session of the street-railway commission on June 28th the question of the renewal of franchises for the street-railway companies was considered, and John M. Roach, president of the Chicago Union Traction company, is said to have suggested a plan for a system of subways that would remove every car from the surface of the down-town streets of Chicago. The project is, of course, one of great magnitude, involving, as Mr. Roach estimated, an expenditure of about $1,000,000 a mile of subway; but it is believed that the Union Traction company is ready to go ahead and build the system of subways for the sake of settling at once, in a satisfactory way to all concerned, the matter of congestion of traffic on the down-town streets, provided the company be given a perpetual franchise for the operation of the subway. In view of the great investment involved, the company is said to have intimated that it did not feel like paying much in the way of cash compensation to the city for the franchise. It was also made clear that in removing its tracks from the surface of the down-town streets the company would require the city not to grant a franchise to any other company to build on the surface.

The commission was naturally somewhat surprised at the proposition, both on account of the magnitude of the undertaking and because of the radical changes involved. The Union Traction company has evidently given the problem of congested down-town traffic considerable thought and has concluded that the Boston subway scheme most successfully meets the requirements.

Much interest has been manifested in the plan. In fact before the present proposition was made various engineers and others had proposed definite routes and schemes.

Since the meeting of the street-railway commission, at which the proposition to build a subway was made, the Chicago City Railway company has announced its decision to co-operate with the Union Traction company in the matter. However, there has arisen a considerable sentiment in favor of the building of the subways by the city itself and charging the street-railways rental for their use, thereby following the plan of Boston. In the latter case the gas and water pipes and electric conduits would be provided for also in the subway. Especially would this be necessary if the subway were to be run with its roof as a foundation for the street paving.

Electric Lighting in Pekin.

A small electric-lighting station has been installed in Pekin, China. In anticipation of transmission to a distance, an alternating-current generating plant has been adopted, so that if required the current may be transformed up. Though at present of very modest capacity, ample provision has been made for ultimate extension of the station on a large scale. The generating plant already installed consists of a 50-horsepower steam set, while a second set of 100 horsepower is on the way, and room is left for a third set, without extending the buildings. Arrangements have also been made to educate the Chinese in the uses of electricity for domestic and other purposes, and to this end a showroom has been attached to the generating station, in which lamps and motors, etc., may be seen in their application to various purposes. Siemens & Halske of Berlin promoted the plant.

Losses in Small Lighting Plants.[1]

By B. V. Swenson and A. W. Richter.

The history of the development of electric lighting shows that the splendid advancement which has been made in the economical production of electric current is due largely to careful and scientific tests of electric plants and apparatus which have been made from time to time.

The complete commercial test, when properly planned and executed, will demonstrate the exact conditions under which a plant is operating, showing the losses which occur in the various parts of

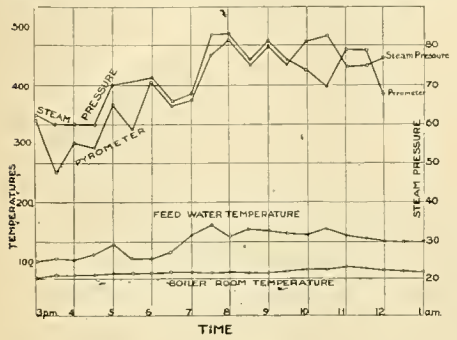


FIG. 1. LOSSES IN SMALL LIGHTING PLANTS.—BOILER-ROOM READINGS.

the system. By a proper interpretation of the test, all losses may be located and means may then be devised for improving the efficiency of the plant. The report of such a test should be arranged in a simple, straightforward manner, and should contain all essential data. A brief description of the test should be given and the results and conclusions should be plainly and logically set forth.

Large plants have been tested more frequently than smaller ones, but, in a general way, these tests have also been of advantage to the smaller plants, as they have shown where machinery and other apparatus were faulty or uneconomical, the result being that manufacturers have improved their product very materially.

In consequence of this, some of the apparatus, as,

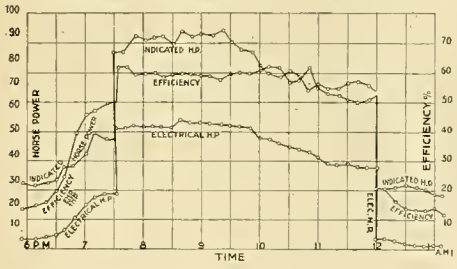


FIG. 2. LOSSES IN SMALL LIGHTING PLANTS —ENGINE AND ALTERNATOR LOAD CURVES.

for example, the steam engine, has been so perfected that but little improvement in its efficiency is possible. Again, various station appliances, both mechanical and electrical, have been devised for increasing the station output and efficiency.

When such tests have been made they have usually brought forth excellent results. Small lighting plants, however, have suffered in this particular, the reason being largely the lack of a full appreciation of the value of such tests. Then, too, it very often happens that the management realizes that improvements might be made and yet is not aware of the fact that, by means of a scientific investigation of a thoroughly practical nature, one can determine just where improvements can best be made.

In a large number of cases, small plants, as well as large ones would be greatly benefited by a prac-

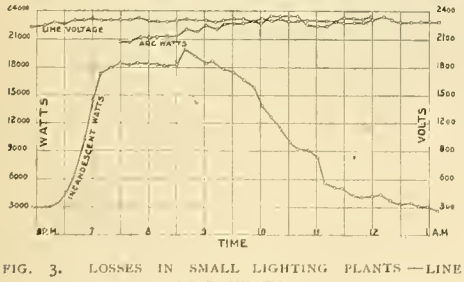


FIG. 3. LOSSES IN SMALL LIGHTING PLANTS —LINE LOAD CURVES.

tical test, if properly conducted and interpreted. This is especially true of some of the earlier plants, containing machinery and apparatus, which, although the very best at the time of installation, is now almost or entirely out of date.

Very frequently in a case of this kind a test will demonstrate that it would be a good investment to "scrap" certain apparatus and to replace with new and more modern equipment. Indeed, it many times occurs that the saving made in one or two years will more than pay the cost of making the change.

It must not be understood in this connection that the writers are condemning old apparatus in general and advocating its replacement with new equipment in all cases. Far from it, for it very frequently occurs that apparatus which has been installed for a number of years will, with certain changes, still serve economically and well. Instances have come to the attention of the writers in which entire new equipment has been advocated, but where, by a proper remodeling of the plant, probably replacing some equipment with new and rearranging the plant in general, it may be operated practically as economically as with new equipment, and with far less expenditure of capital.

In order to illustrate the importance of what has been said, the results are given of one of the tests recently made by the writers in this immediate vicinity.

The plant in question is a combined lighting and pumping station. The boiler room contains two return tubular boilers, each of 43-horsepower capacity. The feed-water was taken from the main and passed through an open exhaust heater before entering the boilers. The engine room contains a 125-horsepower Ideal engine, directly belted to a 90-kilowatt, 2,200-volt Westinghouse alternator. The switchboard is arranged to control two single-phase feeders, each of 45 kilowatts' capacity. The pump house contains two duplex Deane pumps, each of which (at the ordinary speed of operation) has a capacity of 400,000 gallons in 24 hours.

Time will not permit of a detailed description of such a test, neither does it come within the scope of this paper, but a few of the general results obtained may be of interest. The object of the test was to determine the efficiencies of the plant, and all parts thereof, under actual operating conditions, and to decide upon what changes, if any, were advisable.

The coal was weighed as it was brought into the boiler house; the water was pumped into two weighing tanks, so arranged that one could be filled while the other was being emptied. Calorimeter tests at boilers and engine were taken every hour: all other boiler-room readings were taken at half-hour intervals. Indicator cards at the engine and all engine and switchboard readings were taken every 10 minutes. In the pump house all readings were taken at 15-minute intervals.

The station was operated under ordinary working conditions. Boiler No. 1 was started at 2:15 p. m., and at 3:15 p. m. one of the city pumps was started. Boiler No. 2 was fired up at 4:05 p. m., and the city pump was stopped at 5:31 p. m., after which there was an entire stoppage until five minutes of six, when the lighting engine and alternator were started. The arc circuit was thrown on at 7:28 p. m. and stopped at 12 midnight. The whole plant was shut down at 1:15 a. m.

All instruments used were carefully calibrated in the laboratories of the University of Wisconsin, both before and after the test. The data were taken by the writers, with the assistance of two students of the university, and entirely independent of the station employes. Some of the results of the test follow:

Steam pressure, pounds	72.2
Draught gauge, inches of water	0.375
Escaping gases, degrees Fahrenheit	497
Feed-water, degrees Fahrenheit	136
Kind of coal	Indiana block
Total coal consumed, lbs.	3,384
Dry coal consumed, lbs.	3,275
Refuse, lbs	390
Refuse, per cent	11.5
Flue gases: Carbon dioxide, per cent	6.57
Oxygen, per cent	13.43
Quality of steam, per cent	98.5
Total weight of water used, lbs.	19,242
Total water evaporated, dry steam, lbs	18,950
Evaporation per lb. fuel, actual lbs	5.79
Evaporation same from and at 212° F	6.45
Evaporation same of combustible, actual, lbs	6.57
Evaporation from and at 212° F. per lb. of combustible, lbs	7.32
Evaporation per square foot of heating surface per hour, actual, lbs	1.44
Evaporation per square foot heating surface per hour from and at 212° F.	1.61
Standard commercial b. p.	56.55
Builders' rating at 15 sq. ft. of heating surface (two boilers)	80.60
Ratio of commercial to builder's rating, per cent	70.2
Time of engine and alternator trial, 5:50 p. m. to 1:10 a. m.	
Duration of engine and alternator test, hours	7.33
Water pumped into boilers, lbs.	16,254
Water drawn from separator at engine, lbs	370
Dry steam charged to engine, after deducting that used by calorimeter, separator and auxiliary pump, lbs.	15,323
Dry steam charged to plant, after deducting that used by calorimeters and auxiliary pump, lbs.	15,683
Coal charged to plant, 5:50 p. m. to 1:10 a. m., lbs.	2,681
Average i. h. p. of engine	62.3
Maximum i. h. p. of engine (8:40 p. m.)	93.2
Total watt-hours	179,350
Average electrical h. p.	33.2
Maximum electrical h. p.	56.2
Load factor (average e. h. p. ÷ maximum e. h. p.) per cent	39
Water pumped into boiler per engine, i. h. p. hour, lbs.	34.2
Dry steam per engine i. h. p. hour, lbs.	33.5
Dry steam per plant i. h. p. hour, lbs.	34.3
Coal per engine i. h. p. hour, lbs.	5.37
Watt-hours per lb. of coal	66.9
Friction of engine, alternator excited, and exciter, h. p.	21.2
Friction of engine, per cent of total load	8

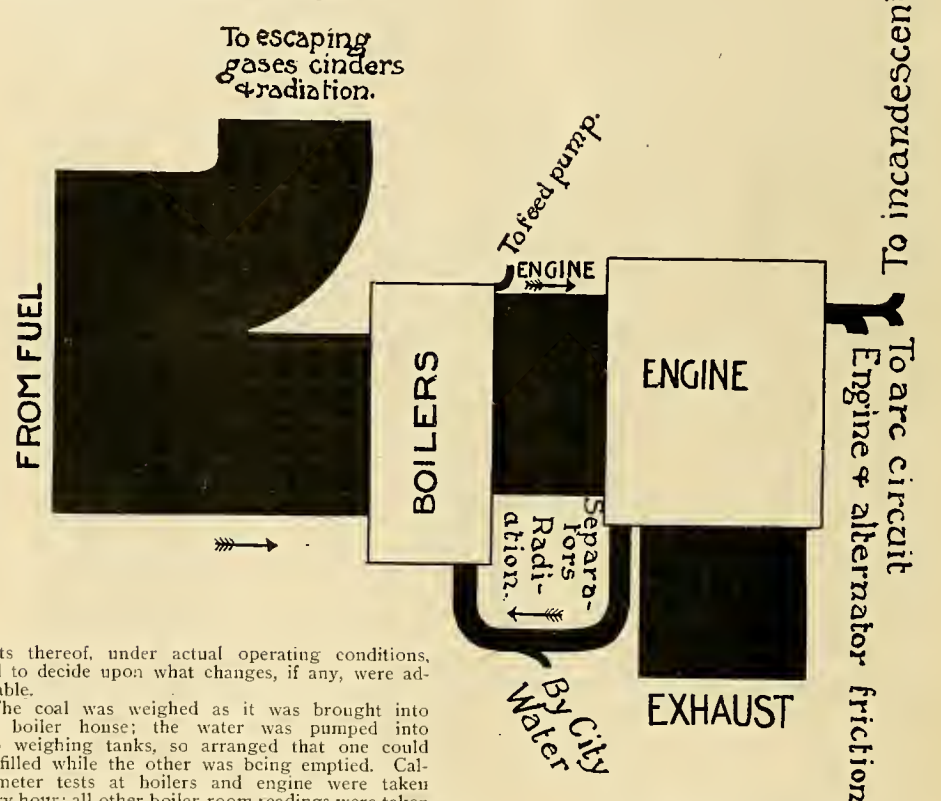


FIG. 5. LOSSES IN SMALL LIGHTING PLANTS —DIAGRAM SHOWING LOSSES IN HEAT ENERGY FROM FUEL TO SWITCHBOARD.

Average efficiency (e. h. p. ÷ i. h. p.), per cent	53.2
Maximum efficiency (e. h. p. ÷ i. h. p.), per cent	62.8
Duty of city pump:	
Per pump displacement per 1,000,000 B. T. U., ft. lbs.	13,510,000
Per tank displacement per 1,000,000 B. T. U., ft. lbs.	12,780,000
Per pump displacement per 1,000 lbs. dry steam, ft. lbs.	13,940,000
Per tank displacement per 1,000 lbs. dry steam, ft. lbs.	12,900,000

The management was under the impression that the boilers and heater were not of sufficient capacity, and that it would be necessary to purchase a larger boiler and heater, which would entail a considerable investment of capital. The test shows that the boilers are operated at an average of but 70 per cent. of their rated capacity, and during the two hours of heaviest load they operate at but five per cent. above rated capacity. It will be seen, therefore, that the boilers are of sufficient capacity for the present requirements of the plant. The temperature of the feed-water (Fig. 1), as given in the test (133° F.), is lower than that of the water as ordinarily pumped into the boilers. This result is due to cooling, while the water was pumped into the barrels and from there into the boilers. In order to find the actual temperature, at the time when no test was being made, the temperature of the feed-water was taken on the evening following the test. The data obtained showed an average temperature of 204° F. and a temperature of 208° F. at the time of maximum load (7:30 to 10 p. m.). This temperature is as high as can be obtained by the use

1. Paper read before the Northwestern Electrical Association at Waupaca, Wis., June 27, 1900. The authors are professors in the engineering department of the University of Wisconsin.

of an exhaust heater without increasing the back pressure on the engine. A higher temperature would be conclusive proof that the back pressure is excessive, and is therefore undesirable.

The indicator cards show that in all cases the pressure drops to atmospheric pressure immediately after opening the exhaust, and gradually rises until compression begins, reaching about 3.8 pounds during the time of heaviest load, and 2.5 pounds during the time of light load. This rise is caused principally by the piping, and cannot well be avoided

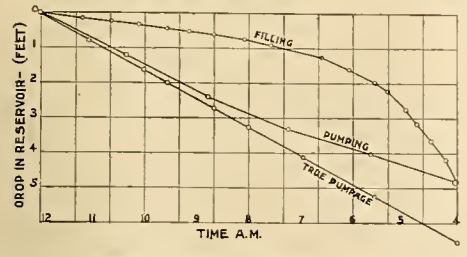


FIG. 4. LOSSES IN SMALL LIGHTING PLANTS.—WATER CURVES.

when both engine and pump exhaust into the same heater. The average back pressure of the engine, namely, 1.9 pounds for the period of heavy load and 1.2 pounds for the period of light load, is very good. The back pressure on the pump, while it was in operation, was less than two pounds. The heater is therefore of sufficient capacity for the present needs of the plant, as shown by the test.

The evaporation (pounds of water per pound of combustible from and at 212° F.), namely, 7.32 pounds, is fairly good, considering the conditions and the method of handling the plant.

The flue-gas analysis shows an average of 6.57 per cent. of carbon dioxide. This result is too low, and shows that too much air is admitted to the furnace. It was found that during the time of light load and after starting boiler No. 2, a test of the flue gases showed but 2.3 per cent. of carbon dioxide, while during the time of heavy load (8:15 to 10:15 p. m.), there was about eight per cent. of carbon dioxide. This last result is fairly good, although it can be improved upon. With very careful handling of the dampers and fire an average result of from eight to 10 per cent. can easily be obtained.

The steam pipe from boilers to engine was not covered. The test shows that during 7 1-3 hours 407 pounds of steam (equal to 2.54 per cent. of the total amount) was lost between boilers and engine. This loss was due in part to radiation, and partly to steam escaping with the water in the separator, due to the fact that the drain from the separator was not kept entirely closed. Assuming a radiation of one British thermal unit per square foot of radiating surface per degree per hour, one per cent. is accounted for, leaving 1.54 per cent. to be charged to the separator.

The engine and alternator are both of very recent design, and, if they were operated at anywhere near full load, would leave little to be desired in this direction. Load and efficiency curves of engine and alternator are shown in Fig. 2. Electrical and indicated horsepower data are given as vertical distances and time as horizontal distances. It will thus be seen that the electrical and indicated horsepower can at once be read off for any time of the day.

The average electrical horsepower is but 33.2, while the average indicated horsepower is 62.3. The maximum electrical horsepower is only 56.2, and the maximum indicated horsepower is 93.2. The minimum electrical and indicated horsepower are 3.6 and 24.8 respectively. These figures show to how great an extent the unit is underloaded. The low efficiency, which is due to this cause, averages 53.2 per cent., reaching a maximum of 62.8 per cent. at 10:10 p. m., and having a minimum value of about 14 per cent. This means that on the average 53.2 per cent of the power generated in the engine cylinder reaches the switchboard; the remainder, 46.8 per cent., is lost in the transmission. When the lighting unit is in operation all night, this loss is increased to a considerable extent.

An investigation was made of the saving, if any, that might be made by the addition of a smaller unit, which might be operated during the period of light load and when the arc lights are not in use. It was found that, with a run to 1 a. m., the investment would bear a good percentage of interest.

The horsepower and efficiency curves show the very light load on the electric station during the earlier hours of the evening and after the arcs are taken off at night, the efficiency of the unit falling as low as 13 per cent. It is evident that a smaller unit, if installed, will decrease the cost of operation to a considerable extent, besides furnishing a duplicate outfit. In case of accident to one of the units, the station will still be able to furnish light to its patrons.

A 30-kilowatt unit will be able to operate the incandescent circuit during the entire run, and it is therefore advisable to install a unit of this size. The average electrical horsepower for the incandescent circuit during the entire run is 14.6 electrical horsepower, and the maximum is 26.8 electrical horsepower.

The results of the test show that the changes contemplated before the test was made are not necessary at present, but that other changes might be made which would greatly improve the economical operation of the plant.

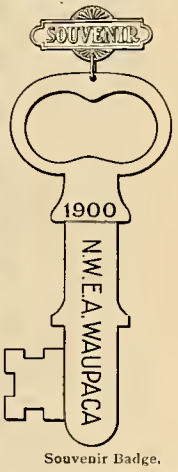
[The paper was read by Professor Swenson, who, at its conclusion, explained the diagrams (Fig. 3 showing the line load curves and Fig. 4 the pumping tests) in somewhat greater detail. The graphical demonstration of heat losses in furnace, boiler, auxiliaries, engine and dynamo, here denominated Fig. 5, was viewed with especial interest by those present.]

Reminders of the Waupaca Convention.

Shortly after noon on the last of the three days of the convention of the Northwestern Electrical association at Waupaca, Wis., last week, a photographer secured some group pictures of the convention visitors on the veranda of the Grand View Hotel at the Chain o' Lakes. Only a portion of the party could be secured, as a considerable number were enjoying the delightful bathing afforded by the resort or were otherwise scattered about. One bather happened along just in time, however, as is shown by the picture of the jolly party given herewith. That it was a care-free summer convention, the photograph gives ample evidence, but, on the other hand, the papers presented in this issue of the Western Electrician show that some good work was accomplished. An illustration (three-fifths size) of the souvenir badge presented to the delegates is also given. The badges were stamped from sheet-brass and were conspicuous and significant.

A Group of Delegates and Visitors.

REMINDERS OF THE WAUPACA CONVENTION.



Souvenir Badge.

One Central-station Man Who Was Not Bulldozed.

E. G. Holmes, of the Detroit Light and Land company of Detroit, Minn., shot M. McCarthy in the head recently. The trouble arose over the electric-light contract for the village. McCarthy is a saloonkeeper, while Holmes is on the opposition side of the saloon question. Recently the council sought to annul the franchise of the Light and Land company, and called an election to vote bonds for a municipal plant. Holmes had certain circulars bearing on the matter, giving the lighting company's side. McCarthy took them from Holmes' carriage and burned them publicly in front of his saloon. Holmes secured a warrant for the arrest of McCarthy for the theft of the circulars. The men met, and McCarthy started to enter the carriage. Holmes warned him not to do so, and told the driver to proceed. McCarthy swung himself into the carriage when Holmes drew a revolver and fired. The ball glanced, and the wound is not dangerous.

English Electric Manufacturing Company.

That energetic American engineer, Prof. S. H. Short, is making himself felt in England, to judge from the long accounts in the English electrical journals, describing the formal opening of the "magnificent factory" of the English Electric Manufacturing company at Preston. The buildings cover five acres, and the London Electrical Review hails "with keenest pleasure the inauguration of a wholly British factory devoted primarily to electric traction, and which, in point of equipment and organization, will challenge comparison with any similar undertaking in existence. Nor will the new works be called upon to establish their position in the trade by tedious and hard-fought steps; on the contrary, they commence operations with orders already in hand to an extent that will tax their utmost capacity for a year to come." Professor Short is the technical director of the company, and is in entire charge of its installation and manufacture.

Referring to these works, the London Electrician says: "The harmonious blend of American skill and experience with British financial enterprise on British soil is a real and effective solution of the problem of American engineering competition."

Electric Plants in Fortifications.

By direction of General Wilson, chief of engineers, a board of engineer officers has been convened at the War Department for the purpose of considering and reporting a uniform system of electric plants at the various seacoast fortifications. These plants are used for the manipulation of ordnance machinery and for illuminating purposes. They are not all of the same character, and it is the province of the board to suggest the best general system for adoption at all the fortifications. The board consists of Major S. S. Leach, from New London, Conn.; First-lieutenant James B. Cavanaugh, from Mobile, Ala., and First-lieutenant Robert R. Raymond, from Boston.

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CONVENTIONS AND EXPOSITIONS.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th

A correspondent, writing to the editor of the Western Electrician, says: "I wish you would persuade some expert electrician among your readers to give his attention to the rational designing of the sparking coil." The gentleman is interested in gas-engine manufacture, and, with some others, thinks that improvement can be effected in methods of electric ignition. However, many men are working toward the betterment of this and other features of the gas engine, and from the fact that the electric igniter is gradually taking the place of all other types, it is evident that the design of the spark coil is a detail that must receive due attention.

In a paper on "Expert Evidence" recently read before the American Institute of Electrical Engineers by Mr. J. E. Hyde of the New York bar, the author made an interesting prediction: "I look forward to the time," he said, "when the court will have its own expert as its technical adviser, and then, while there may still be that 'conflict of evidence' which is now so usual, it will do less harm. The court and its expert will work together to arrive at the truth and sift the chaff from the wheat. I believe that this practice has been adopted in France and in Germany." This idea, so far as it relates to patent causes, at any rate, seems to be worthy of serious consideration. If competent experts were appointed as officers of the court, as disinterested as the judge and with no more bias or partiality, it would seem that the ends of justice would be more readily advanced than by the present system of retaining experts on one or both sides. Many difficulties in the way of the practical execution of the plan may be imagined; but with the present reputation of "expert testimony" the suggestion is not to be summarily disregarded.

Managers of small lighting plants will find it well worth their time to read with care the paper entitled "Losses in Small Lighting Plants," presented by Professor B. V. Swenson and Professor A. W. Richter of the University of Wisconsin at last week's convention of the Northwestern Electrical association and printed in this issue of the Western Electrician. The authors describe a test they made recently on a combined lighting and pumping station of small size and present results that are instructive and interesting. The management of the plant was under the impression that the boilers and heater were not of sufficient capacity and that apparatus of greater size was needed. But actual test demonstrated that the boilers were of sufficient capacity for present requirements. It was shown, however, that it would pay to install a smaller lighting unit to be operated during the period of light load. Thus the test showed that the changes contemplated were not necessary, but that others might be made to advantage. Incidentally, the authors prepared a striking diagram to show the heat losses from the coal-pile to the switchboard. This drawing illustrates in an impressive manner the small percentage of the theoretical energy of the fuel realized at the switchboard. The paper shows the practical, commercial value of testing, even in the smallest plants, and is a worthy contribution to the literature of central-station operation.

It is not surprising that in the discussion on Mr. Ferguson's paper on "Storage Batteries for Small Stations" at the recent Northwestern convention there should be a consensus of opinion that, from the financial point of view, it is not advisable to install a storage battery in a small lighting station. But it is especially interesting to note the exact statement of the financial limitations of storage-battery auxiliary in the lighting station. Said Mr. Ferguson: "If the characteristic of the [load] curve [of the station] is such that the average width of its peak is more than 1½ hours, then the initial cost of steam and electrical generating equipment to provide capacity for this peak will be less than that of the necessary storage-battery equipment, at the present market prices, to do the same work. If the curve has an average peak width of less than 1½ hours, then the initial cost of the storage battery will be less than that of the steam and electrical generating equipment to take care of this peak." This is a clear-cut statement, and as the average width of the peak of the load of the small central station is more than 1½ hours, it follows that the storage battery is out of the running from the purely economical point of view. There are, of course, advantages in the use of the storage battery, such as the ease with which the reserve comes into play in case of a sudden and unexpected demand for current; but, on the whole, it is unlikely that this useful class of apparatus will be employed to any great extent in small central stations at the present range of prices.

Striking evidence of the growth of American export trade in electrical machinery and other electrical apparatus is presented in a table prepared by the Treasury Department, showing the exports in these lines during the 11 months of the fiscal year, as compared with the values for the corresponding period of the two previous years. During the 11 months of the fiscal year 1900 the exports of electrical machinery reached a total valuation of $3,834,317, as against a value of $2,517,797, for the same period of 1899, and $1,883,306 for 1898. The exports of instruments and apparatus for scientific purposes, under which classification are included telegraph, telephone, and other electric apparatus, during the 11 months of 1898 were valued at $2,521,280, increasing to $3,929,073 in 1899, and still further to $5,876,618 in 1900.

Gratifying as these comparisons are, it is to be borne in mind that every American victory in the foreign field has stirred commercial Europe deeply. The statistical statements prepared from time to time by the Treasury Department, showing the enormous growth of our exports, are studied abroad even more carefully than at home. The competition will unquestionably become keener as the years pass, and it behooves American manufacturers, therefore, to prepare now to hold the advantage they have gained and to become so familiar with every phase of the world market that they can confidently send abroad in the future the precise goods that the buyers want and at prices which will command trade.

The rights of telephone companies in the streets constitute an old and fruitful topic of discussion. In the recent case of Castle against the Bell Telephone company of Buffalo, the Appellate Division of the Fourth Department of the Supreme Court of the state of New York holds that a telephone company having its poles and wires in the streets of a city may, when authorized and commanded by the city so to do, place its wires in underground conduits in the streets without paying tribute to abutting property owners.

While a public highway is primarily intended for the accommodation of travelers employing the ordinary means of locomotion, the court holds that it is, nevertheless, in another and broader sense, a public convenience. And a street in a populous city, it assumes to be the well-settled law of the state, may properly be devoted to any purpose which the enjoyment, comfort and convenience of the locality may require, and the rights of abutting property owners, even though they own the fee, as it is termed, to the center of the street, will be subject to this paramount right of the public.

Is, then, the telephone a public convenience, in this sense of the word, and such a one as that a street in a populous city may be devoted to it consistently with the general purpose for which that street was originally designed? So far as the first branch of this question is concerned, the court thinks that it may be unhesitatingly answered in the affirmative; for, of all the discoveries of modern science, it pronounces the telephone one of the most wonderful, as it is one of the most useful, there being a thousand ways in which it can be used to such advantage as to render it well-nigh indispensable to an urban resident. That the transmission of intelligence by electricity is not only a public convenience, but a public necessity, being established, the court holds that where, as by the use of underground conduits, the means for such communication neither disfigure the surface of the street nor interfere in any degree with its use by travelers upon foot or in vehicles, no good reason suggests itself why it should be regarded as an additional burden entitling the owner of the fee to further compensation.

Mr. Justice Laughlin alone dissents from the proposition that a telephone is a public necessity or convenience, and holds that placing conduits for telephone wires in a public street is not a proper municipal or street use, as against the owner of the fee.

Toll-line Traffic.

After the reading of Mr. J. B. Ware's paper on "Toll-line Traffic" at the recent Independent telephone convention in Cleveland [Western Electrician of June 16th, page 391], the following disucssion ensued:

M. McFarlin, Des Moines, Iowa: I would like to ask Mr. Ware what objection he has to charging a percentage on interchanged business. This is the rule where I am, and it occurs to me that by this method the result would be easy to get at—easier than by a mileage basis.

J. B. Ware, Grand Rapids, Mich.: The question is, why is percentage preferable to mileage basis. Those percentages are based upon actual distances traveled, are they not? It is impossible, as far as my experience in Michigan has gone, to reach a percentage that is absolutely accurate. Percentage is a makeshift; we agree that one company shall take 65 per cent., and another 35 per cent., in order to save working out details on each message. When you come to build long-distance toll lines, I doubt whether a percentage basis can be agreed upon where there are so many telephone companies in the field. There is no question, so far as the theory is concerned, that if you get your percentage according to the actual number of miles traveled, you are getting what belongs to you. We are providing for our company on a percentage basis the same as your company. What kind of a percentage basis could be agreed upon for messages passing over your lines to exchanges, perhaps from points beyond, where you have nothing to do but transfer? You get no percentage. The percentage is fixed. As I stated a moment ago, it is fair to divide on a basis of 65 and 35, and you are putting business through the exchange and over the lines from which you get absolutely nothing. It is so in Grand Rapids. We have been for two years putting through the exchange anything and everything that has been offered by neighboring lines. In order to get a message over our lines to a point 75 miles away, that message goes through on a percentage basis, and we get nothing for handling that message ordinarily. We have faced that problem heretofore, and we have solved it temporarily by fixing a percentage; but there is only one true basis, in my judgment—only one true basis for settling—and that is the actual mileage in air-line distances. There is a great deal of work to be done, and it is a hard problem to work out, but it must be done to get the results desired.

R. F. Johnson, Saginaw, Mich.: I would like to ask the gentleman from Iowa if he ever felt satisfied that he got what belonged to him on a percentage basis. Is it not a fact that it is simply jumping accounts with your neighbors, and you never feel satisfied?

Mr. McFarlin: In answer to the gentleman's question I would say that our business has been in a chaotic state. I believe in a clearing house. In Iowa I know many companies never make any settlements at all. Rather than go to the trouble of figuring it out they let it go. I asked the question to bring about a general understanding. I think Mr. Ware's idea is very good.

Mr. Ware: I venture to say, without knowing anything about matters outside of Michigan, that 90 per cent. of the companies represented here have jumped accounts with their neighbors. This has been possible up to the present time, but cannot continue; the toll business has got to be on a business basis. I am sorry that someone with more experience has not written upon this subject. However, the committee assigned the subject to me. I am satisfied that if we could compare notes at this convention we would find that we have not been doing business on a business basis, so far as toll lines are concerned; and the matter must be settled very quickly, if we are going to make a success of the toll-line business.

E. B. Fisher, Grand Rapids, Mich.: I would suggest that the traffic associations give us some sort of a hint as to what they are trying to do and have already accomplished. It might furnish solutions to such questions as this. We would like to have a hint at this convention as to any particular work that is going on here, in Pennsylvania or Indiana. This should be given to other states at this convention.

A. L. Bigelow, Bryan, Ohio: Regarding division of tolls on a mileage basis, as suggested, I would like to ask if, in addition to that, the originating line would be entitled to any larger percentage than the lines over which the message passes. For instance, for a message originating at one of our local stations, say 10 miles distant, then passing through our switchboard at Bryan and over the United States lines, the rate would be 10 cents. The business originated in our plant, and passed through our switchboard, but upon division of tolls we would receive comparatively nothing.

Mr. Ware: The question is whether there should be a larger percentage for the originating of that business than would be paid. All originating business is to have a percentage. For the handling of the business in the exchange a commission should be paid. I suggest 25 per cent., with a maximum of 12½ or 10 cents on any one message. Twenty-five per cent. is theoretically the proper commission. Why should your 10 miles be worth more than any other man's 10 miles? You have received a commission for originating that business, and that is all you are entitled to. The commission for originating business in Grand Rapids is worth as much more than other cities. I think the commission should not exceed 20 or 25 per cent. For business originating in toll stations I am perfectly willing that the exchange should receive its 25 per cent. regular commission, although the agent himself may receive but 15 per cent. I care not where the message originates, whether it be in an exchange or toll station, the toll lines are entitled to no more than if it originated in the city.

Mr. Bigelow: Suppose, as was suggested, that we should jump accounts with our neighbors, and business would originate at a local plant and pass over three or four small local lines and be transferred through our switchboard and re-transferred through another. Would you suggest any transfer percentage in addition?

Mr. Ware: No. If you allow a switching charge on each message, and there are enough of them, you would find the toll lines would be paying for the privilege of sending messages, and that is not fair. If the proposed method is not fair, there are only two solutions—either the small companies should take their percentage of mileage, the same as the large companies, or they should sell out to the large companies. Switching charges cannot be paid without demoralizing the business and eating up all the profits, and that would mean the end of the long-distance business.

Horton Park, Kenton, Ohio: You spoke in reference to transfer charges. If we are not to have anything for transfers, what are we to do?

Mr. Ware: I know what I would do. Of course, it is impossible to make any rules that do not have some exceptions, even in the telephone business, but I would ask the toll-line companies to build through lines or take care of the toll-line business themselves, or establish some other way of providing switching charge, if it becomes a burden on your exchange, or the lines are not sufficient to take care of the through business. There may be special conditions that have to be handled in a special way. It is a fact that if we recognize switching charges, we might as well abandon the through business. The time will come when through circuits will be built, which lessen the switching burden. You can better afford to do your exchange business free of cost for the toll-line company than not to have the toll-line business; can better afford to do it at a loss than to have them disconnected. The problem to be solved is how your people can get connections with every other exchange, not only 50 miles away, but 500. If we cannot solve that problem we have failed in accomplishing that for which we have come. No one can be too careful in handling the toll-line business in his exchange. There is not a man in this room that has had experience in the toll-line business that is getting compensation for the business he does. The toll-line agent never has received and never will receive proper financial compensation for the annoyance he has in connection with the tolls themselves and the reports at the end of the month. If this is true, why should we be so particular in figuring up our expenses in connection with the toll lines? We are actually dependent upon the toll lines for the success of our exchanges, no matter where we are located, and whatever we can do to encourage additional local long-distance business we should do without regard to whether we are making a success of our business or a loss. This is the problem we are facing, and we might just as well face it. There is no man that can figure out to the cent just what he should receive, and allow any part of the toll.

H. E. Graham, Norwalk, Ohio: For the benefit of Mr. Park I would like to make a short statement. We fought the Bell people three years at Norwalk, with their free service, and but for their toll lines I think they would have been out of the business; but with their toll lines they kept their subscribers, and we found they were gaining ground. It was either a question of toll lines or going out of the business with us. Still, when the United States company wanted a contract for 99 years, our people thought it was forever, and hesitated to sign. They finally signed it, and every month watched the toll business very closely for results. For nearly a year the result has been that we got from $9 to $12 per month commission. We were paying our toll operator $20, and some of our company were inclined to feel that the business was not paying. I showed them the number of subscribers at $2 a month that we never would have had otherwise than through the toll lines. The long-distance connections brought us the subscribers and keep them. We never would have had them in any other way, and what we lost on the toll business was paying good dividends on the exchange. Then, too, the toll business has increased with the number of subscribers, and it is advertising the exchange. Last month our commissions exceeded $27.

Patent Suit over Sprague Controllers.

[Special dispatch to the Western Electrician.]

Boston, July 2.—The General Electric company and the Thomson-Houston company have entered three suits against the Boston Elevated Railway company in the United States Circuit Court here, alleging infringement of patents, in connection with motor controllers for the defendant company's cars. While the Boston Elevated company is made the defendant in the suits, the real parties concerned are the General Electric company and the Sprague Electric company, makers of the controllers. This suit arises in connection with the contract between the Boston Elevated and the Sprague companies for the equipment of 60 elevated-railway cars with the Sprague multiple-unit system, recently signed, as reported in the Western Electrician, and by which the Sprague Electric company furnishes the Boston Elevated company with a bond guaranteeing it against loss through any patent litigation.

J. S. B.

Electrical Engineering Trade in South Africa.

[From the Electrical Review, London.]

In the early days of the Rand, things went pretty much the way of the English manufacturer, and direct-current dynamos from England tumbled into the country as fast as they could be made. But after a little while there came a change over the scene. The Frankfort Exhibition was held; polyphase dynamos and motors were shown in operation over long distances, and the superiority of this system for the transmission of power was demonstrated. And then slowly, but surely, the polyphase machine began to get an entrance into the Transvaal, to the exclusion of the direct-current plant, and to the benefit of the foreigner. But the English manufacturer made no move; he has hardly begun to do so now. The result is that the trade has largely gone away from England. In the first place the Germans and the Swiss benefited largely by the new state of things, but they were greatly handicapped by the demand for similar machinery at home. In the meantime, however, the Americans had been adopting polyphase machinery on a large scale, and what is more, standardizing and making a special study of it. Being more enterprising than their Continental rivals, they sent men to Johannesburg, and not only opened agencies, but even went so far as to form a supply company for certain mines. What was the result? Americans are as clannish as the Scotch, and it became the case of the unclean spirit who found the house swept and garnished. American machinery required Americans to understand it; the mines engaged them. These engineers required Americans to drive their machinery; they were forthcoming. New machinery was required; specifications were drawn up by the American engineers in their own language and indicating their own type of machinery. English makers could not or would not always quote to new patterns; they had made certain patterns all their lives, and they were not going to change now. To the next thing was but a short step; what more natural than that American dynamos must have American engines to drive them, American pumps to feed the boilers, and to be driven by American motors, and so on ad lib. And now the Rand is full of American engineers, American practice is de rigueur, and American terms are the vernacular. Specifications are already being handed around for machinery which contain many words strange to our ears, and which clearly indicate their source and the type of machinery required.

Now, where does the English manufacturer stand? Orders for machinery to the value of millions of pounds will be given out in the course of the next year or two, not only for mines, but for towns, which will increase rapidly in size. How many of these orders will he get? Will he strive to get out of his groove? Will he send out or appoint agents who are conversant with the requirements of new countries, or will he continue to try and force them to take the plant he has made for years? It is for him to answer, and not for us, but let it be understood that we do not grudge the Americans their success; it is due entirely to their enterprise and our lack of it that they are now more or less in a position to dictate as to the origin of the machinery required. We only wish to issue a warning in time, now that a new state of things is springing up, so that the English manufacturer may get his fair share of the plums.

Apart from the question of polyphase machinery, which he is now beginning to make, there are many other directions in which he is at a disadvantage with the Americans. Take the question of overhead line equipment, for instance. Why is it that we have to buy so much of this material from the States, not only for the Transvaal, but also for our own requirements at home? Are our own insulator-makers energetic enough? Another point, which applies less to the mines than to the towns, is the supply of car bodies and trucks for electric tramways. Hot countries like Africa require open cars, or cars without windows, and with top canopies. Are we going to continue to make closed cars only, because the Englishman is satisfied to travel in the summer in a rolling Black-hole of Calcutta, rather than force the tramway companies to put on cars with open sides in the hot weather?

It is not as if the English manufacturer cannot make these things. Indeed, he can make them in every respect as well as the Americans, and the solidity of his work is generally better. But he must standardize his goods rather more so as to offer them at a lower price, and in a shorter time, if he wishes to secure his share in the growing South African trade. There is room enough out there for everybody, but we cannot afford to let our colonies and our new territories become the dumping ground solely for American machinery—or see all the good posts filled by Americans after we have fought for them ourselves.

DEVELOPMENT OF THE TELEPHONE FIELD.

Notes from Ohio.

The Independent lines leading into the Builders' and Traders' Exchange at Columbus were cut one night last week. This building belongs to E. T. Mithoff, who has refused to allow the Citizens' Telephone company to operate instruments in any of its buildings unless the company allow him a telephone free.

Manager Reutinger, of the Independent company of Chillicothe, says his town will soon be connected up with a number of places outside of the state. It is now connected with nearly all river points and with the lake cities.

In the case of Samuel Stukey et al. against the North Electric company at Lancaster, Judge Slough has granted an order restraining the company from erecting telephone poles for long-distance service upon the property of the plaintiffs, south of Lancaster. The latter are farmers and have gotten contrary for some reason.

The Columbiana County Telephone company has issued a list of its patrons in that county.

The Home Telephone company of Kent, Ohio, has been incorporated by Marvin Kent, J. G. Getz, F. L. Allen, G. E. Hines and W. H. Butler. The capital stock is placed at $50,000 in shares of $100 each. The company will purchase the system originally installed by W. H. Butler, and will make a number of valuable improvements and additions.

The Bell people have established a free-service line from Pemberville to Brader and Prairie Depot, Ohio. It may also be extended to Bowling Green and some other points.

The contract for the construction of the fire and police system at Akron, Ohio, has been awarded to the Standard Underground Cable company at $7,813.28.

The City Council at Marion, Ohio, has refused to grant a franchise to an Independent company which is seeking admission, the old company making a hard fight against it. The new company is securing subscribers and will appeal to the Probate Court under the statutes of the state.

The new fire and police system invented by L. G. Woolley of Kenton, Ohio, was tested over the Central Union Telephone company's wires between Columbus and Springfield last Sunday. The alarm box has three magnets and a spring device and works without a battery. It also has a tester which shows every 2½ minutes whether the apparatus is in perfect working order or not. Mr. Woolley is also the inventor of the magneto telegraph which works without batteries, and he is backed by the National Magneto Electric Telegraph company of Springfield, Ohio, in all his experiments.

The following-named companies have been incorporated within the past few days:

Gibsonburg Electric Light company, Gibsonburg, Ohio, to operate a light plant and a telephone system. The capital stock is $12,000, and the incorporators are W. H. Mohrhoff, F. H. Westhoff, Charles Sanders, Louis Gerwin, Henry Feehrmeyer and Albert Miller.

Co-operative Telephone company, Coldwater, Mercer County, Ohio, to supply the town and neighboring villages with telephone service. The capital stock is placed at $2,000 and the incorporators are C. F. Marvilius, J. B. Hashinger, J. M. Willhoff, Anthony Rathweg and P. F. Weamer.

Attica Telephone company, Attica, Seneca County, Ohio, by Fred C. Myers, John Schotter, Richard T. Hearson, Harry G. Blaine and Ernest G. Blaine. The capital stock is $2,500. The company is authorized to build exchanges and lines in Ohio and especially to promote telephone interests in and about Attica.

Farmers' Telephone company, New London, Huron County, with a capital stock of $2,000. The incorporators are Charles Peck, A. H. Collins, E. E. Hubbard, U. E. Snyder and H. W. Townsend. The company proposes to erect a plant at New London.

The Paulding Home Telephone company is arranging to put in an exchange at Payne, a small town in the northern part of Ohio. Already the company has more than half the required number of subscribers on their books.

Workmen are busy putting in the wire and apparatus in the new exchange at Salem, Ohio. The Central District and Printing company is putting in the plant. O. M. C.

Telephony in Michigan.

Mr. J. B. Ware, general manager of the Citizens' Telephone company of Grand Rapids, estimates the number of Independent telephones in Michigan as 29,000, against the 32,000 of the Michigan Telephone company (Bell). The growth of the Independent companies is due to reasonable rates, superior service and rapid development of local toll lines. The Citizens' company of Grand Rapids increased its business from 1,460 telephones on September 1, 1895, to 3,306 on May 8, 1900. Mr. Ware figures that in 1899 the average gross income from each Bell telephone in Michigan was $29.49. As the stock and bond issue amounts to $234 for each instrument, he thinks the business must be done at a loss and that ultimately the Independents, with one-third the investment per instrument, will prevail.

Telephone News from the Northwest.

The Northwestern Telephone Exchange company made a distinct hit with its toll service by giving bulletins from the National Republican convention in Philadelphia. The nominees were known throughout the Northwest within a very short time after the convention had taken action.

Two independent companies have been organized at Marshfield, Wis., to build toll lines to surrounding towns. The system will include Wausau, Grand Rapids, Marathon City, Edgar, Fenwood, Stratford, Mosinee, Athens, Pittsville, Bethel, Vesper, Arpin and other points.

The Northwestern Telephone Exchange company is taking bids for the erection of a handsome central building in Fargo, N. D.

It is understood the Little Wolf River Telephone company contemplates an exchange for Chippewa Falls, Wis. It is said that many of the contracts on a low basis with the Wisconsin Telephone company expire January 1, 1901, and that that company does not intend to renew at the present figure. It is believed this will give the Little Wolf River company a chance to enter the field.

The Northwestern Telephone Exchange company at Grand Forks, N. D., demands a bond from a housemover to protect the company from the expense of cutting and repairing its lines. Injunction proceedings are threatened if the bond be not forthcoming.

The council of Superior, Wis., granted permission to the People's Telephone company to issue bonds. Some of the aldermen feared it was a scheme which would result ultimately in the consolidation with the old company, but the city attorney assured them that the city's rights were guarded.

A local electrician at Grand Meadow, Minn., placed a transmitter in front of a speaker at a camp meeting held there and the discourse was listened to over the wire in a number of houses on the line.

The Arcadia (Wis.) Telephone company is constructing a line to Whitehall, Wis.

The Sunset Telephone company is extending lines from Aberdeen, Wash., to South Aberdeen, and a new toll wire to Montesano.

A farmers' telephone line is projected from Liscomb, Iowa, to Conrad, by way of Whitten.

Owen Gray, late with the Western Electric company of Chicago, has been selected as superintendent of the Mutual Telephone company of Des Moines, Iowa. A number of improvements to the system are planned.

The Cedar Valley Telephone company of Waterloo, Iowa, is preparing to put its wires underground in the business section. Other improvements will be made.

The new telephone system at Rolfe, Iowa, has been completed and turned over to the owners by the contractors.

Work has been begun on the construction of the Holstein (Iowa) Telephone company's system.

The Billings (Mont.) exchange has 147 subscribers according to its latest directory.

The Inland Telephone company is about to extend a toll line from Ellensburg, Wash., east to Yakima and west to Palmer.

The Central Telephone company will soon move its Rockwell City (Iowa) exchange to new quarters. A new and larger switchboard will be put in use at the new offices.

The Wisconsin Telephone company plans to extend its toll wires to Rhinelander, Wis., soon.

The Sumner Telephone company is arranging to establish a local system in New Hampton, Iowa. About 100 subscribers have been secured.

The Lincoln (Neb.) Independent Telephone company has been incorporated with $150,000 capital stock. Local capitalists are interested in the enterprise. An exchange is to be established in Lincoln.

The Dakota Central Telephone company, which lately absorbed the local exchange at Watertown, S. D., proposes to rebuild the exchange as soon as possible. R.

Managing an Exchange in Opposition to the Bell.[1]

By W. B. Burke.

In the beginning of the Independent enterprise it was a serious question in the minds of those who contemplated investing in opposition to the Bell. The Bell people had control of every device that was used in a telephone and the public could scarcely realize that the patents had expired. But when the first opportunity was opened the opposition began. Threats were made by the Bell people from the beginning and every effort made to subdue further development. They did not seem to realize how an Independent exchange could exist when they already occupied the field. At first it was no easy matter to secure sufficient means to put an exchange in operation, as nearly everyone was warned as to their existing patents. It was necessary for the Independents to equip with instruments and switchboards that were not desirable, but as fast as suits were brought against these their exchanges were equipped with new and improved boards.

The Bell interests compelled the Independents to be where they are to-day. We had the long experience of the Bell, but they had made but little progress until the Independents entered the field. They forced the Independents to improve on their equipments until the Independents have to-day equally as good apparatus as the best the Bell can produce. The sympathy of the people is with the Independent movement. The old monopoly has held sway so long and been so exorbitant, arrogant and independent, that everyone is willing to render his assistance to the new enterprise and is willing to patronize the home company.

In conclusion, permit me to say that which we all seem to be in an excellent state of preservation, and are not working for glory, we should unite ourselves and by so doing strengthen our relation with one another, so the Independent field will be united for the purpose of systemizing telephone communication. In this way it may become a mutual business relation to all.

1. Abstract of paper read before the Illinois Telephone association at Chicago, June 7, 1900.

Pittsburg and Vicinity.

The Pittsburg and Allegheny Telephone company expects to have the new Pittsburg Exchange of 5,000 subscribers in operation by the middle of July. Work on the Allegheny City Exchange is progressing rapidly, and it is expected to be in operation not later than Nov. 1, 1900.

The Federal Telephone company has just completed a new exchange of 200 telephones in Wilkinsburg, Pa. This is a model plant, both as to construction and equipment. American Electric telephones, switchboards and protective devices are used exclusively.

An exchange of 100-drop capacity has just been put in operation at Millvale. Victor switchboard and American Electric telephones are used.

A new exchange has just been completed in Coraopolis, Pa. This plant consists of 100 subscribers.

The Avonmore exchange has been rebuilt, and a new 100-drop switchboard installed. This exchange is connected by trunk lines with Leechburg, Kittanning, Hyde Park, Saltsburg, Edri and Salina.

The Leechburg exchange has also been rebuilt and a new switchboard and new instruments put in to replace the old.

A new plant has been completed recently at Freeport, Pa., and a trunk line is being built between this town and Leechburg, Pa.

Exchanges of 100-subscriber capacity have just been completed and put in successful operation at Emsworth, Pa., and at Bellevue, Pa.

Monessen, Pa., less than two years old, with its 7,000 inhabitants, can now boast of a new Independent telephone exchange of 100 subscribers' capacity, which the Federal Telephone company has just installed.

A new telephone plant of 100 subscribers has just been installed in the flourishing town of Charleroi.

The New Castle Independent telephone plant of over 600 telephones is in a flourishing condition. The Council of this town is again agitating the question of underground conduits for all telephone, telegraph, electric light, and trolley wires. Should Council pass such a general ordinance, it would be a serious blow to the Independent telephone interests, as they have but recently put up several miles of aerial cable. In addition to this, it would, on account of the high price of such material, cost a large sum to install such a system—an expense which most telephone companies other than the Bell are ill able to afford.

A new telephone plant has but recently been installed at Ellwood City, Pa., near New Castle, and has been connected by trunk line with the latter city.

The Independent telephone plant at Johnstown, Pa., has a subscribers' list of over 900, being one of the largest independent plants in Western Pennsylvania. The Bell company's list does not equal one-third of this number. This plant started five years ago with 100 telephones, and has grown to its present size in the short space of five years. The plant has altogether outgrown its present quarters, and the question of rebuilding now confronts the stockholders. The company has received several bids for an underground system, and it may be that before the dawn of another year Johnstown may boast of the only Independent underground system in Western Pennsylvania, outside of Pittsburg and Allegheny.

The Allegheny County Telephone company, controlling plants in Braddock, Homestead, Duquesne and Rankin has just sent to press a new directory of its 700 subscribers. Connected by trunk line with this system is the Federal Telephone company's plant of 1,000 subscribers at McKeesport, Pa.

The West Pennsylvania Telephone company is installing an exchange in Burgettstown, Pa.

Ordinances have been granted to the Pittsburg and Allegheny Telephone company at Charleroi, Pa., and at Monessen, Pa.

Ordinances have been granted to the Federal Telegraph company at Belle Vernon, Pa., Baden, Pa., and Verona, Pa.

Rumor says that the Pittsburg and Allegheny Telephone company has absorbed the independent plant at Elizabeth, Pa. M.

New Keelyn Apparatus.

The Keelyn Telephone Manufacturing Company of Chicago, which reports a good order business, is exploiting the new apparatus illustrated herewith. The company announces that it will keep abreast of the times, and several original and novel appliances have been brought out already.

The Keelyn exchange and long-distance instrument (Fig. 1) is of the series type, with 80 ohms' resistance in the pair of ringer coils and a heavy three or four-bar magnet generator with high efficiency armatures capable of ringing strongly through 25,000 ohms of resistance. The switch hook is of the long-lever, cast-brass type, with strong steel spring and german-silver circuit springs provided with platinum contacts. Wide gears and an automatic cut-out operated by the crank are provided. The binding posts are of the lock-nut type, while the wiring and workmanship are neatly done; all being mounted in a highly polished, French finish, hardwood case of quartered oak or walnut. All exposed parts are in fine nickel finish. Fig. 2 shows the Keelyn telephone with extra battery capacity.

The Keelyn transmitter is said to be of exceptional simplicity and efficiency. The transmitter cup or box is cast in one piece on the arm, to which cup is screwed the cast-brass, nickeled cap. This cup and cap enclose simply a diaphragm,

Fig. 1.

Fig. 2.

Fig. 3.

NEW KEELYN APPARATUS.

granular carbon in a loose or free state (being one-half full), a thick carbon disk which latter is screwed over a mica disk against the enameled back of the cup by a plated machine screw which passes through a hard rubber bushing and is connected to one terminal lock-nut binding-post, the other circuit leading through the arm to the induction coil. The arm is of the "rocker" type, mounted on the induction-coil base, the whole being enameled and neatly decorated. The induction coils (like all Keelyn coils) are of the full silk-wound copper-wire type, being quite long, with a heavy Swedish iron wire core. The primary is 0.75 ohms and the secondary 75 ohms' resistance, which Mr. Keelyn claims to be proper for two-cell battery.

Among the specialties is the new Keelyn combined carbon and fuse lightning arrester (Fig. 3, actual size). This shows to what extent improvement can be made. The usual type occupies a space two by seven inches, while the new Keelyn type only occupies a space of two by one-half inches, or one-fourteenth as much. The device is fitted with german-silver spring-standards for holding the carbon and fuses, each standard being provided with an "eye" for soldering in the wires, making a certain connection.

NEW COMPANIES.

The Petroleum Telephone company, capitalized at $1,000,000, and the Clark Automatic Telephone Switchboard company were recently incorporated in West Virginia.

The Iroquois County Telephone company of Cissna Park, Ill., capitalized at $2,500, was a recent Illinois incorporation. Its incorporators are Tunis Young, J. C. Sailor and Fred Breymeyer.

The Kraft Combination Telephone company of Chicago was recently incorporated, with a capital stock of $375,000, to operate telephones and vend-machines. The incorporators are Charles H. Kraft, William L. Rohrer and Isaac M. Hamilton.

A charter has been issued to the Guthrie Telephone company of Guthrie, Okla., with a capital stock of $9,000. The purpose of the company is to build and operate a telephone system in Guthrie, in connection with the long-distance system of the Arkansas Valley Telephone company. The incorporators are A. G. C. Bierer, Jos. W. McNeal, B. S. McGuire and Frank Dale of Guthrie, and John M. Noble of Perry.

Telephone Improvements Abroad.

Under date of May 5th United States Consul Worman of Munich, Germany, reports that a syndicate has been formed under the auspices of the Bank of Darmstadt to bring into practical use certain telephone improvements that have been tested in government offices. These inventions are to make it possible to retain the spoken word and to repeat it as freely as desired; to use the same wire for simultaneous conversation by different persons; to repeat the same conversation at various points; and to strengthen the sounds so as to make the long-distance telephone operate with better results.

From London comes the statement that Ernest Kumberg has invented an important appliance for the telephone. "It is an ingenious combination of the phonograph and telephone," says a correspondent, "with a cylindrical attachment, which greatly magnifies the sound of the voice and produces a deep impression on wax. When the man who is called up is at hand he may take his message without recording it phonographically, or he may decide, if it is an important matter, to secure an impression for future reference. If he is out the machine will record the message on its own responsibility, and will reply courteously that its owner has just popped out, and that it will be glad to receive the message and hold it until its master returns."

Gray Magneto Patent Case.

The United States patent to Elisha Gray, No. 309,617, granted December 23, 1884, was passed upon by Judge Clark in an opinion filed on June 14th, which was published in the Western Electrician of June 23d. This patent was again considered by the court in settling the form of decree to be entered against the Williams-Abbott Electric company of Cleveland. It was granted for a telephone-call box provided with an automatic device for controlling the shunt around the armature, invented by Professor Gray in the fall of 1878, and has largely gone into use in equipping telephone and other signaling circuits.

The three claims of the patent read as follows:

1. The combination, with a magneto or dynamo electric machine, of a main circuit and a shunt or short circuit around said machine, and means for automatically breaking such short circuit upon and continuously during the operation of the machine.

2. The combination, in a dynamo or magneto electric machine, of a main circuit, a shunt of low resistance around the coils of the armature, a key in said shunt, and mechanism whereby said key is automatically opened upon and continuously during the operation of the machine, said key being closed and held closed automatically when and while the machine is not in operation.

3. The combination of the driving shaft of a dynamo or magneto electric machine, a sleeve mounted thereon to such manner as to have a determinate longitudinal movement thereon, and a circuit-breaker automatically operated by the longitudinal movement of the sleeve.

In his supplemental opinion, filed June 28th, Judge Clark says: "It will be found, of course, on reference to that opinion [Western Electrician, June 23, 1900, page 408], that the holding was that the particular device or combination covered by claims 2 and 3 was protected, and the opinion could not be construed as going beyond the claim, or as intended to broaden the claim. It was the particular instrument or means of accomplishing the result set forth in claims 2 and 3 which is protected, and not any other means or device not substantially equivalent to the device or means therein described. I do not deem it necessary to say anything further."

Competition in Ohio.

There has been quite a contest among the business and professional men at Columbus as to which telephone system they will use the Citizens' (Independent) or Central Union (Bell), and those in the different branches of trade have held meetings from time to time to discuss the matter. The physicians have finally decided upon the Citizens', and the druggists will likely do the same, as they will necessarily have to use the same system. The grocers have also decided upon the Independent system, and the butchers are now debating the matter. They are in such a position that they will have to use the same one as the grocers, since many of them handle groceries also.

This same matter has been under discussion among the business people of other towns in the state, and at Delaware the grocers have adopted the Independent system. So far as known, the dry-goods merchants have taken no action in this matter, and it is not known whether they will take it up or not. Their custom comes from all over the city, and from users of both systems, and it will be a hard matter for them to decide. In many instances where the Central Union instruments are already in they will be kept and both systems used.

G. H. Pratt, assistant traffic manager of the Central Union, was in Columbus a few days ago and discussed the rate matter with some of the local newspaper men. He declared that there would be no reduction in the prices, as had been reported, and that everyone who uses one of his company's instruments will have to pay the regular price for it. The Central Union has lost about 250 patrons in the city, he said, but in their place had secured between 300 and 400 new ones. The company has ordered new cable lines, which will accommodate 1,000 subscribers, and a new section long-distance board has just been put in which will accommodate 20 circuits.

GENERAL TELEPHONE NEWS.

The South Carolina Telephone company, at Columbia, announces that it is ready for business. Patrons will not be required to sign contracts.

The exhibit of the Ericsson Telephone company of New York at the Paris Exposition is from the Ericsson factory at St. Petersburg, Russia. Visitors are invited to inspect the exhibit, which is to be found in class 26, groups 4 and 5, in the Russian section, just beneath the luminous fountain.

The Charleston (S. C.) Mining and Manufacturing company has brought suit against the American Telephone and Telegraph company for $50,000 damages, charging that the defendant entered upon the lands of the plaintiff and trampled down the grass and herbage, injuring the land to the extent above named.

The bill to incorporate the Washington Telephone company, although passed by the House, and favorably reported upon by the District commissioners, seemed about to die in the hands of the Senate committee. As great pressure was brought to bear upon this committee, it decided to present a report on the bill without recommendation.

The directors of the Southern New England Telephone company voted recently in New Haven, Conn., to increase the capital stock of the corporation from $2,500,000 to $2,750,000. The proceeds of this amount are to be used to pay off the floating debt incurred for enlargement of the company's plant in various parts of Connecticut.

The Winchester (W. Va.) Telephone company has nearly all the poles up for its Charlestown and Harpers' Ferry line. This company is reaching out in every direction and will ultimately connect all the small towns in the Shenandoah Valley by telephone, and put them in communication, by means of long-distance telephones, with the large cities.

A news dispatch from St. Ignace, Mich., states that on June 22d a cable was successfully laid between that point and Mackinac Island by the Michigan Telephone company, and speaking communication established with the island for the first time. Various cities east and west were spoken with during the afternoon. Several of the company's officials celebrated the event with a dinner at the Grand Hotel.

Mayor Hayes of Baltimore, Md., said recently that he was negotiating with the Maryland Telegraph and Telephone company for the erection of an exchange in the city hall, and the replacing of all Chesapeake and Potomac telephones now in service of the city by Maryland telephones. It is also probable that Maryland telephones will be installed in all the fire houses during the summer. The trouble concerning what telephones the city uses seems to hinge on the use of the city's conduits. The Chesapeake and Potomac company refuses to use the city's conduits, whereas the Maryland Telegraph and Telephone company is said to express great willingness to use the conduits.

MANUFACTURERS AND DEALERS.

A new issue of the Ericsson series, published by the Ericsson Telephone company of New York, has just made its appearance. It contains mention of many of the foreign telephone plants installed by the Ericsson company, and an illustration of the 10,000-subscriber multiple switchboard at Copenhagen, Denmark, said to be the largest single switchboard in the world. The company receives a large number of requests for these little publications, which are mailed free to any address.

The Marietta Telephone company of Marietta, Ohio, is engaged in building an exchange, which, it is said, will be a credit to the company and a source of satisfaction to the citizens. The system, which has been purchased complete of the Sterling Electric company of Lafayette, Ind., will be of the centralized-energy and automatic-flashlight type, and the company will begin doing business with at least 600 subscribers. It hopes to give service by the middle of July. The Sterling Electric company is also furnishing the complete equipment, including switchboards and telephones, for the West Liberty (Iowa) Telephone company, and a new switchboard for the Linden, Ind., telephone exchange.

Development of the Incandescent Lamp in Twenty Years.

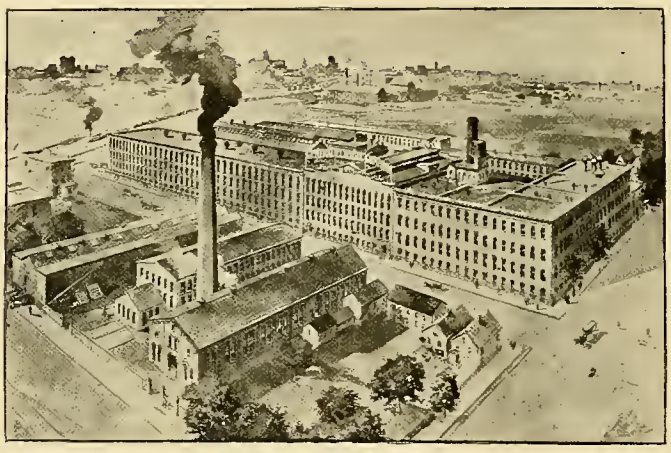
Twenty years ago, Edison, after two years of experimental work, gave the first public exhibition of his incandescent lamp in his laboratory at Menlo Park, and early in 1880 started the first Edison lamp factory. It is an interesting fact that the lamp to-day contains the same elements that it contained 20 years ago, none having been added and none omitted from the lamp during this period of time, and yet each of the elements which constitute the lamp has been so changed and developed that the lamp to-day is different in every respect from the old lamp, both in appearance and performance, and also in economical construction. The economy is well illustrated by the fact that 20 years ago lamps sold at $1 in the same quantities for which they now sell at 20 cents, and the profit per lamp is much more now than it was then; in fact, it is believed that lamps sold at $1, 20 years ago, were sold at a loss.

The lamp bulb of 20 years ago was made at the lamp factory, from glass tubing, being blown by eye, without any other guide, so that the shapes could not possibly be more uniform than the skill of various operators could make them. The bulbs are now blown in a mold at the glass works, insuring uniformity of shape and size.

The filament of the lamp has changed very materially, both in appearance and in character. It was then made of bamboo, cut to the desired size by plane. This planing required eight different operations before the piece was reduced to the desired size. This was not only very expensive, requiring very accurately made tools, but even at best, it was very difficult to make a filament which was as uniform in size as the requirements of the lamp demanded.

The old bamboo filaments were put into the lamps just as they came from the carbonizing furnace, so that the performance of the lamp was limited by the temperature which this piece of wood charcoal would stand. This temperature was nothing like as high as is possible with the present filament, which has the graphite coating, which is now added to the filament after it comes from the furnace.

Edison Lamp Factory in 1880.



Edison Lamp Factory in 1900.

DEVELOPMENT OF THE INCANDESCENT LAMP IN TWENTY YEARS.

The efficiency of the lamp, which is ordinarily expressed in watts per candle, is determined by this temperature, and the difference between the old and the new may be well illustrated by the figures of six watts per candle in the lamp of 20 years ago, and 3.1 watts per candle at the present time.

This difference in efficiency does not tell the whole story, because the filament of 20 years ago was a plain loop, which, although it gave 16 candlepower in the position in which lamps are measured, yet the total light given by a 16-candlepower lamp then was much less than that given by a 16-candlepower lamp now, because the present filament, being of the well-known oval form, gives a much larger light in the positions other than the one in which lamps are measured than did the old one. Thus, the old loop, measured through the tip of the lamp, only gave three candles, whereas, the present lamp in that position gives seven candles.

The glass tube which supports the filament from the bottom of the lamp has been developed very considerably, although in appearance it is much the same. The tendency of the change has been to reduce the amount of platinum used. In the old lamps probably 10 times as much platinum per lamp was used as is used to-day, and yet the platinum of to-day does its work just as well as did the old lamps with the large amount.

The base of the lamp has been improved, not only in appearance, but also in performance, as the old bases were constructed on a bad principle, which caused many of them to break in use.

The last, but one of the most important elements in the lamp, which, although important, is invisible, is the vacuum. Vacuums were produced 20 years ago as good as can be produced to-day, but great improvement has been made in the methods of getting them and in the uniformity with which they are made. Twenty years ago it took five or six hours to exhaust a lamp, whereas now they are exhausted in one minute, while the proportion of inferior vacuums produced 20 years ago was very much greater than it is to-day.

The improvements in methods of manufacture, which is illustrated by the great reduction in cost mentioned before, may be further illustrated by the fact that only a few years ago the cost per lamp produced of the breakage incurred in the manufacture was greater than the total cost of the lamps at the present day.

Another element in the lamp, the changes in which have been plainly evident to the eye, is the joint between the filament and the platinum leading-in wire. In Edison's early lamps this joint was made by means of a small screw clamp, the filament being squeezed into the jaws of this by a screw-driver, which was a very expensive method. This was followed by a copper-plated joint, the leading-in wire being folded around the end of the filament, and the whole joint being covered by copper by electrodeposit.

Both these methods required that the ends of the filament be enlarged so as to coil the filament before it came in contact with the metal. This required greater accuracy in the cutting of the filament, as, being made with enlarged ends, there was no possible variation in length after it was carbonized, and if it was made wrong originally, it could not be changed.

The present filaments are made longer than they are needed and cut to the right length after they are carbonized. This is made possible by means of a carbon joint between the filament and wire, which is not injured by the high temperature at the point where the filament leaves the joint.

This carbon joint was first made by folding the leading-in wire around the filament, and heating the joint so made very hot under gasoline. The heat decomposed the gasoline and deposited a carbon covering on the joint, which made a very perfect connection. This was superseded by the present carbon joint, which is applied in the form of a carbon paste, which, after being baked in a furnace (which decomposed the hydro-carbon liquid element of the paste), forms a dry-carbon joint, which is quite satisfactory.

A great deal of work has been done in the development of each of the elements of the incandescent lamp, and the development of each one must be done with a knowledge and consideration of all the other elements, as a change in one element may be very good, considering that element alone, but may affect the others disadvantageously.

This makes a problem with several factors in it, all of which are very important, and the effect of a change in one is often very difficult to trace to the element which has caused it, as the effect often appears as far distant from the cause as is possible.

The success of the Edison lamp has been very materially aided by the system of inspection employed at the factory, and by the very accurate selection of lamps, so that each lamp is shipped for use at the voltage for which it is best adapted. A lamp used on its proper circuit will give a very satisfactory result, whereas, the same lamp on a wrong circuit will perform very badly. To accomplish the desired result, very careful attention must be given to the processes in the factory which determine the voltage and candlepower of a lamp when finished. There are used in the factory, pieces of apparatus which measure the diameter of the filaments to the forty-thousandth of an inch. Enough of these instruments to do all the work are in constant daily use in the factory, handled by regular employes, so that it is a commercial machine, and not a mere laboratory tool.

The other essential measurements of the filament, which is the determining factor of the candlepower and voltage of the lamp, are also done with great accuracy, and the result is the manufacture of useful lamps only, so that there is no temptation to ship lamps wrongly assorted, in order to get rid of undesirable stock.

The system of inspections which cause the rejection of lamps for faults which would not have received consideration a few years ago, is a considerable expense to the factory, as apparently good lamps are rejected, and made up to standard, or else broken up.

While the immediate effect of such inspections and rejections is to increase the expenses, the ultimate effect is to increase the business on account of the greater excellence of the lamps which are shipped. The result of this policy is shown in the very large increase in business during recent years.

The Edison lamp factory of the General Electric company turns out 55,000 lamps a day, or nearly 16,000,000 lamps per annum. The pictures show the Edison lamp factory at Menlo Park in 1880, with its production of 300 lamps a day, compared with the present factory at Harrison, N. J.

Operating Work as a Feature of Electrical Laboratory Training.[1]

By William S. Aldrich.

In the representative institutions the engineering courses are now so organized that the junior student enters the engineering laboratory fresh from work in the physical laboratory. Advanced work along similar lines is carried on in many cases after the student has entered upon his professional studies. The earlier training is chiefly by way of illustration and demonstration, familiarizing the student with the phenomena, principles and laws of physics. The later training acquaints the student with some of the exact methods of modern experimental work. In consequence of such work, the engineering student should early assume toward all phenomena and problems in the realm of physics that attitude so characteristic of the scientific mind. Granting its thoroughness, there is less necessity for attempting similar training in the engineering laboratory. More time is therefore available for developing the latter along engineering lines.

The work of physical and of engineering laboratories naturally overlap each other. No hard and fast line can be drawn between them. It becomes daily more impossible to define clearly their respective limits, with the advance in physical science and the growing industrial applications of that science. In the engineering laboratory are investigated the properties of water, steam, gas and electricity with special reference to their industrial applications; the chemical, physical, mechanical, electrical and magnetic properties of materials, as the case may require; the functional relations of mechanisms, machinery and prime movers, and their performance in detail or in the aggregate.

The bearing of these considerations upon electrical laboratory training is obvious. Preceding experimental work with new electrical appliances or processes there should be carefully arranged work along the following lines: Study, inspection, illustration and demonstration, operation. By thorough study of actual and typical appliances the necessary preliminary electrical and mechanical data are secured. By inspection the student is assured of the electrical, magnetic and mechanical condition of the apparatus essential for successful operation of the same. By way of illustration and demonstration he is familiarized with the phenomena and principles underlying the functional working of apparatus and the handling of instruments and circuits. By operation the student acquires that familiarity, facility, confidence and resourcefulness so essential for the satisfactory handling of electrical circuits and appliances.

Training in handling electrical machinery is quite as essential as training in electrical measurements. The one should be done and the other not left undone. If, with all of his familiarity with galvanometer work, the young electrical engineer is left to the mercy of the wireman or the operating engineer, his laboratory training has been incomplete. A knowledge of the behavior of electrical machinery and confidence in handling electrical circuits is becoming more necessary with each widening use of electricity. The utilization of alternating currents and the operation of alternating-current machinery constitute to-day a most interesting and important field, one with which the electrical student cannot become too familiar. It is the result of experience that students who have been given a course of electrical laboratory training involving study, inspection, illustration and operation have a better understanding of testing work than if they had been put at once into the latter without attention to the former.

At Terre Haute, Ind., a company of capitalists, including several Boston men and W. P. Ijams of Terre Haute, has secured franchises on five roads leading out of Terre Haute for electrical-railroad rights-of-way. The company has a capital stock of $800,000, and work will begin on the lines within a few months.

1. Abstract of paper read before the Society for the Promotion of Engineering Education, at the New York meeting, July 2-4, 1900.

Zeco Igniter for Gas Engines.

To the Ziegler Electric company of Boston belongs the credit of devising the compact and well-designed outfit for igniting gas and gasoline engines which is shown in the illustrations. The apparatus consists of a switchboard and an electrical generator of either the dynamo or magneto type. Upon the switchboard (Fig. 1) are mounted three storage batteries, the spark coil and a single-throw switch.

To set up this outfit and operate it is simplicity itself. The storage cells are sent out fully charged and have merely to be put into the rings provided for them on the switchboard. Wires are run from the dynamo or magneto to two binding posts on the switchboard labeled "dynamo," and the two other binding posts labeled "engine" are connected by wires to the terminals of the engine. The dynamo (Fig. 2) can be run either by a pulley and

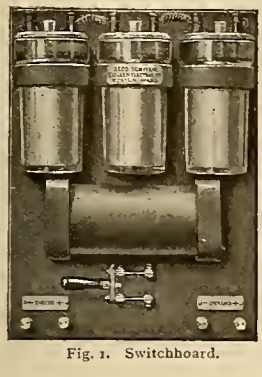


Fig. 1. Switchboard.

Fig. 2. Dynamo.

Fig. 3. Magneto.

ZECO IGNITER FOR GAS ENGINES.

belt or by a buff wheel in contact with the flywheel of the engine. To start the engine, it is only necessary to close the switch on the switchboard. This sends the current of the storage cells (7½ volts) to the spark points of the engine and ignites the fuel. As the engine comes up to speed, the dynamo also begins to generate. The switchboard is so arranged that the storage cells and the generator are connected in parallel. Before the dynamo is speeded sufficiently to generate, the entire load is assumed by the batteries. As soon as the dynamo is generating, however, both dynamo and batteries co-operate to give a hot, full spark at the moment the spark points of the engine touch. When the spark points of the engine are apart, the current of the dynamo is sent through the storage cells, restoring to them the current which has been used in starting the engine and keeping them at all times up to their maximum strength.

For those who prefer a generator of the magneto type the machine shown in Fig. 3 is provided.

It will be seen that with electric currents from two sources uniting at the spark points, there is practically no chance of missing an explosion. Furthermore, if, for any reason, it is necessary to run the engine slowly, the dynamo will cease to generate, but the load is at once assumed by the batteries, and the current at the spark points remains constant.

From the above description it will be noted that one of the strongest points of the Zeco outfit is simplicity of operation. Closing a switch starts the engine; opening the switch stops it. Again, there is uniform current at the spark points, no matter what the speed of the engine may be. Other important features might also be named. The outfit is comparatively light; it takes up but little room, and the cost is small, especially so when it is considered that the first cost is the only one. And, in addition to the many positive advantages which appear in the Zeco outfit, it is to be noted that there is no turning of the flywheel of the engine by hand until the generator is up to speed, no double-throw switches to be thrown back and forth at just the proper moment, and no renewing of batteries. The Ziegler Electric company says, in its very attractive circular, that the outfit is "automatic and perpetual." If the outfit will do all that is claimed for it, the phrase seems well applied.

Paris Meeting of the Institute.

Some 70 members of the American Institute of Electrical Engineers have signified their intention of attending the Paris meeting of the society, which is to be held on August 16th. About 20 others have said that they may possibly attend. Among the western men who may go are Professor W. E. Goldsborough of Purdue University, Samuel Insull of Chicago, A. E. Brooke-Ridley of San Francisco, E. A. Sperry of Cleveland, B. J. Arnold of Chicago, Professor Morgan Brooks of the University of Nebraska, Professor D. C. Jackson of the University of Wisconsin, H. H. Wait of Chicago and E. R. Weeks of Kansas City. Secretary R. W. Pope will sail from New York on the Majestic on August 1st. Mr. F. E. Drake, the director of machinery and electricity for the United States Commission to the Paris Exposition, has secured permanent quarters for the American Institute of Electrical Engineers in the Electrical Palace at the Paris Exposition.

G. I. Automatic Circuit-breakers.

The illustrations show the new automatic magnetic circuit-breakers of the General Incandescent Arc Light company of New York. Fig. 1 represents the single-pole instrument for 125, 250 or 500 volts, and Fig. 2 the double-pole type for 125 or 250 volts. The company states these advantages:

The contacts are of the laminated type, which, being perfectly protected from arcing by three metal shunts, one opening after the other, and a final carbon break of great length, at all times make perfect contact. In the case of 500-volt railway panels two long carbon breaks in series are provided on the single-pole circuit-breakers. These laminated contacts, tending to free themselves by opening the circuit, are at all times alive to respond to an overload and tendency to stick is obliterated. Gravity also tends at all times to open the breaker. The contact blocks upon which the laminations make connection are flat and parallel with the switchboard, so that in transferring the device from its templet to the switchboard variations from their position make no change in the excellence of contact. The laminations are carefully calculated so that each leaf bears with an equal pressure. They are protected from mechanical as well as electrical injury. The opening spring, which actuates both the laminated contacts and the carbon carrier levers, operates until the carbons are free and open; hence there can be no sticking of the carbons. The laminated contacts are separate and distinct from other parts of the device and are therefore readily taken out for inspection, and their weight is not a drag on the moving parts. There is no hammering or great exertion needed to close the breaker, as it can be closed by a steady pressure well within the strength of anyone. On the larger size a toggle scheme is provided, which is of novel form and which has many distinctive features of superiority.

The moving parts are all provided with perfectly fitting bearings, machined to a definite size, and all parts are interchangeable, being made to drawing by the most approved tools and modern methods of manufacture. Any part that becomes necessary to replace through any accident can be obtained from stock and inserted by the operator.

In the double-pole type each side of the circuit is independent, with separate latches, hence each side is closed separately, and if an overload condition exists it is impossible to close the circuit. The first side closed opens upon the second side being closed upon an overload. This feature makes it unnecessary to provide a switch in series with the circuit-breaker.

The magnetic portion of the circuit-breaker is of the coil and plunger type, consisting of a solenoid of liberal dimensions to carry an excessive load, and a movable core of soft iron, which is raised by the magnetic energy against gravity, there being no springs or other uncertain means of adjustment. This construction allows very wide range of adjustment, and one that remains constant under all conditions.

Roller latches are provided in all the circuit-breakers, the company believing this to be the only frictionless method. The latches are made of hardened steel, and are interchangeable. One thousand amperes to the square inch is the standard for conducting parts.

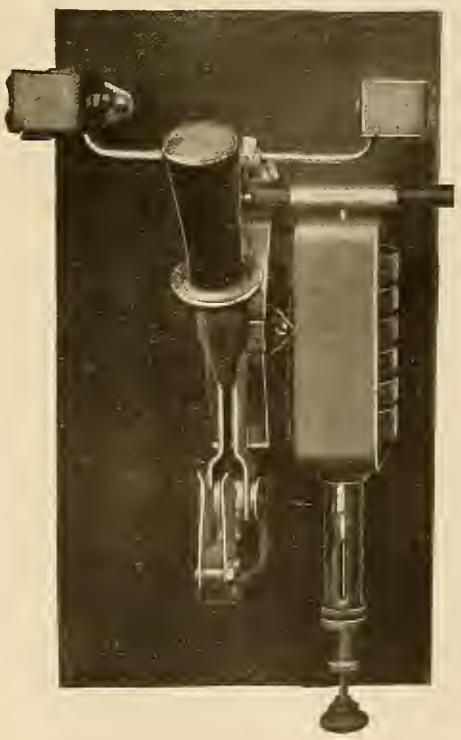


Fig. 1.

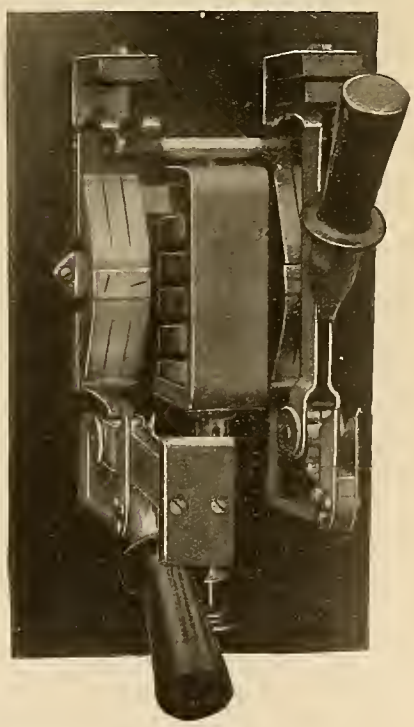


Fig. 2.

G. I. AUTOMATIC CIRCUIT-BREAKERS.

Automobiles as Source of Revenue for Central Stations.[1]

By Elmer A. Sperry.

One year ago, in New York, predictions, optimistic in their general tone, were made as to the rapid and general adoption of electric road vehicles, and some disappointment has been felt by station managers that more substantial advancement toward heavy demands for current has not yet been forthcoming for this purpose. Managers will recall that during the year frequent inquiries have been made that have not resulted in desirable business.

It is my purpose to outline briefly some of the factors that have contributed to these unfavorable conditions, and to record some advances made. It has been discovered in many instances that the demand for current is not so favorably located on the load curve or on the network as was hoped. For instance, electric delivery wagons required charge at times of heavy load and on the part of the network heavily taxed in lighting. Again, the factors controlling the seasons of the heavy demand for lighting during the year are found identical and in phase with those requiring heavy duty of commercial electric vehicles. The carriage of the shopper and the delivery vans are both more active at these seasons. Furthermore, the same weather conditions producing heavy traction at the same time increases the demand for light. In a word, the diversity factor that it was hoped would be introduced with the automobile has not been in evidence.

Many of these difficulties may be made to disappear entirely, and diversity factor be developed that is practically ideal, by the simple device of duplicating the traction batteries. Where this has been done, it has been found that the charging can go forward at times and rates dictated by the station, and practically under its control. No hardships need be experienced by rigid conformance with this practice. Careless infringement of this principle may be remedied in a number of ways. The employment of two-rate meters has been suggested.

The station management has not in all instances been able to conceal disappointment at the unfavorable developments along some of the lines above pointed out, and has allowed it to react back to inquirers. I regret to say that prospective customers have in some instances been embarrassed by want of co-operation, aid and enthusiasm, justly expected

1. Read at the meeting of the National Electric Light association at Chicago, May 24, 1900.

from the management. Opportunities have thus been lost to encourage the industry, as the results that are now assured amply justify, as I shall endeavor to show.

Mechanical traction is coming rapidly to the front. Animal power is being superseded on every hand, and, especially for commercial uses, a universal effort is being made to break away from the horse and place roadwork on a mechanical basis. As a source of power, the mechanical is found to be simpler, more reliable and shrouded in far less mystery than the cellular-tissue-nerve combination. It should not be out of place, before this body, to recall some of the evident merits and advantages of the electric over other automobile systems. The perfect storage battery presents some remarkable features; it even rivals the electric motor itself in its fitness and special adaptability to the automobile problem. Its very large reserve power at instant command; its entire freedom from danger when fully charged; its almost constant pressure throughout its capacity—mark its superiority. This straight line of discharge of the battery is not matched by any other power-storage system of which we have knowledge. The recently developed capacity for quick charging and the ease with which the charge may be obtained in almost any hamlet in the country are among its advantages.

It has long been supposed that compressed air is an ideal form of stored power, but it is safe to say that electric storage distances compressed air in all the important features. Reliable batteries are now available and on the market that will yield for each 100 pounds 1.8 horsepower hours. Compressed air will yield to every 100 pounds (air and tank, exclusive of reheater) three-tenths horsepower hour, or six times the power for electric that it is possible to obtain from air. This result will be a surprise to some engineers. The fact that with the electric system we have a rotary motor of ideal simplicity, with a capacity for overload, coupled with an efficiency that is nothing short of wonderful, contributes inestimably to the success of electric-motor-driven systems, and is in marked contrast to the multiplicity of compounded, reciprocating engines employed as motors by our compressed-air friends.

The single feature of the constantly increasing cost of supply of fuel-using vehicles has already driven the makers to the extremity of seriously considering alcohol, with its weak power factor, as a possible substitute for the lighter petroleum products. The thoughtful engineer is constantly confronted with conditions indicating that in the realm of power coal is king, and only those traction systems that are organized to derive power from this source will keep to the front. This point, coupled with the electric system, is responsible for the stupendous development in present urban or street traffic. To show its superiority over all other powers, one need only recall the total absence of either steam or gasoline street cars. Germane to this subject, the question is often asked, Will automobiles replace street cars? Its great flexibility and independence of track certainly render the new claimant an ideal urban conveyance. Can the central-station man look forward to supplying so large a demand as would thus be created?

The automobile, under street-car conditions, brings forward an interesting field of inquiry. The single fact that the stupendous cost of permanent way and its maintenance is at once eliminated makes the problem of more than ordinary importance. The interest and income on these two items would yield so large a sum as easily to offset much extra expense of operation, and especially expense attending the development and smoothing out of the early workings, and covering the expense of adjusting a system of this magnitude to new conditions. Such a system would, however, be subject to certain limitations, chief among which will be found decreased weight per passenger, difficulty of easily directing the excessively heavy structure, large increase in power per passenger carried, increased rolling-friction factor, and—one of the most important—the limitation as to roadbed; soft tires being precluded by the excessive tonnage. Considering these factors separately and collectively, the point is at once reached, showing conclusively that with anything like wheel pressures equal to that now obtaining in street-railway service, nothing but steel pavement could be practically employed. To demonstrate this matter tests were made as follows: Asphalt roadbed was taken as the standard roadbed of the future. A piece of very hard asphaltum, laid in the most approved manner and in constant use for two years, was selected. This had been maintained at an average temperature of 38° for 18 hours (no sun), the highest temperature during this time being 46° at time of test. A 62-inch wheel, with 3½-inch steel tire, was loaded to 5,000 pounds on scale. This wheel was taken over various parts of the hard asphaltum, with the following results: Once over, average depression, .029 inch; twice over, average depression, .047 inch. These depths were taken by a micrometer, depth gauge easily reading to one-fifth of a thousandth of an inch, and some 30 readings were taken in each instance. It will be noticed that this depression is somewhat over one-and-one-half thirty-seconds of an inch. The amount of this depression is surprising, considering the comparatively light load, broad tire, large wheel, extremely firm condition of the roadbed, and the temperature at which the asphaltum was tested, and seems to bear out the statement that the real limitations are probably more those of roadbed than of any other one factor.

Another factor destined greatly to increase the radius of action of electric vehicles, and the consequent demand for power, is roadway improvement. The present good-roads agitation is certainly in line of progress and should be given all possible aid and encouragement. In this connection, I see no reason why we could not wisely follow the plan, based on historical precedent, of utilizing for this important work of permanent improvement our convict labor, the disposition of which in this country has always been a source of embarrassment to the authorities. This system certainly has much to recommend it, and the improvement of our roadways calls for a vast expenditure of labor and has much need of a uniform and systematic effort.

The fact remains, and has been emphasized within the past year, that progress in electric vehicles has not been as rapid as was expected, and causes have existed that were not foreseen and that were not generally understood. Some vital reason seems to have prevented the rapid development and general adoption, that at one time seemed assured. Was it the element of cost? Two important conditions stand out prominently in connection with electric road vehicles. These are, first cost and cost per mile of operation. It is not my purpose to discuss the first as there are endless variables entering into the question, and it is doubtless true that the prices will gradually decrease. This part of the problem is always found to be self-correcting, and even to-day, with the electric, the cost per pound of vehicle complete is lower than other and far less available and pleasurable systems.

The cost of electric power for automobiles has been demonstrated in Paris to be less than with any other power system, and surely this factor is not the one now preventing the wide adoption of electric vehicles. In a paper before the American Institute of Electrical Engineers, G. F. Sever and R. A. Fliess of Columbia University give results of extended trials with electric delivery service in New York city. It is shown that with present power and rolling-friction factors, there is effected a saving of nearly 2½ cents per car-mile over horse service, and with the capacity of many more miles per day than with horses. With a daily service of 36 miles a saving of 356 hours per year of actual delivery service per vehicle is effected. The average horse was found to have a capacity for three hours' work per day at the rate of seven miles per hour. The authors state: "The figures given above speak for themselves, and would appear to be most effective argument in favor of adopting electric-automobile delivery service."

A popular notion exists that carriage batteries and electric batteries are charged with a certain number of miles. It requires only a second thought to see the error or delusion embodied in this idea. It is evident that a battery when fully charged contains, not miles but electrical power, which may be expressed in horsepower, and which is proportional to the size and capacity of the particular battery in question. With this in mind, it will be readily seen that the statement that carriage contains a capacity to run a given number of miles would only be true when a certain standard pavement or roadbed is considered, because it is found that it requires very much more battery power to drive a carriage a mile on a soft, uneven and hilly road than it requires on a smooth, hard and level road. It should always be understood that a standard pavement or roadbed is considered.

Again, for instance, where two motors are employed, the power and efficiency is divided, requiring, it is found, a larger amount of power from the battery to drive a vehicle of given weight a mile upon standard road; again, the mechanical condition of the bearings, or amount of rolling friction present, in carriages of different makes also varies. It is evident, therefore, that a number of important considerations should be included in any attempt to give a definite or prescribed mileage capacity to electrical vehicles and their batteries.

In electric-road traction, the consideration of prime importance is the battery. What is its efficiency, its durability and, above all, at what cost will it produce a ton-mile?

We will confine our attention in the following remarks to that class of storage battery known as the lead-lead element. These batteries are of two general kinds: The one having its active material formed or developed from metallic lead—Planté's process—the other having its active material mechanically applied—the Brush or Faure process.

A prominent German writer, giving results of recent tests, states that an average carriage with a Planté battery would run 20 miles per charge, the battery weighing 1,260 pounds, yielding 2.8 ampere-hours per pound, 5.25 watt-hours per pound, and requiring 51 pounds of battery per ton-mile; whereas, with the Faure battery of the same capacity, he found the weight to be 980 pounds, yielding 3.6 ampere-hours per pound, 6.5 watt-hours per pound, running the same carriages an average of 29 miles, requiring 30 pounds of battery per ton-mile, showing a life of 3,000 and 4,000 ton-miles. This simple report reveals the fact that batteries of different weights, though possessing the same capacity, will propel the same vehicle different distances, requiring a marked difference in the pounds of battery per ton-mile. One of the highest engineering authorities in storage batteries recently stated:

"The advantage which would follow the introduction of a high-capacity cell would not be merely the extension of the radius of action of the electrical vehicle, but would be a lengthening in the life of the battery itself. This is brought about by the fact that it would almost entirely remove the most powerful cause for deterioration—that of over-discharge. Present batteries have 20 to 30 miles' capacity. In the case of a battery capable of propelling a vehicle 60 miles on one charge, only the most inexcusable carelessness could bring it to the state of complete discharge, for 90 per cent. of the discharges would be for distances of less than 30 miles. Under these circumstances, the battery would be seldom discharged over 50 per cent. of its capacity, a condition of affairs which would insure a greatly increased life, probably between four and six times the life under present conditions."

The importance of proper manipulation, also proper adjustment of the capacities to the work to be performed, is here emphasized. Not only will it be seen that the life of the battery is improved, but, what is more important, the cost per ton-mile is also materially reduced. In this connection, it will be interesting to investigate the relation of the cost of operation per mile due to this factor, namely, the storage battery. Very little, if any, literature is available on this all-important subject, and, in fact, so little experience up to the present time has been available, and so little information has been given out, that it is not surprising that only meager records of this function exist.

Beginning with the supposition that the present heavy batteries, namely, those yielding about 2¾ amperes per pound, are possessed of a given life, certain deductions will be made by introducing series of variables yielding results and data, the bearing and significance of which is of more than passing interest.

Before entering upon a more detailed discussion, it might be well to state the result of more general observations in this line. The desirability of the electrical system of traction, the extent of its adoption, and consequent extent of the demand of the central station for supply, will depend upon the earning capacity that can be demonstrated. The value and present cost of the same work are both known factors. The question remains, what is its cost under the new conditions? Under practical conditions of operation, a battery having a life equal to 1,000 ton-miles will drive a vehicle weighing a ton 1,000 miles, or a vehicle weighing two tons 500 miles. For purposes of illustration of the possible cost of this factor, let us assume that this battery costs $500. It will then be seen that each cab-mile covered in the latter instance will cost $1; which would, of course, be prohibitive. Nevertheless, it is a fact that batteries have been made and marketed, and, what is still more serious, others have been so misused in practice, so as to have a life less than above assumed. Suppose the average life of the battery to be five times that assumed—the new cost per cab-mile will be 20 cents.

In the early stages of any industry, conditions are often found to exist, the practical results of which, though startlingly disappointing, are finally met and overcome; and especially is this true where the result is an important one, and where capital and skill are available. This is most certainly true of the art under consideration, and within the past year advances have been made that are favorable in the extreme; advances that are destined to reverse the adverse verdict, and to place the art of electric road traction by batteries high above possible criticism.

Taking unity as a basis of the battery factor in the cost per mile, we will proceed to introduce the variables as to weight and cost, and to note the results. Suppose we assume that the heavy battery is about half the total weight carried. Engineer Maxim, in his Milwaukee paper, says 45 per cent.; this is close enough to 50 per cent. for present purposes.

First, assuming a battery of same capacity to weigh one-half, it will at once be noted that the vehicles carrying battery of only one-half the present weight can easily be made one-eighth lighter, giving a total reduction of weight of one-fourth plus one-eighth, or three-eighths. The capacity remaining the same, the lighter combination, or new carriage, will be propelled unity divided by 625, or 1.6 times its former mileage. This factor—1.6—represents the new mileage, yielding the new cost per mile of five-eighths, or .625. In the above calculation it has been assumed that the lighter battery costs the same as the heavier battery, or twice the cost per pound.

Light battery costing the same per pound as heavy battery, the cost is now reduced to one-half, but the battery is of the same capacity, and will propel the vehicle 1.6 times its former mileage. Introducing this factor, we have a new cost per mile of less than one-third (.31).

Important reductions in cost per pound of battery have been made during the past year. Let us now assume the following:

Light battery costing one-half per pound of the heavier battery, the cost becomes at once one-half of one-half, or one-fourth; but we must still introduce the mileage factor of 1.6, which yields 1.5, or a cost per mile of one-seventh (.155).

In the above calculations we have assumed only the original life of the batteries, with no renewals. It is found in practice that vehicle batteries with the renewals cost about one-half the first cost of battery, and the life by renewing is extended half

the former period; a condition, it will be observed, that does not alter the cost factor per mile.

It has been found that a battery when exhausted weighs as much, and is possessed of its full quota of chemical Pb. and though heretofore it has been difficult to recover any portion of its original cost, at present, with the batteries of one maker at least, it is possible to recover and reuse the exhausted material over and over again, at slight additional cost, the original total investment in lead being practically the only investment required.

Assuming, now, that these renewals be made at half original cost, and that the batteries be carried through only four such renewals, it is found that the whole battery cost and energy produced throughout its extended life is six-tenths of that during the first period, which alone has been considered above. Introducing this factor in the last result, we find a cost per mile of practically one-eleventh (.094).

Advances in the art have, however, gone further than reducing the weight of battery by one-half, and it is now possible to obtain on the market batteries of excellent life that have the original capacity with one-third the weight. With such a battery a vehicle required to carry one-third weight of battery can easily be made one-sixth lighter, making a total reduction of the combined weight of one-third plus one-sixth, or one-half. This battery, having the same capacity, will push the lighter vehicle a distance of unity divided by one-half, or twice the mileage possible with the heavy battery; or at a rate of cost per mile of one-half (.5).

The last result assumes that the light battery (one-third weight) costs the same as the heavy battery.

Light battery costing same per pound as heavy battery, the weight being only one-third, the cost will therefore, at once be one-third. But it will still drive the carriage twice the mileage, yielding a total cost per mile of one-sixth (.166).

Light battery costing one-half per pound, there being one-third the weight, the cost will at once be one-sixth; the battery, still having the original capacity, will propel the carriage twice the mileage, as above, and will yield a total cost per mile of one-twelfth (.0833).

Carrying this battery through a course of four renewals under the conditions above stated with reference to renewals, we find that through the extended life of the battery the cost per mile has been (.0833 × .6 = .05) equal to one-twentieth (.05).

The realization of these sweeping reductions in cost is all-important. The results are evidenced as follows: Vehicles with live load, total weight of 1 1-3 tons, have yielded 1,000 miles per discharge with batteries weighing less than 1,000 pounds. Partial realization of the desirable features yielding the results above given will work economies that are proportionate. The above calculations are given not only as indicating the high point that has been attained in the development of traction batteries, but also as indicating the line in which future effort should be directed for still further advancement.

As showing the position of this country in this most important work, and especially the recent developments and advances on this side, reference will be made to the competitive tests recently concluded in Berlin, in connection with the International Motor Car Exhibition in that city, which were productive of important and valuable data regarding electric-motor vehicles. Not the least interesting is the average weight of battery to the ton-mile. This figure is named as 28 pounds per ton-mile, but recalculation shows it to be nearer 30 pounds.

It will be seen in the test recorded from the German authority quoted earlier in the paper, that the values of 30 and 51 pounds per ton-mile were assigned. Values in this country for vehicles most frequently range between 28 and 50 pounds. As the result of experience, the author would state that this value should be held at or below 10, and vehicles that can easily show this value are in daily commercial service; which makes an extremely favorable showing. So light a battery lends itself readily to the duplication of batteries referred to as creating the necessary diversity factor. The results of the battery tests, so-called, made under the auspices of the Automobile Club of France, recently concluded, indicate that the best results must be expected from batteries in which the active material is retained with, or its retention in place upon the grid is materially aided by, the use of proper envelopes; this being especially true with traction batteries. Furthermore, every means should be employed to shield the battery and to insulate the same thoroughly, not only electrically, but especially against jar and vibration. It has been demonstrated that concussion and molecular vibration are factors tending most seriously to disintegrate the elements. A plan has been devised that seems destined to secure this result; it affords a cushion support for the individual plates by the simple device of rendering the cap of the plate supports within the receptacle elastic and yielding, thus allowing it to perform the function of a cushion.

As a result of the past five years' observation of and close contact with this most engrossing work, the author can assure station managers that the time has arrived when traction batteries, under conditions of vehicular traffic, are making excellent records and showing commercial results that are most satisfactory. At last, this element of greatest mystery and uncertainty, and the one that has beclouded the electric-vehicle world from the first, has cleared from the horizon, leaving only known factors, with which we may deal with certainty.

The success of the electric vehicle being thus assured, a steadily increasing demand for current is sure to follow, which will result in large business. This field belongs to the central station by right of discovery; but history repeats itself, and the opportunity will be lost if the territory is not occupied and its resources developed. The central-station organization and equipment is the proper guardian and natural source of expert service and attendance for both battery and machinery, and will naturally be looked to to foster the interests that it shares with the vehicle operators. It has not been demonstrated that central-station owners should not be the principal operators themselves. Much can be said in favor of such a combination. In any event, they should closely ally themselves with this important industry, and the earlier a practical experience is had by the station men themselves, the sooner will they understand the needs of the business, and the sooner will they be prepared to guide their patrons into a successful and widespread use of electric-road traction.

CORRESPONDENCE.

London Letter.

London, June 19.—A small army of laborers is now trench-making in many of London's streets preparing the Postoffice's new underground telephone system. Scarcely a street in the one square mile that comprises the city will be exempt from these excavation works, and the magnitude of the scheme may be judged from the fact that in the subways to be constructed in the neighborhood of the central exchange on Queen Victoria street, provision has to be made for the necessary wires to connect 40,000 subscribers. The first portion of the system is to be completed early next year at a cost of $2,500,000, but the total expenditure will considerably exceed five millions.

English railways are improving in their ways. Yesterday I traveled in a Metropolitan extension train, which was actually and in fact lighted by electricity, even an ordinary third-class carriage having 10 incandescent lamps all to itself, the light from which was really startling after the miserable flare of antiquated oil lamps, to which one has been so long accustomed and which has brought fortunes to oculists.

According to the returns of the National Telephone company, made up to April 12th last, the number of calls and replies for the preceding year amounted to 615,000,000, or, roughly, 2,000,000 per working day. The total is about nine times as great as the number of telegrams dispatched annually by the General Postoffice.

On Thursday an International Tramways and Light Railways Exhibition, the first of the kind to be held in this country, will be opened at the Agricultural Hall. As a proof of the tramway revival that is taking place in this country, it is significant that out of the hundred odd exhibitors most of them are British. Of course, American and Continental firms are well represented, but the home exhibitors are in the majority. This shows that during the last few years rapid strides have been made, and from the exhibits already sent in experts tell me that there are now very few things in the matter of modern tramway materials that England need go to America for. Many of the English exhibits, however, are made under American patents.

Experiments will be made at Ilfracombe in a few days with wireless telegraphy between that town and the Mumbles, a distance across the Bristol Channel of about 21 miles. It will be interesting to observe how the installation will work on the iron-bound rocky coast of North Devon, so much dreaded by the maritime community, as is evidenced by the numerous black marks placed against it on the wreck chart.

The Central London Railway is determined not to make a Paris Exhibition of itself, and refuses to admit the public before it is quite ready for the reception. Experimental trains are running already, and on the 27th of this month the Prince of Wales is to open the line. The whole journey from Shepherd's Bush and the Bank will cost only twopence first-class, for there is no second or third. Moreover, the workman who travels before half past seven in the morning will pay only twopence for a return ticket. They will bless electricity, for the shilling a week which they will pay for the pleasure of living in the suburbs will be more than covered by saving in rent. W. H. B.

New York Notes.

New York, June 30, 1900.—A new electric-light trust has just absorbed the electric-light companies of New Brunswick, Perth Amboy, Rahway, Metuchen and Bound Brook, N. J. It is known as the Central Electric company, and its object is said to be to take in all the electric-light plants in central New Jersey, just as the United Electric company has already corralled the electric plants of northern New Jersey.

The Manhattan Elevated Railway directors let the contract for the mason work on the company's new electric power house at Seventy-fourth street and the East River, on Tuesday last. M. Reed & Co. are the contractors. This power house will cover an area of 86,204 square feet, and extend from Seventy-fourth to Seventy-fifth streets. Nearly all the machinery to go in this station has been already contracted for, and will comprise some of the largest generating units yet built. The total capacity of the power plant will be 64,000 horsepower at its most economical rating, while the total available capacity will be 96,000 horsepower, making the largest power plant in the world. There are to be four stacks 17 feet in diameter and 275 feet high. They will be built of a special brick, similar to that used in the Krupp works in Germany. The location of this power house was a matter of long consideration as a number of feasible locations were suggested. W. E. Baker, formerly superintendent of the Metropolitan Elevated of Chicago, has charge of all the electrical construction for the Manhattan Elevated.

The Westinghouse Electric and Manufacturing company has a contract to equip a road to run around the edge of Lake Geneva, Switzerland. An American syndicate is building the line. Most of the members of the syndicate are New York men. They purchased an old road and are electrically equipping it. This road was originally operated by steam locomotives and horse cars.

The Metropolitan Street Railway company has received a part of the 125 air motors from the Compressed Air company, which are to be introduced on the Twenty-eighth and Twenty-ninth street lines. These replace the unsatisfactory air motors formerly used on these streets.

It is expected that the Rapid Transit Subway company will close a contract soon with John C. Rogers for the tunnel under the Harlem River. Work on the downtown part of the subway itself will begin soon, permits to open downtown streets in a number of places having been issued to the Degnon-McLean Construction company.

Lightning struck the flagstaff of the American Tract Society building last Tuesday and sent a shower of large and small splinters raining down into Nassau street. Lightning also did considerable damage in a number of eastern states the same day.

Further harmonizing of interests over gas and electric-light matters between persons identified with the Consolidated Gas company and the Metropolitan Street Railway company seems to have been effected through the acquirement by the New York and Queens Gas and Electric company of the Jamaica Electric Light company and the Electrical Illuminating and Power company of Long Island City. While the companies acquired are not of very large proportions, they control the entire electric light and power and gas field of the Borough of Queens, with the single exception of a small property in Rockaway, which is so far removed from the general scope of operations as to render it no factor in any scheme of opposition, and it is understood, on the contrary, to be in full accord and harmony with the new combination. Both of the acquired properties were owned by the Electric company of America, a Philadelphia corporation, of which William L. Elkins, P. A. B. Widener and Thomas Dolan of the Metropolitan Street Railroad are directors. The New York and Queens Gas and Electric company is in itself a consolidation of the Flushing Gas and Electric Light company, the New York and Queens Light and Power company and the Newtown Light and Power company. Its franchises are perpetual. Its president is Frank Tilford, president of the Standard Gaslight company of this city, which has just been sold to the Consolidated Gas company, and among its directors are George F. Baker and Harrison E. Gawtry, both directors in and the latter president of the Consolidated Gas company. The company has $1,000,000 in stock and $900,000 in bonds outstanding. Harmony of interest between the Metropolitan Street Railway and the Consolidated Gas company was first manifested last January, when the former sold out the New York Gas and Electric Light, Heat and Power company to the Consolidated company, and Messrs. Whitney, Ryan and Brady of the Metropolitan faction, became directors of the Consolidated company. The present transfer of property appears to be a move in the same direction, only on a smaller scale.

The American Association for the Advancement of Science, with its 16 affiliated societies, held its forty-fourth annual meeting at Columbia College this week. Denver was chosen as the place for the next convention. M. L. G.

From the Buckeye State.

Columbus, Ohio, June 30.—There has been considerable excitement in Columbus for some time over the fact that the railway committee of the City Council voted the Chillicothe, Mt. Sterling and Columbus Electric Railway company a franchise, and then the members turned around and blocked the way by refusing to advertise for bids, as the law requires. They showed their willingness in one way, and then put up a barrier in another. Some of the local papers have "roasted" the members of that body unmercifully for going back to the tactics of the old body, from which the people thought they were free. The same tactics were shown when the council set about to declare the Columbus Rail-

way company's franchise to the Westerville line void and then backed down at the last meeting. The commissioners of Franklin County granted the road a franchise, and the people of Columbus will not rest until they get a council which is favorable to the interurban railways. Many of them are ready to come into the city as soon as they are assured that they will receive proper consideration at the hands of the council.

The people of Dalton, this state, want an electric-light plant, and there are two persons after the franchise, one a Mr. Teich of that place and the other a gentleman representing a New York company. Mr. Teich claims to have the promise of enough business to warrant him in installing a plant as soon as the franchise is granted him.

The Ohio Valley Electric Railway company will erect a bridge over the Big Sandy River at Kenova, W. Va., to cost $100,000.

Material has arrived for the new road to be built from Pomeroy to Racine. Work will be begun on it at once, the towns along the river having granted an extension of time for the completion of the work.

The Pomeroy Electric company, Pomeroy, Ohio, has made arrangements to put in a new plant throughout. A new 350-horsepower engine from the shops of Russell & Co., Massillon, Ohio; a monocyclic alternator, capable of furnishing 3,000 lights; the Hartford system of enclosed arc lamps and new transformers from the General Electric company will constitute a good part of the new machinery. It is said that Pomeroy will have one of the finest plants on the Ohio River when completed.

The Shelby Electric company sent out the largest mail one day last week that ever went out of the local postoffice at Shelby. In all it weighed over 1,000 pounds and consisted of 20,000 pieces.

The authorities at Columbus cannot agree over the municipal light plant at Columbus. Director Kauffman has not been absolved from responsibility in the matter as yet, and says unless something is done he will close down the plant within 10 days. If the council takes action absolving him from the responsibility of creating an additional deficiency in the light fund he will go on with the experiment.

Work is now progressing on the new electric line from Dayton to Troy. A line may be built to Tippecanoe also, as a branch of this road.

The commissioners of Madison County have granted the Urbana, Mechanicsburg and Columbus Electric Railway a franchise for 25 years, and work is to commence within six months.

A number of New York capitalists are negotiating for the street railroads in Alliance and Salem with a view to connecting the two places with a line passing through Sebring, a thriving manufacturing town. The electric-light plant at Alliance may be sold to the syndicate also, as that town will build a municipal plant.

The Portage Lake Transit company has the consent of the property owners along its line, and will soon apply to the counties for franchises. This line will extend from Beford to Ravenna and Kent.

There is trouble between the town authorities and the Gas and Electric company at Kenton, and as a result the town is in darkness.

The East End electric plant at East Liverpool is being greatly improved. New poles and new wire will be put in.

Cars were started on the new Cincinnati, Lawrenceburg and Aurora electric road last Sunday. No fares were charged and people were allowed to inspect the line.

The officials of the Columbus and Buckeye Lake Electric road claim they will have the line in operation within one year. Some slight changes have been made in the route in Columbus.

Elmer E. Wilson, who some time ago purchased the Niles Electric Works, has secured the right-of-way from Niles to Salt Springs and will build an electric line. It may be extended on to Youngstown.

A. M. Jornon, the well-known railway promoter, has in contemplation the construction of an electric line from Oak Harbor to Napoleon, in the northern part of the state. O. M. C.

PERSONAL.

Henry Severson, a former employe of the Western Electric company, was killed in the relief expedition which was sent from the United States warship Newark to the relief of the Pekin legations.

George P. Barton, the well-known patent attorney of Chicago, recently underwent a serious surgical operation on his ear, in New York city. Happily, the operation was successful, and Mr. Barton is now recuperating at his old home in Rochester, N. Y.

Judge James M. Thomas of Chillicothe, Ohio, president of the Independent Telephone association, has been chosen as general manager of the United States Telephone company, with headquarters in Cleveland. Judge Thomas is a man of ability, and will carry on the business of this big concern with honor to himself and to the company. President Everett, in speaking of the matter, said that the judge needed no introduction to Ohio people and that he would have the hearty co-operation of all the exchanges and would be a big factor in building up a fine long-distance business,

ELECTRIC LIGHTING.

The Blair County Electric Light, Heat and Power company (capital, $50,000) has been incorporated at Altoona, Pa.

The New Jersey Electric Light and Power company has been incorporated at Newark, with $100,000 capital stock, by W. Hanna, A. H. Groel and Ed. Kenny. The principal office will be at 800 Broad street, Newark.

At Redding, Cal., the De Lamar Townsite company has filed incorporation papers to construct electric-light plant, waterworks, etc. The capital stock is $25,000, and the directors are J. W. Girdner, H. W. Weldon, J. G. Estep and M. E. Dittmar.

ELECTRIC RAILWAYS.

The coroners' inquest into the death of Leroy Stringham, who was killed on a street-railway car at Muskegon, Mich., resulted in the verdict that he came to his death by his left hand coming in contact with an unprotected lighting wire under the hood of the car.

The City Council of Ft. Wayne, Ind., has granted a franchise throughout the city to the Ohio and Indiana Traction company, which will operate an electric line from Hicksville, Ohio, to Marion, Ind., by way of this city and Huntington. Work on the new line will soon begin.

The German Society of Mechanical Engineers will this year award the Veitmeyer prize of 1,200 marks ($285) with gold medal for the best plan and specifications for an electric railroad between two distant cities, designed exclusively for trains running at a speed of 200 kilometers (124¼ miles) an hour, and following each other in quick succession without intermediate stopping points, each train to have a minimum capacity of 150 passengers. The contest will close on October 6th.

AUTOMOBILES.

A Washington account states that the first self-propelling carriage ever on the Island of Porto Rico will be taken there in a few days by Wallace Donald McLean of Washington and Frank C. Esterly of the office of the auditor of Porto Rico.

It is announced that the Baltimore and Ohio Railroad company will establish an automobile-cab service to and from the Grand Central railroad station in Chicago. The vehicles will be electrically operated, and a sufficient number will be provided to accommodate the passengers of the lines using the Grand Central depot as a terminus. The railroad company has established similar services at its Washington and Philadelphia stations.

PUBLICATIONS.

The Carpenter Tap and Die company, Pawtucket, R. I., has just issued its catalogue No. 13 of tools for cutting all kinds of screw threads.

Bulletin No. 62 of the Paragon Fan and Motor company of New York describes and illustrates the desk, bracket and ceiling fans of this company. The apparatus is clearly described, and prices are given for extras and repair parts, as well as for complete fans.

The Weber Gas and Gasoline Engine company of Kansas City, Mo., has a fine new catalogue of its engines, which it will be pleased to send on application. The pamphlet describes engines adapted to a large variety of purposes and also auxiliary appliances for gas-engine use.

The Western Electrical Supply company, 10 and 12 North Ninth street, St. Louis, Mo., is distributing a complete catalogue of house goods, telephones and telephone supplies. This catalogue will be sent to anyone desiring it. A large edition has been issued to supply the demand.

The Ohio Electric Works of Cleveland, the well-known manufacturers of electrical novelties, are out with a new catalogue of its line of goods, larger and better than ever. The concern calls attention to the fact that this new catalogue and discount sheets in four languages are now ready to mail.

The Bullock Electric Manufacturing company issued a beautiful souvenir pamphlet for distribution at the Master Car Builders' convention at Saratoga this year. The work contains fine half-tone engravings of the company's generators and motors, motors geared to machine tools and views in the Bullock works and offices.

The Mexican General Electric company, Apartado 403, Mexico City, issues a bulletin in Spanish which contains illustrations and information concerning the apparatus of the General Electric company of Schenectady, N. Y., which it handles. A list of important electrical installations throughout the Mexican republic is also given.

The Arnold Electric Power Station company of Chicago has published a bulletin containing a complete description of its work at the Oelwein shops of the Chicago Great Western railway at Oelwein, Iowa. The Arnold company designed and built the power, water, lighting and heating plant of the shops. The bulletin is well illustrated with diagrams and pictures of the shops.

SOCIETIES AND SCHOOLS.

Bulletin No. 35 of the University of Wisconsin at Madison announces the courses in the College of Mechanics and Engineering for 1900-1901. It can be obtained upon application.

On June 15th the Engineering Association of the South held its annual outing at Mount Pleasant, Tenn. Secretary Jones, in his report, says: "The day was ideal; the company congenial; the [phosphate] works interesting and instructive; and in all it was one of the best outings the association has yet held."

The annual meeting of the British Association for the Advancement of Science is to be held at Bradford, England, commencing Wednesday, September 5th. The president-elect is Professor Sir William Turner. Section A, mathematical and physical science, will be presided over by Professor Joseph Larmor, D. Sc., F. R. S. An evening discourse on "Animal Electricity" will be delivered on September 7th, by Professor Gotch, F. R. S.

The Pacific Coast Electric Transmission association held its fourth annual convention on the summit of Mt. Tamalpais on June 19th and 20th. Officers for the ensuing year were elected as follows: President, Prince Poniatowski, of the Standard Electric company of California; vice-president, Dr. Charles Van Norden, of the Central California Electric company; treasurer, William Angus; secretary, George P. Low; executive committee, C. P. Gilbert, of the Standard Electric company, and E. J. de Sabla.

MISCELLANEOUS.

The Society of Agricultural Industry and Commerce of Milan, Italy, is said to be offering a gold medal to the person of any nation who makes known the best method of protecting working electricians from accident in the course of their duty.

The Treasury Department has awarded to Keller, Pike & Co. of Philadelphia, Pa., the contract for installing a complete system of wiring in the new mint building at Philadelphia. The contract price is $27,460, and the work is to be completed within 100 days.

The Civil Service Commission of Chicago will hold an examination for mechanical engineers on July 24th in Room 400, City Hall, Chicago. Applicants for this position must have a thorough knowledge of steam engineering, electrical engineering and appliances, and applications must be on file in correct form in the office of the commission at least four full days before the date of the examination. T. J. Corcoran, the secretary of the commission, can give further information.

TRADE NEWS.

The Sterling Varnish company of Pittsburg has acquired the business of Semple Brothers of that place, and will continue the manufacture of the different grades of varnish heretofore made by the retiring firm.

The General Incandescent Arc Light company, 572 First avenue, New York, announces that it will hereafter carry on the business which has heretofore been taken care of by the Martin J. Insull company of Chicago, and will have western headquarters at 48 West Jackson boulevard, Chicago, with sub-offices at Milwaukee, Minneapolis and Denver. The present representatives of the Insull company in the cities named will in future act for the General Incandescent Arc Light company under its western sales manager, Francis Raymond, who will be located at the Chicago office. All accounts of the Martin J. Insull company outstanding on July 1st should be paid to the General Incandescent Arc Light company. It is intended to carry a sufficient stock of General Incandescent apparatus at sub-offices to fill immediate demands and a larger stock in Chicago from which the other offices may draw when quick deliveries are essential. The company is closely affiliated with and acts as selling agent for the General Incandescent Lamp company of Cleveland, makers of the General Incandescent lamps and will keep a full stock of these lamps at its new offices.

BUSINESS.

The Electric Appliance company, Chicago, reports large sales of Dayton fans, and says that if the orders keep up the season will prove a record-breaker in the fan business.

The Great Western Smelting and Refining company, Chicago, reports that the usual midsummer dullness is not apparent this season at all. In fact the company is kept "humping" to fill orders promptly.

Charles H. Besly & Co., 10 and 12 N. Canal street, Chicago, report that their general business has been very good. They are daily making large shipments of Helmet oil and Bonanza cups to agricultural districts and note especial demands from California and vicinity. Their specialties, Helmet bronze, sheet and wire, Badger and Gardner die stocks, taps of all descriptions, and Gardner grinders, are largely called for by foreign buyers, recent shipments having been made to Japan, England, South America, Germany and Mexico.

ILLUSTRATED ELECTRICAL PATENT RECORD.

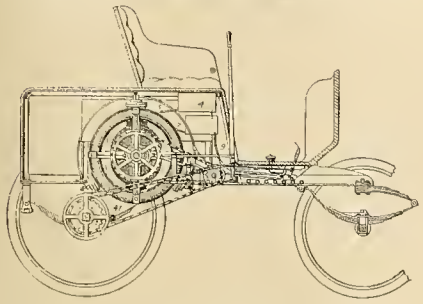
Issued June 26, 1900.

652,266. Electromagnetic Brake. Edwin M. Herr, Pittsburg, Pa., assignor to the Westinghouse Air Brake company, Pittsburg, Pa. Application filed November 18, 1899.

In a brake apparatus are a magnetic wheel shoe, a wheel shoe, adapted to be mechanically applied, and a connection between them, whereby the magnetic wheel shoe may by its movement apply the other shoe.

652,270. Pneumatic Transfer-tube System. Walter A. Houghtaling, New York, N. Y. Application filed February 24, 1899.

The system comprises a tube having an opening for the introduction of a carrier, a pivoted controlling device or arm, a gate for the opening fixed to the arm, a valve controlling the air-pressure inlet located in position to be opened by the movement of the arm to close the gate, an electric circuit including a magnet, a circuit-closer and a circuit-breaker, the electromagnet being fixed in position in proximity to the arm, an armature therefor fixed to the arm, the circuit-closer at the transmitting station in position to be closed by the operation of the arm in closing the gate, and the circuit-breaker at a second station having a movable part or member projecting into the path of the moving carrier whereby the circuit is broken.



NO. 652 278.

652,272. Telephone Toll System. John A. Johnson, Waveland, Ind. Application filed May 1, 1899.

The apparatus described combines an electrical circuit and indicating devices controlled thereby, coin-controlled circuit-closing means including a series of contact points, a coin chute, and an adjustably mounted carrier for the contact points.

652,278. Motor Vehicle. Fredrick A. La Roche, New York, N. Y. Application filed March 2, 1900.

In the vehicle are a primary power apparatus consisting of a gas engine, a dynamo and a secondary system, consisting of secondary batteries and a translating device and of suitable propelling gear, the gas engine being adapted to drive the dynamo and the dynamo being adapted to charge the secondary batteries, the translating device being adapted to reverse the dynamo, whereby it shall run as a motor, a suitable igniting device and igniting circuit for the gas engine, deriving its energy from the secondary battery, and means for throwing the propelling gear off from the power apparatus. (See cut.)

652,301. Elevator. Walter C. Stokes, New York, N. Y. Application filed February 21, 1900.

Combined with an elevator car are a pair of rack bars on each side, a screw between each pair of bars mounted on suitable bearings attached to the car and an electric motor mounted directly upon the shaft of each screw and operating the same.

652,302. Device for Electrically Operating Bulkhead Doors. Albert H. Thomas, Philadelphia, Pa., and Franklin B. Richmond, Camden, N. J. Application filed May 10, 1899. Renewed December 18, 1899.

One claim reads: In a controlling device for an electric motor, in combination, the motor, a rheostat furnished with a line of contact points and connected at or near its center with one of the main line wires, a movable contact point, actuated by the motor, adapted to make contact successively with the contact points of the rheostat, an electric connection between the movable contact, the armature of the motor, and the second main line wire, and means for energizing the field magnets of the motor.

652,309. Battery Compound. Henry Blumenberg, Jr., New York, N. Y. Application filed October 10, 1899.

The compound is composed of a chloride of the metals of the alkalis or alkali-earth metals, a sulphate of aluminum and a chlorate of the metals of the alkalis or alkali-earth metals.

652,333. Electric Signal. John H. Sanor, Canton, Ohio. Application filed October 19, 1899.

In the electric signal described are a series of frames or housings formed of frustums and the frustums connected at their smaller ends, a light located at the meeting point of the frustums, lenses connected to the frustums, held switches located at intervals along the path of circuit, magnets located at one end of the circuit, an armature to engage the magnets, a switch to engage spaced clips and the clips normally insulated one from the other, and one return wire for the battery and dynamo wires.

652,340. Globe for Indicating Trade Routes, etc. Ernst Vohsen, Berlin, Germany, assignor to the firm of Dietrich Reimer, Berlin, Germany. Application filed March 10, 1900.

A globe for indicating trade routes and the position of transports thereon is described. It consists of a translucent globe, illuminated from within by an electric lamp and carrying a translucent map on which the routes are represented by strips of a soft material.

652,360. Motor Rheostat. John L. Hall, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed May 10, 1900.

The rheostat comprises means for progressively cutting out resistance, a circuit breaker operated thereby to close a branch circuit around the resistance when the motor is cut in, and a releasing device permitting the rheostat to be returned to its open position after the circuit-breaker has been closed.

652,374. Incandescent Lamp for Electric Lights. John F. Sanders, Chicago, Ill., assignor to Harry Brown, Chicago, Ill. Application filed October 12, 1899.

An incandescent electric lamp is described which combines a glass bulb or globe terminating in a prolongation at its bottom adapted to receive and hold a ring of conducting material, a bottom ring of conducting material arranged in the prolongation of the bulb or globe and provided with recesses in its upper face adapted to receive and hold incandescent pencils or electrodes.

652,385. Secondary Battery. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed August 3, 1899.

In the battery are a series of perforated conducting casings or cells for containing the active material, and a connecting strip for the cells, the upper ends of the cells being formed with vertical slits to receive the connecting strip, which upper ends are flattened upon the strip.

652,389. Waterwheel Governor. William W. Handy, Baltimore, Md. Application filed March 9, 1899.

Combined with a centrifugal governor, a source of electricity and electrical contacts, a gate or valve mechanism connected with the contacts, and a lever operated by the governor and normally held in a state of balance between the electrical contacts are means for automatically moving the lever away from the contacts after the circuit through the same has been established, and means for automatically moving the contacts in the same direction through the same distance as the lever, so that when the lever returns to its normal position, the contacts and the lever will be in the same relative position with respect to each other.

652,390. Electric Governor. William W. Handy, Baltimore, Md. Application filed March 9, 1899.

In combination with a governor, a dynamo, a relay device and brushes operated thereby, the brushes being adapted to move over a series of contact points are a rheostat connected to the contacts, a solenoid in series with the rheostat, electrical connections between the dynamo and the above-named parts, and means for moving the brushes over the contacts.

652,419. Electric Tramway. Edouard Bonnet and Jules Panfique, Lyons, and Georges Liniére, Ecully, France. Application filed March 27, 1900.

The tramway system has surface contacts and a crossing road of resistances interposed between the supply and the contacts located near the crossing road, whereby only a limited current may pass.

652,422. Apparatus for Setting Lines of Type or Matrices. Hubert Burg, Mollkirch, Germany. Application filed December 31, 1897.

An apparatus operated by electromagnets for setting provisional lines of types or matrices by means of a register strip containing marks for letter types, for provisional spaces and for hyphens to sever syllables, is described.

652,430. Electric Hand-lighting Gas Burner. George J. Galbraith, Boston, Mass., assignor to the Electric Gas Lighting company, Boston, Mass. Application filed August 24, 1899.

In the apparatus are a burner pillar provided with a fixed electrode, an oscillating gas-cock and an electrode-carrying arm rigidly attached to the spindle of the gas-cock.

652,432. Telephone System. Cornelius C. Gould, Philadelphia, Pa., assignor to the Gould Telephone company, Wilmington, Del. Application filed February 12, 1900.

In the system are a main circuit, an inductive resistance, the secondary coil whereof is in series with the main circuit, a local-battery circuit, the primary coil of the inductive resistance connected in series in the local-battery circuit, a transmitter and a receiver in multiple with each other and in series with the battery of the local circuit.

652,436. Thermo-electric Battery or Pile. Joseph Matthias, Stuttgart, Germany. Application filed June 19, 1899.

The combination of two solid staff-shaped electrodes in each element, one of them resting on a projection of the other, is described.

652,437. Thermo-electric Battery or Pile. Joseph Matthias, Stuttgart, Germany. Application filed June 19, 1899.

The inventor describes the combination of a clay cover around an electric center piece, both with coinciding side holes, with a metallic bridge piece conducting to the next element and fastened to the clay cover by a pin situated with its bead-shaped end inside the bridge piece and passing with its forked branches through the center piece and the clay cover on the outside of which the branches rest with their ends bent over.

652,438. Electric-railway System. Lowell M. Maxham, Boston, Mass., assignor to the Bay State Traction company of West Virginia. Application filed September 20, 1899.

A third-rail system is described which comprises two insulating L-shaped stringers, an electric conductor supported upon and between the same, an insulating strip filling the remainder of the space between the stringers and having a series of vertical apertures, mercury cups located in the apertures and held thereby in close contact with the conductor, circuit-closing pins in the cups, and an exposed rail secured upon the stringers.

652,446. Electro-medical Bath. Johann J. Stanger, Ulm, Germany. Application filed April 20, 1900.

In an electric bath are combined a bathtub with a series of rods arranged on opposite sides thereof, switch levers for throwing some of the rods in circuit, and electrodes supported upon the rods and projecting into the tub.

652,453. Alternating-current Electric Meter. Emile Batault, Geneva, Switzerland. Application filed August 2, 1898.

An induction alternating motor meter is described which consists of a revoluble armature, two shunt coils diametrically disposed to the armature and inducing fields of opposite polarity therein, whereby a checking effect is produced on the rotating armature, and means to induce fields of different phase in, and effect rotation of, the armature.

652,454. Alternating-current Electric Meter. Emile Batault, Geneva, Switzerland. Application filed August 2, 1898.

This meter combines with a revolubly mounted conducting body, series and shunt coils connected to the supply conductors and producing magnetic fields through which the conducting body passes, thereby causing the body to rotate, and a core common to both of the coils laterally adjustable with respect to the center of rotation of the conducting body, whereby the starting torque of the latter may be varied.

652,459. Electric Circuit. Cornelius C. Gould, Philadelphia, Pa., assignor to the Gould Telephone company, Wilmington, Del. Application filed January 21, 1899. Renewed February 23, 1900.

In the system described are a main circuit and inductive resistance coils located in series with the circuit, and a transmitter and a receiver in series with the circuit and in multiple with each other.

652,485. Combined Gear Muffler and Shunt for Magneto-generators. James G. Nolen, Chicago, Ill., assignor of two-thirds to Stanley A. Duvall, Chicago, Ill., and Benjamin F. Stewart, Evanston, Ill. Application filed May 10, 1900.

In a magneto generator are combined a driving wheel, a driven wheel loosely mounted on the armature shaft, a sleeve longitudinally movable on the armature shaft, a cam device intermediate the driven wheel and the sleeve, means for yieldingly pressing the sleeve toward the driven wheel, and a circuit-breaker operated by the sleeve.

652,494. Electric-lighting Apparatus. Charles A. Terry, New York, N. Y. Application filed July 14, 1898. Renewed December 16, 1899.

The inventor describes the combination of two or more glowers, whose conductivity increases within normal limits with increments of temperature, connected in parallel with each other and a current-restraining device connected in series therewith.

652,504. Electric Heater. Edward Bennett, Jeannette, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed December 7, 1899.

The heater comprises a tube of insulating refractory material, terminal wires projecting through perforations adjacent to the ends of the tube and fused therein, and a heater wire helically coiled around the tube and having its ends joined to the terminal wires.

652,507. Pad Holder for Telephones. Cornelius A. Bovee, Adrian, Mich. Application filed November 16, 1899.

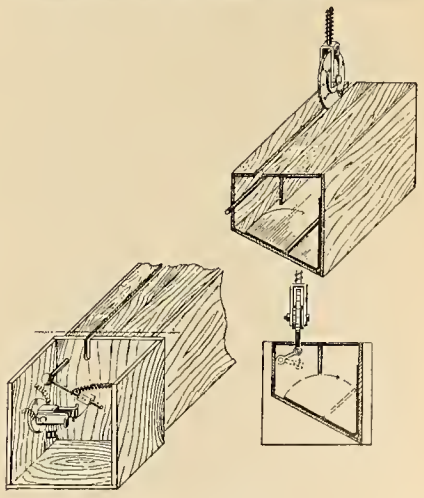
A pad holder for telephones is described.

652,508. Microphone Transmitter. Clayton B. Clark and Charles E. Clark, Sing Sing, N. Y. Application filed July 25, 1899.

The transmitter has two diaphragms, the outer one being provided with perforations and supported by its rim, the inner diaphragm being less in diameter than the outer one, unconfined at its rim, resting on a bed of carbon and felt, and separated from the outer diaphragm by a bed of carbon retained by an elastic ring within the circle of perforations in the outer diaphragm.

652,564. Subterranean Current Distribution for Electric Street Cars. Eduard von Mairhofen, Würzburg, Germany. Application filed March 9, 1900.

One claim reads: In an electric railway, the combination of a closed switch box, containing fixed circuit terminals, a rod not itself acting as a conductor, entering the box, and carrying a circuit-completing piece, and a rail connected to the rod and adapted to be operated by a key wheel for mechanically closing the circuit between the terminals in the box. (See cut.)



NO. 652,564.

652,580. Electric Lamp. Serge B. Apostoloff, London, England, assignor to the Spiral Globe Limited, London, England. Application filed October 10, 1899.

Combined with an electric incandescent lamp are a pair of hollow hemispherical or cup-shaped segments of translucent material halved together and secured to one another so as to constitute a globe or cover wholly inclosing the bulb, and a solid translucent light-refracting and diffusing medium contained in the space between the bulb and the globe and screening the filament.

652,595. Telegraphic Transmitting Apparatus. Frederick G. Creed, Glasgow, Scotland. Application filed November 7, 1898.

In a machine for perforating telegraphic tapes are a keyboard and punches with means for selecting the punches under the control of the keyboard and a cylinder and piston with valve for operating the selected punches.

652,596. Switch for Electric Circuits. Ethan I. Dodds, Avalon, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September 9, 1899.

Combined with two electric circuits, one including a glower and the other including an electric heater therefor, are means for closing both circuits simultaneously, and an automatic time switch for opening the heater circuit at the expiration of a predetermined period.

652,597. Switch for Lamp Circuits. Ethan I. Dodds, Avalon, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September 9, 1899. Renewed May 14, 1900.

A glower, an electric heater therefor and separate circuits for the glower and heater are combined with means for closing both circuits simultaneously and automatic means for breaking the heater circuit by a quick sudden movement when the glower circuit has become active.

652,598. Snap Switch for Electric-lamp Circuits. Ethan I. Dodds, Avalon, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September 9, 1899. Renewed May 29, 1900.

A hand-operated switch having independent contact-arms adapted to close two circuits by a movement of the hand, and a spring adapted to operate the arm which controls a heater circuit by a quick sudden movement, is described.

652,599. Automatic Push-button Switch for Electric Lamps. Ethan I. Dodds, Avalon, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September 9, 1899.

A push-button is connected to switch arms for closing circuits simultaneously, and a spring joined to the arm controls the glower circuit, whereby a quick rupture of the circuit is made possible.

652,600. Knife Switch for Electric-lamp Circuits. Ethan I. Dodds, Avalon, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September 9, 1899.

The switch comprises a suitable base and a contact-arm pivoted thereto, two pairs of contact-terminals co-operating with the arm on the same side of the pivot, the arrangement being such that the arm strikes one terminal pair before it strikes the other terminal pair.

652,601. Cut-outs for Electric-lamp Circuits. Ethan I. Dodds, Avalon, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September 9, 1899.

A spring-actuated switch or cut-out and a thermostatic device consisting of a cylinder of expansive fluid in operative relation to a plunger, and a tripping-arm connected to the plunger, are described.

652,607. Electric-lighting Apparatus. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed March 24, 1899. Renewed January 9, 1900.

A terminal for glowers for incandescent lamps is composed of one or more rare earths, the terminal consisting of a solid body of metal socketed in the end of the glower.

652,608. Multiple Glower Lamp. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 21, 1899. Renewed March 27, 1900.

In the lamp are a plurality of glowers and a single circuit-breaking coil having as many strands as there are glowers, each strand being connected with a separate glower and a single circuit controller operated by the conjoint action of currents flowing through such strands.

652,609. Glower Terminal for Electric Incandescent Lamps. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 22, 1899. Renewed April 28, 1900.

A method is described of securing a permanent union between the leading wires and the glower terminals in the lamps, which consists in securing to the ends of the glowers a chalk-like porous material, then baking the same upon the ends and attaching the leading-in wires to the baked material by any suitable conducting solder.

652,610. Electric-lighting Apparatus. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed May 2, 1899. Renewed April 16, 1900.

In the apparatus are combined one or more glowers, a support therefor, a heating device for the glowers carried by the support, steadying resistances for the respective glowers also carried by the support, and a detachable coupling device for securing the support to a stationary support.

652,611. Combined Diaphragm and Electrode. James Hargreaves, Farnworth-in-Widnes, England, assignor to the General Electrolytic Parent company, Limited, Farnworth-in-Widnes, England. Application filed February 12, 1898.

The invention consists of a wire-cloth cathode, a superposed layer of paper, clay, or other temporarily retentive material, a coating of Portland cement and a covering composed of asbestos.

652,626. Heater Cut-out Device for Electric Lamps. Walther Nernst and Henry N. Potter, Göttingen, Germany, assignors to George Westinghouse, Pittsburg, Pa. Application filed September 12, 1899.

In an electric lamp having a glower which requires the application of heat to render it conductive, are a heater, a current-restraining device in series with the glower, and an interrupter for the heater-circuit comprising two thermostatic arms movable in the same direction under the influence of the heat developed in the current-restraining device, one of the arms being in closer proximity to the current-restraining device than the other.

652,634. Automatic Heater-operating Device for Lamp Circuits. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed August 9, 1899.

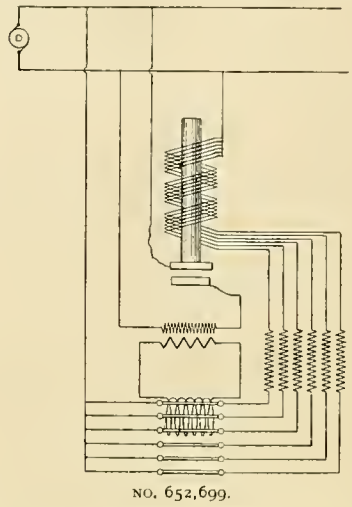
Combined with an electric lamp having a glower composed of material which is a non-conductor when cold and a conductor when heated are a heater for giving an initial temperature to the glower, and means for temporarily placing the heater in proximity to the glower, operated by the current traversing the heater.

652,635. Electric Heater and Supporting Material Therefor. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed August 9, 1899.

A heating device for electric lamps is described. It consists of a thin insulating-body of curved or U-shaped cross-section, the body being provided upon its outside with grooves transverse to its longitudinal axis and being cut completely through at the ends of the grooves so as to form teeth along the edges of the heating device, in combination with a heating-conductor wound back and forth within the grooves and around the teeth.

652,636. Controlling System for Electric-lamp Heaters. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed August 14, 1899.

In an electric-lighting device are a glower, a heater therefor, the glower and heater being located in parallel circuit, a controlling device for determining the relative positions of the glower and the heater, the controlling device being located in a shunt-circuit around the heater, and outside the glower-circuit.



NO. 652,699.

652,637. Press for Forming Tubes. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed August 14, 1899.

A press for forming tubes from pasty materials comprises a die composed of a central core or button, and a disk, having an opening surrounding the core so as to leave an intermediate space, a nut holding the disk in place and two or more screws pressing against the bottom of the disk.

652,638. Heater for Electric Glower Lamps. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed September 8, 1899.

A spirally-encircling heater is in conical form, the spirals of the heater being spread so as to permit the passage of light from the glower through the heater.

652,639. Heater Cut-out Device for Electric Lamps. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed September 11, 1899.

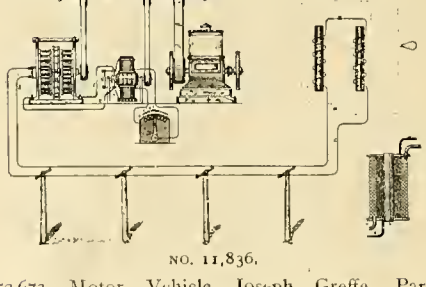
The cut-out has its actuating element operated by the joint action of heater and glower currents.

652,640. Electric Furnace. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed September 15, 1899.

The furnace consists of a tube composed of a mixture of dry electrolytes, an electric circuit including the tube, a surrounding jacket composed of one of the constituents of the tube, a heating conductor surrounding the jacket, a support therefor, and means for charging the electric circuit.

652,671. Insulated Electrical Conductor or Cable. Henry Edmunds, London, England. Application filed May 1, 1900.

The conductor has applied thereto paper saturated with a mixture of resinous matter and oxidized oils of a sealing, or waterproof character, alternating with paper, saturated with an oily matter, or treated with a lubricant.



NO. 11,836.

652,673. Motor Vehicle. Joseph Greffe, Paris, France. Application filed October 13, 1899.

Combined with the hind carriage of a vehicle are an independent fore carriage, means for pivotally connecting the hind carriage to the fore carriage, a storage battery arranged under the axletree of the latter, and suitable winches for raising and lowering the storage battery as required.

652,676. Aerial Switch for Electric Railways. Otto Joedicke, Mühlhausen, Germany. Application filed December 11, 1899.

An aerial trolley-wire switch is described.

652,699. Multiple-glower Lamp. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 21, 1899. Renewed January 17, 1900.

The inventor describes the combination of multiple glowers which are normally non-conductors and require heating to become conductors, located within such proximity to each other as to receive heat from each other, an electric heater for heating a selected number of the glowers to conducting temperature, means for causing currents to flow through the heater and also through the selected glowers, and means for cutting out the heater when the selected glowers become conductive. (See cut.)

652,700. Igniting System for Electric Lamps. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 9, 1899. Renewed January 24, 1900.

In the system are a generator of electricity and mains proceeding therefrom, two or more lamps connected up between the mains, and individual circuit controllers for each lamp, in combination with heaters for the lamps and a heater circuit common to all the heaters and controlled by a separate circuit controller.

652,701. Igniting or Lighting System for Electric Lamps. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 9, 1899. Renewed February 14, 1900.

In this system the glowers are brought to a state of conductivity by electrical heating devices and there are a number of such lamps arranged in one or more groups at local stations, a corresponding number of heaters in proximity to the lamps and arranged in series with each other, a switch controlling the heater circuit, the switch being located at a central station.

652,702. Circuit Breaker for Glower Lamps. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 9, 1899.

One claim reads: In a lamp wherein a glower of material which is a non-conductor when cold and a conductor when hot is employed, a heater circuit including a heater in proximity to the glower, a switch in the heater circuit, a solenoid or other electromagnetic appliance having its core or armature connected to the movable part of the switch, and a catch or detent engaging the core or armature after its initial operation, and adapted to be tripped by the opening of the switch.

652,703. Removable Part for Glower Lamps. Alexander J. Wurts and Marshall W. Hanks, Pittsburg, Pa., assignors to George Westinghouse, Pittsburg, Pa. Application filed July 24, 1899.

The part consists of a heat-resisting disk for supporting the glowers and the circuit-terminals, and a second heat-resisting disk supporting a heater, the disks being connected by heat-resisting material.

652,704. Electric Lamp and Fixture. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed August 19, 1899.

There is mentioned the combination of multiple glowers, a supporting plate therefor, a heating conductor carried upon the surface of the plate adjacent to the glowers, and terminal connections for the glowers located upon the opposite side of the plate from the heating conductor.

652,705. Heater-tube Support for Electric Lamps. Alexander J. Wurts, Marshall W. Hanks and Frederick M. Goddard, Pittsburg, Pa. and Edward Bennett, Jeannette, Pa., assignors to George Westinghouse, Pittsburg, Pa. Application filed December 7, 1899.

An insulating heater support having a pair of laterally projecting lugs provided with confronting recesses, in combination with a plurality of tubular heaters, the ends of which are removably supported in the confronting recesses, is described.

652,706. Means for Heating High-voltage Glowers. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed December 7, 1899.

The means comprise a plurality of independent heaters respectively disposed adjacent to different portions of the glower.

652,707. System of Distribution for Electric Lighting. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed February 21, 1900.

In the system are a source of current and a plurality of lamps the glowers of which are connected in parallel and the heaters of which are connected in series to the source, in combination with a manually operated switch in the conductor supplying the heaters, a switch in each glower circuit and means for simultaneously actuating the glower-circuit switches to alternately close and open the circuits by successive closing movements of the heater-circuit switch.

652,734. Alarm System. Clyde Coleman, Chicago, Ill., assignor to the Bankers' Electric Protective company. Application filed October 18, 1897.

Combined with an electrical protective circuit extending from the protected structure to the alarm station are a generator for supplying an alternating, vibratory or varying current thereto, means for varying the reactive resistance of the circuit within the protected structure and a signaling device irresponsive to the prearranged variations, but responding to abnormal variations.

Reissue.

11,836. System of Electrical Distribution. The Westinghouse Electric company, Pittsburg, Pa., and John D. Gibbs, London, England, for the Westinghouse Electric company, assignee of Lucien Gaulard, deceased, and John D. Gibbs, assignor to the Westinghouse Electric and Manufacturing company, Pittsburg, Pa. Application filed August 6, 1889.

The described method of electrical distribution and conversion consists in establishing in a closed electric circuit a current of alternate and equal positive and negative potential, producing, by the influence of such current, an inductive field of alternate polarity, and thereby inducing, in translating devices situated in an independent closed circuit traversing such field, a similar alternating secondary current of greater quantity and less potential than the originating or producing current. (See cut.)

Design.

32,880. Insulating Backpiece for Switches and Rosettes. Frederick Browning Potter, Newark, N. Y. Application filed May 24, 1900. Term of patent, 14 years.

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English Searchlights.

By Frank C. Perkins.

The most important features of an electric searchlight projector are the automatic electric lamp, the light-reflecting surface and the controlling devices. The reflecting surface is either a silvered-glass lens or a polished-metal reflector. The silvered-glass lens is so ground that when the arc is in its focus parallel rays of light are reflected from its surface. The Mangin type of lens has two spherical surfaces of different radii, the reflection and refraction of the glass causing the rays of light to be projected in a straight line. The parabolic type of lens has true parabolic surfaces and reflects the light in parallel lines. When it is desired to have a projector which will illuminate a large area at comparatively short range, metallic mirrors of hyperbolic form have frequently been constructed two feet or more in diameter. The metal mirrors are considerably cheaper than the glass lenses, and still give excellent results.

The current used in the electric searchlight is usually a direct current of from 60 to 110 volts and ranging from 20 amperes in a searchlight of one foot diameter to as high as 150 amperes or more in projectors five or six feet in diameter.

Some English types of searchlights are herewith illustrated. Figs. 1 and 2 show two projectors manufactured by Ernest Scott and Mountain of Close Works, Newcastle-on-Tyne, England. These searchlights have the hand-feed mechanism and the lamps are of the inclined type, the carbons operating up and down and not horizontally.

Fig. 3 shows a 20-inch projector with diverging lens, as manufactured by J. H. Holmes & Co. of Portand Road, Newcastle-on-Tyne, England. The automatic-feed lamp is most satisfactory for the electric searchlight and is frequently located in such a position that the carbons move horizontally within the searchlight, while the feeding mechanism is located just below, as seen in Fig. 4. This latter searchlight is a Holmes projector, with automatic-feed lamp, and is known as the 24-inch Admiralty projector. These projectors are frequently mounted in cages, as shown in Fig. 5. This searchlight is of the Suez Canal type, and is equipped with a diverging lens and a lamp of about 12,000 candlepower. It has hand-feed adjustment and a weatherproof lantern. The beam at 1,000 yards' distance is about 100 yards in diameter. This projector is provided with adjustments for vertical and horizontal movements and was especially designed to meet the requirements of the Suez Canal company. The galvanized wrought-iron cage is made collapsible, with teak platform and seat.

The 25,000-candlepower searchlight shown in Fig. 6 requires a current of 100 amperes, while that shown in Fig. 7, known as the Admiralty pattern, requires considerably greater current and is equipped with diverging lens. These projectors are equipped with automatic lamps, the mounting of which may be readily seen in Fig. 6.

ENGLISH SEARCHLIGHTS.

The other evening the electric lights of Juanita, Cal., failed, and the next morning three suits were instituted against the corporation. According to one of the lawyers in the case, "the parlor was at the time filled by guests at a children's party, many of whom made use of the opportunity for illicit kissing and romping, which resulted in the destruction of costly ornaments and was harmful to the moral welfare of those present."

Municipal Ownership in Saginaw.

The fight that is being waged in Saginaw, Mich., over the establishment of a municipal electric-lighting plant is perhaps the most spirited that has engaged the aldermen in years. At present the municipal scheme enjoys a majority of two votes in the council, beside the indorsement of the members of the Board of Public Works, while the taxpayers oppose the project, notwithstanding the fact that at a special election held on March 3d last it was voted to empower the city controller with authority to bond the city for $75,000 with which to build a plant if the council decided, after a thorough investigation, that it would be economy for the city to manufacture its own light instead of contracting for it. Subsequent investigation has proven beyond a doubt that the city can be lighted under the contract system at a much less expense than if a plant were built, to say nothing of the cost of installing a plant. The commercial lighting companies, fearing the advent of municipal ownership, have submitted bids for lighting that are amazingly low, about $65 a light per annum.

The dogged opposition to contracting for the city lighting, although it is the most economical course, arises from a socialistic element in the council that favors municipal ownership of public utilities.

Shocking Electric-railway Accident at Tacoma.

Undoubtedly the worst accident yet recorded in the history of electric railroading was that which occurred on the morning of July 4th at Tacoma, Wash. A car coming from South Tacoma and Spanaway jumped the track at a curve at the entrance to a high bridge over a gulch at Delin and D streets. The car speed got beyond the motorman's control, and the car struck the curve with such force that it turned completely over and went crashing down the side of the gulch, until it landed 100 feet below, bottom up. Thirty-six persons were killed and nearly 60 hurt. The car was crowded. Some of the men on the patform managed to take a few children with them and jump off before the car struck the curve, as they foresaw the accident, but most of the people were penned in the car. The only wonder is that so many escaped alive in the awful fall.

The city of South Haven, Mich., has voted to issue $10,000 bonds to build an electric-light plant.

On the Intrinsic Brilliancy of the Crater of the Arc.[1]

By J. E. Pateval.

The following is a portion of a paper on "An Experimental Research on Some Standards of Light." In discussing the arc lamp the author says that for many years it had been noticed that the area of the crater of an electric arc when burning between carbon poles increased about in proportion to the current; also, that the light emitted increased in the same ratio as the area of the crater. These and other facts led to the conclusion that the temperature of the crater remained constant. The hypothesis was put forward that this temperature was the boiling point of carbon, this theory being supported by the experiments made in 1892 by J. Violle. In the same year it was proposed simultaneously by Swinburne, S. P. Thompson and Blondel that the crater of the arc should be used as a standard of light, Blondel publishing a series of experiments illustrating the way in which the new standard might be used.

In 1894 A. Trotter proved that when the arc is not silent the crater is formed by a point or line of very high intrinsic brilliancy rotating at a speed

FIG. 1. INTRINSIC BRILLIANCY OF THE CRATER OF THE ARC.

of from 50 to 450 revolutions per second. The existence of the above-mentioned phenomenon forms a serious objection to the use of the electric arc as a primary standard, but it does not, per se, render its use impossible. Finally, the variation of the intrinsic brilliancy of the crater is a question which in itself offers considerable interest.

The points on which the present work bears are threefold: (1) What is the average intrinsic brilliancy of a normal (silent) arc? (2) When the conditions are carefully specified, are the variations still too great to allow of the use of this source of light as a standard? (3) What variations can be obtained by the use of excessive currents and current densities, and by surrounding the arc with an enclosure maintained at a very high temperature?

To obtain consistent results the observations must be made on a very small area selected from the central portion of the crater. The diaphragm used for this purpose is shown in Fig. 3. The opening (d) is 1.47 square millimeters in cross-section. The diaphragm is shaped much like the tuyere of a blast furnace, and being kept cool by a water circulation, it can be placed within a very short distance of the crater of the arc.

The next question involved was the determination of the best relative position of the carbons. In the usual arrangement of the arc the center of the crater is hidden by the negative carbon. A modification of this arrangement, used by Blondel, which consists in slanting the carbons and placing the positive slightly behind the negative, was found not to be entirely satisfactory. An attempt was made to take the observations through a hole drilled out of the negative carbon (see Fig. 1), but when the arc was started this hole became filled with mist, and the plan had to be given up. Fig. 2 shows diagrammatically the next arrangement which was tried. The carbons (n_1), (n_2), (n_3), are negative, and form the edges of an equilateral pyramid, the axis of which is in the prolongation of the positive carbon (P). The summit of the pyramid is at the point (P). The crater formed on the positive carbon by these three arcs is in full view, and good results might have been obtained in this manner. Unfortunately, this disposition had to be abandoned, as it soon became evident that it was impossible for one observer to adjust the currents in the three independent electrical circuits, to feed up the four carbons, and to make all the electrical and photometric readings. The disposition which was finally adopted is shown in Fig. 3. The diaphragm (d) screws into a screen (s). This screen is supported on a system of pivots and leveling screws, so that it can be raised, lowered or turned around a vertical or horizontal axis. The opening (d) can thus be directed to any portion of the crater. The positive carbon is horizontal and so placed that its axis coincides with the axis of the photometer.

Two distinct series of experiments were carried out: One with the arc placed in a metallic enclosure kept at about 20 degrees Centigrade by a water circulation, the other in the enclosure shown in Fig. 3. The temperature of this enclosure varied from the melting point of silver to near the melting point of platinum, according to the amount of power expended in the arc. Referring to Fig. 3, (c) is a carbon crucible surrounded by a thick layer (b) of firebricks and refractory clay. The outer covering (a) is of asbestos. Both the high and low-temperature enclosures were provided with a small camera obscura (not shown in the figure), by aid of which the relative positions of the carbons could be adjusted and the length of the arc measured. "Apostle" carbons were used in all the experiments. The size of the positive carbon varied from six millimeters to 25 millimeters in diameter. To obtain reliable results a sufficient current density must be used to give a fairly large crater. The arc must also be sufficiently stable for the crater to remain some considerable time without shifting its position. Finally, it is desirable that the arc should be burning in a normal manner, and therefore neither hissing nor roaring. Given these conditions, it is impossible to vary either the current, the electromotive force or the length of arc, within very wide limits.

1. Abstract from the Electrical Engineer of London of a paper read before the Royal Society.

TABLE I.—"Silent" Arcs. Enclosure at about 20 degrees Centigrade.

E.M.F. in Volts.	Current in Amperes.	Power in Watts.	Diameter of the Positive Carbon in millimeters.	Current Density in Amperes per square millimeter of Cross-sectional Area of Positive Carbon.	Length of Arc in Millimeters.	Intrinsic Brilliancy of the Crater in Candlepower per square millimeter.*
65.0	8.1	526	8	0.161	4.8	136
64.5	7.0	452	8	0.139	—	141
72.0	10.3	742	8	0.205	6.0	143
70.3	7.3	513	6	0.258	—	147
61.7	6.0	370	6	0.212	5.1	154
62.0	9.1	564	6	0.322	6.0	160

TABLE II.—"Silent" Arcs. Enclosure above 900 degrees Centigrade.

83.0	11.0	913	8	0.219	—	136
57.0	10.9	621	15	0.061	—	142
61.0	8.6	525	8	0.171	6.0	152

TABLE III.—"Hissing" Arcs. Enclosure at 20 degrees Centigrade.

70.0	15.8	1,106	8	0.314	4.8	136
42.0	21.6	907	8	0.410	1.2	143
53.0	25.8	1,367	8	0.514	2.9	157
44.0	50.0	2,200	15	0.283	—	160

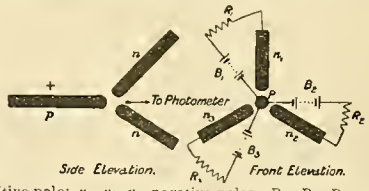
TABLE IV.—"Hissing" Arcs. Enclosure above 900 degrees Centigrade.

79.0	18.0	1,422	15	0.102	—	119
45.6	42.0	1,915	15	0.238	—	121
60.3	13.6	1,322	25	0.038	—	130
52.0	55.0	2,860	25	0.112	—	133
41.0	43.4	1,779	25	0.088	—	137
50.0	39.3	1,965	15	0.222	—	142

*Each of the figures in this column is the mean of a number of photometric observations.

In the experiments recorded in Table I., the mean intrinsic brilliancy is 147 candlepower per square millimeter; the variations from the mean amounted to 10 per cent. Table II. gives experiments made under similar conditions, but with the enclosure in which the arc was burning at a temperature of over 900 degrees Centigrade. The average intrinsic brilliancy calculated from this table is 143, or about three per cent. lower than when the enclosure was at the ordinary temperature. It would, however, be unwise to attach too much importance to this change. The difficulty of obtaining consistent results is considerable, and a three per cent. variation is well within the experimental error.

The conclusions we have reached may be summed up as follows: (1) The intrinsic brilliancy of the crater of a silent arc is about 147 candlepower per square millimeter. (2) Even when the most favorable conditions are selected, and the intensity of current and the length of the arc are maintained constant, it is difficult to obtain consistent results, variations of over five per cent. being by no means infrequent. The crater of the arc does not therefore possess the qualities required of a standard. (3) Variations in the size of the carbons, in the



P, positive pole; n_1, n_2, n_3, negative poles; R_1, R_2, R_3, variable resistances; B_1, B_2, B_3, batteries.

FIG. 2. INTRINSIC BRILLIANCY OF THE CRATER OF THE ARC.

intensity and density of the current, in the length of the arc, and in the total power expended (as long as the arc is kept silent), will not cause the intrinsic brilliancy to vary more than 10 per cent. on either side of the mean. (4) No sensible variation in the intrinsic brilliancy, and therefore in the temperature of the crater, is produced by placing the carbons in an enclosure maintained at over 900 degrees Centigrade.

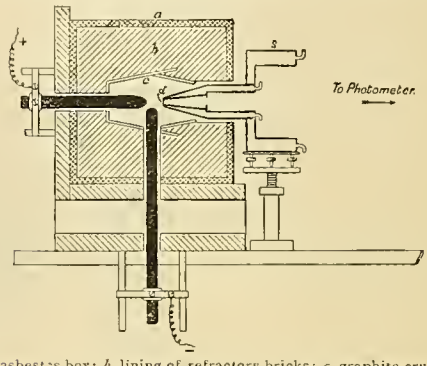
With regard to the constancy of the temperature of the crater, these results are not without importance. Having this question in view, it was necessary to determine what were the effects of extreme variations of current density and power. In Tables III. and IV. will be found the results of observations taken when the arc was hissing. The word "hissing" is used here as being the generally accepted term. It is only when the current density is small that it is actually descriptive of the sound made; as the current increases the pitch rises, until with a very short arc and a current density of about one ampere per square millimeter, the sound is between a whistle and a scream. The arc then assumes a very peculiar aspect, a pointed blue flame, like the flame of a blowpipe, being sent out from the crater. This effect was most marked when the high-temperature enclosure was used. With the above current density the entire carbon becomes white hot and burns away with great rapidity; an increase in the intrinsic brilliancy seems also to take place. Unfortunately, it was not found possible under these circumstances to obtain reliable photometric observations.

It will be seen that the current varied from six to 50 amperes, the current density from 0.03 to 0.51 ampere per square millimeter, and the power from 370 to 2,800 watts. The lowest photometric readings gave 119 candlepower and the highest 160 candlepower per square millimeter.

If we assume that the formula

$$t - 400 = 889.6^{e^9}\sqrt{b}$$

(t = temperature in degrees Centigrade, b = intrinsic brilliancy in candlepower per square centimeter) holds good for carbon at these high temperatures, the above change in candlepower corresponds to a variation of temperature of from 3,866



a, asbestos box; *b*, lining of refractory bricks; *c*, graphite crucible; *d*, diapbragm; *s*, screen.

FIG. 3. INTRINSIC BRILLIANCY OF THE CRATER OF THE ARC.

degrees to 4,018 degrees Centigrade. The total alteration in absolute temperature thus works out at four per cent. Observations made on silent arcs (Tables I. and II.) reduced in the same manner give the extreme limits of temperature as 3,935 degrees and 4,018 degrees Centigrade, or a change of two per cent. in the absolute temperature.

These variations are somewhat greater than we should meet with in the case of substances boiling at ordinary temperatures. It must, however, be borne in mind that even in the case of a silent arc the crater is the seat of several secondary phenomena, which, under certain circumstances, may affect the boiling point. The term boiling point is in itself misleading, as it seems possible, if not probable, that at atmospheric pressure carbon does not become liquid, but, like carbon dioxide, passes direct from the solid to the gaseous state. It has frequently been stated that impurities cannot affect the temperature of the crater, as all known bodies become gaseous at a lower temperature. The experimental data to substantiate this are entirely wanting; silica, lime, alumina, magnesia and other substances are solid at the temperature of melting platinum, and it is difficult to predict at what temperature they volatilize. Taking everything into consideration, it may therefore be said that the present experiments confirm the theory that the crater of the arc is at the temperature of volatilization of carbon.

The earliest determinations of the intrinsic brilliancy of the crater were made in 1878, at Chatham, under the direction of the Royal Engineers' committee. The results varied from 39 candlepower to 442 candlepower per square millimeter, the mean value being 110. With regard to more recent researches, Trotter gives the intrinsic brilliancy as 64 candlepower, Weber as 70 candlepower, and Blondel as 158 candlepower per square millimeter. With the exception of those of Blondel all previous results are very much lower than the values I have obtained. The discrepancy may be attributed to the fact that instead of using a diaphragm to select the rays from the center of the crater, the first-named observers estimated the total area of the crater, and compared it with the total amount of light.

Central-station Change in Detroit.

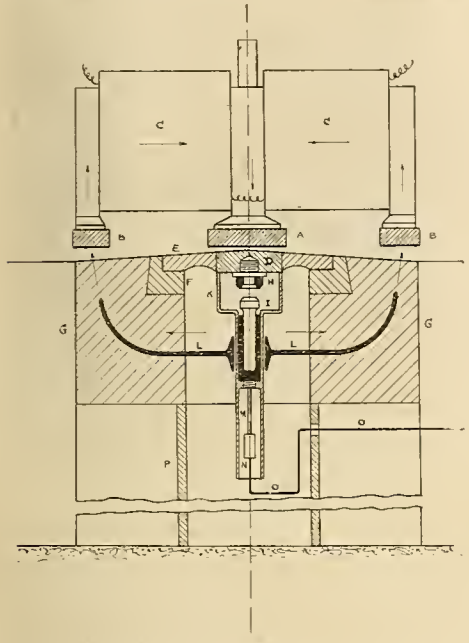
The Detroit Electric Light and Power company, organized in 1890, which had the city-lighting contract for three years, has passed into the hands of the Edison Illuminating company of Detroit. The Central Trust company of New York, representing the bondholders, asked for the appointment of a receiver. Under a decree of the United States Circuit Court the plant has been sold at auction. It was purchased by Hoyt Post of Detroit for $165,000. Mr. Post is largely interested in the Edison company, and it is said that he also represents in the transaction the majority of the stockholders of the Detroit Electric Light and Power company. Mr. Post is said to have acted for these stockholders in order to save what money they have invested in the property. Many of the stockholders are interested in both companies, and this fact, coupled with the fact that at last the controlling interest in the Detroit Electric Light and Power company has

passed into the hands of Detroiters, has led to the report being circulated that in all probability the company will eventually be operated through the Edison company. Heretofore it has been a speculative concern largely, and owned by outsiders.

Diatto Surface-contact Electric-railway System.

Supplementing the illustrated account of the Diatto electric-railway system at Tours, France, in the Western Electrician of August 26, 1899, the following description of the system as now exhibited at the Paris Exposition will be of interest to the readers of this journal:

In the transportation section is shown a car equipped with the Diatto system of surface contact. The system uses a central contact rail running the



DIATTO SURFACE CONTACT ELECTRIC RAILWAY SYSTEM.

whole length of the car, passing over a series of contact blocks laid along the track between the rails. It is coming into favor in Europe, ever since its successful operation has been demonstrated upon the street railways in the city of Tours, where about 1½ miles are operated by this system, in connection with 2½ miles of trolley road. In the same city are to be installed four urban lines of a total of 12 miles, of which about eight miles will be constructed on the surface-contact system, connecting with three suburban trolley lines of 15 miles total.

The car shown in the exhibit represents a complete equipment, with a portion of track, along which have been laid a number of contact blocks. The action of the system will be seen by referring to the drawing. The contact rail (A), supported to the car by a series of uprights, is connected by lateral pieces to two side-rails (B B), running along the whole length. The cross-pieces joining the rails carry the magnetizing coils (C C). There are five sets of coils distributed over the length of the rails. The contact rail (A) slides over the contact blocks, which are spaced along the track at distances of about 15 feet. Each block consists of a mass of asphalt (G), which is laid upon a bed of cement, with a drain pipe (P) below. The space between the rails is laid in asphalt, making the whole arrangement water-tight. The asphalt block carries at the top a disk of non-magnetic metal (F), which supports a central core (D) of soft iron. The piece (L), cast in iron of good magnetic quality, is imbedded in the asphalt block and carries in the middle a socket which supports the ebonite vessel (K) partly filled with mercury. The lower part of the mercury cup has a contact screw, from which passes a wire (N) into a small mercury cup in the end of the terminal wire (O). In the mercury vessel floats the iron cylinder (I), whose weight is adjusted so that it is almost in equilibrium in the mercury and will require but a small effort to lift it. It is provided with a contact head, formed of hard carbon, which, when raised, fits into the socket (H) of the same material, held in the mass (D). The ebonite vessel is supported at the upper part by a brass bell, held to it by a flange with three bolts, forming a tight joint, the detail of which is not shown.

The action of the system is as follows: When current is passed in the coils (C C) the bars (A) and (B) are magnetized, the circuit taking the path shown by the arrows, the wings of the piece (L) serving to complete the circuit below. This causes the cylinder to be lifted against the socket (H), thus allowing the current to pass from the wire (O) up into the rail (A), and from there to the motor circuit. Each of the coils (C) has two windings in the same direction; one of these receives the main current and is generally used; the second winding is used for starting, and is fed by a small battery of accumulators placed under the seat of the car.

It will be seen that the blocks are energized only at the time of passage of the rail. When the rail leaves a block, the cylinder (I) falls and the current is interrupted. To avoid the formation of a spark between the two carbon contacts, which would soon deteriorate the apparatus, the contact rail is arranged at the end of the car so as to curve upward slightly, thus being out of contact with the block; it has still sufficient magnetizing power to hold up the cylinder, and when the rail has left the block and the cylinder falls, the current has already been broken by the rail above, and no spark occurs. The contacts are made of very hard carbon, taking a high polish; they are carefully worked and made so that the angle of each is the same, thus fitting exactly, one in the other, insuring a good contact.

Besides the car on the lower floor of the Transportation building, the upper floor of the Electrical Palace contains an exhibit of the Diatto system showing the details of the pieces, among which is a section of the contact block in which the working parts are clearly seen. A line is now being installed from Paris to the suburbs, on which the system is used on the portion within the city limits. The road starts from a point near the exposition grounds and passes along the quays of the Seine, toward the eastern part of the city, ending at the suburb of Vanves. The construction of the track, with its contact blocks, is now nearly completed, the pavement being entirely in asphalt.

Mrs. West, Lamp Saleswoman.

The pleasant-faced woman whose portrait is given herewith is believed to be the only traveling saleswoman for an electrical manufacturing company in the United States. She is Mrs. M. West and she represents on the road the Shelby Electric com-

MRS. WEST.

pany of Shelby, Ohio, selling incandescent lamps exclusively. Mrs. West calls New York city her home, although she is traveling 10 months out of the year, and for the last two years she has made trips east and south of Ohio. Now, however, she proposes to travel in the West, so that her experience will ultimately cover most of the country. Mrs. West has been in the lamp business nearly three years, and before going on the road took a thorough course in the factory at Shelby. She is a thoroughly practical, businesslike woman and presents her goods on their merits, precisely as a man would do, asking no favors or special consideration on account of her sex.

As is known to all electrical people (it seems that one must no longer restrict the expression to "electrical men"), one of the principal features of the lamp business is the making of photometric tests, and Mrs. West takes some pride in the fact that in this work her knowledge and experience enable her to meet her competitors of the opposite sex on at least equal terms. She is not afraid of electricity and knows all about lamps, photometers, measuring instruments, circuits and connections. She makes her own tests and demonstrates to a customer or possible customer that she knows what she is talking about. She is making a success in the business in which she is engaged and thinks that the electrical field offers many opportunities for greater emoluments and influence to business women who are now engaged as stenographers, bookkeepers or clerks.

Mrs. West is a native of Philadelphia and is a widow, dependent upon herself for a livelihood. She has one young daughter whom she is educating. She is prepossessing in appearance and manner and a credit to the industry.

"Fellow Servants" in Electrical Companies.

Where employes are in the service and subject to the general control and direction of a common master, and the labor of each conduces to the accomplishment of the same general purpose for which they are employed, the Supreme Court of Georgia holds that they are fellow servants, within the provision of the civil code of that state, and that, except in case of railroad companies, the master is not liable to one servant for injuries arising from the negligence or misconduct of other servants about the same business. That they may be employed in different departments of duty, and so far removed from each other than one can in no degree control or influence the conduct of the other, it does not consider, alters this.

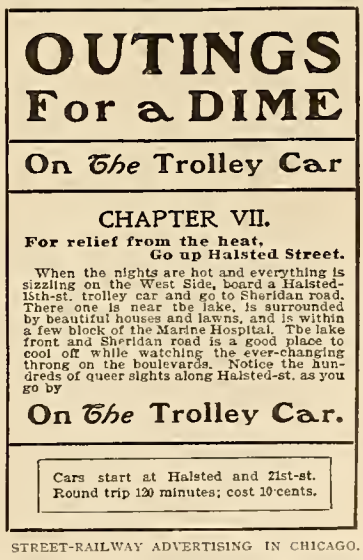
Applying the law as it conceives and thus states it to be to the case of the Brush Electric Light and Power company against Wells, the court holds that the engineer of the company and its lineman, being subject to direction and control by the same general master, in the same common enterprise, were fellow servants, though employed in different departments of duty, and so far removed from each other that one could in no degree control or influence the conduct of the other. And so, granting that the lineman was killed by reason of the negligence of the engineer in failing to give the signal before the electric current was turned on one afternoon, the company, the Supreme Court holds, was not liable to the lineman's widow for his death.

Wireless Telegraphy in San Francisco Harbor.

A press dispatch from Washington states that General Greely, chief signal officer of the United States Army, has received word from San Francisco that the Signal Corps wireless-telegraph stations are in successful operation transmitting messages between Alcatraz Island in San Francisco harbor and Fort Mason. Cable communication between these points has been rendered almost impossible because the cables were constantly being damaged by incoming ships dragging their anchors. This is said to be the first use of wireless telegraphy in regular service where other means have failed.

Street-railway Advertising in Chicago.

The Chicago Union Traction company is taking advantage of the advertising columns of the daily newspapers of Chicago to call attention to the facilities it has to offer for pleasure riding at trifling cost. The idea is a good one and seems founded on the summer literature and advertising of the steam railroad companies. The "ads" are attractive, as the one reproduced herewith shows. By a coincidence this advertising appears at about the time of the opening of the Northwestern Elevated; but the advertising scheme is doubtless worthy of more attention than it has heretofore received.



STREET-RAILWAY ADVERTISING IN CHICAGO.

Willesden Station of the Metropolitan Company, London.

An interesting instance of forethought in the planning of a central station is afforded by the Willesden plant of the Metropolitan Electric Supply company of London. A site covering 8½ acres was chosen for the purpose, its boundaries being defined on three sides by the London and Northwestern railway, the Midland railway and the Grand Junction Canal. The finished power house, as projected, will be 384 feet long by about 300 feet wide. The present plant occupies one corner of the plot of ground, covering about one-fourth of the total area of the projected building. The boiler and engine houses are placed side by side, and will be extended to twice their present length as the demand for electric supply increases, and then duplicated by extension laterally. When completed there will be one large engine room 284 feet by 112 feet, with boiler rooms along both sides. In this way a convenient, symmetrical structure will be developed. Each of the four groups of boilers of the finished plant will have a large, separate stack, the one now being erected being 165 feet in height, with an internal diameter of about 14 feet.

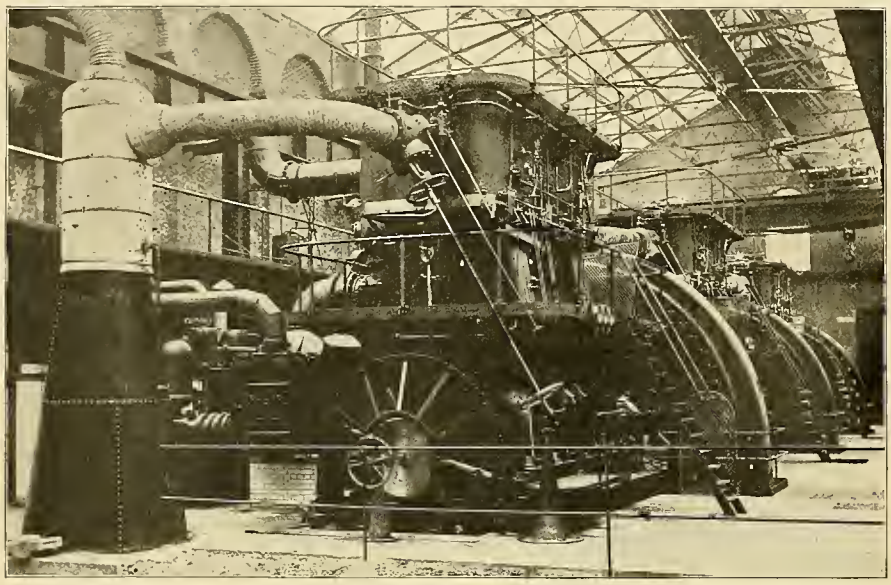


FIG. 1. WILLESDEN STATION OF THE METROPOLITAN COMPANY, LONDON.—VIEW SHOWING THREE 2,500-HORSEPOWER ENGINE DYNAMO UNITS.

Admirable features for handling coal have been provided, sidings having been run from the main railroad lines and a wharf having been built into the canal. The coal cars from the railroad lines, as well as barges from the adjacent canal, may be run directly underneath a special form of conveyor, which carries the coal to bins having a capacity of 1,000 tons, located over the boilers. The coal-conveying machinery has a carrying capacity of about one ton a minute, and the ash-handling machinery is also very complete. There is at present installed a battery of 16 Babcock & Wilcox boilers, working at a steam pressure of 160 pounds, and fitted with superheaters. Mechanical stokers have been applied to 10 of the boilers; the remainder are hand-fired.

The engine room contains three 2,500-horsepower Westinghouse engines of the vertical compound type, having cylinders 36 and 55 inches in diameter, with a 36-inch stroke. The engines, which are of massive construction, with foundations of concrete 15 feet thick, run at from 116 to 145 revolutions per minute. Flywheel governors are used, and are adjustable while running. Onto the shaft of each engine is connected a Westinghouse engine-type generator, giving an alternating-current output of 1,560 kilowatts at 500 volts and 7,200 alternations a minute. Each machine is provided with an individual exciter, mounted on the end of the shaft.

In the transformer room, connected with the engine room by means of a tunnel, are 12 250-kilowatt step-up transformers, which raise the voltage from 500 to 10,000.

In the sub-stations supplied from this point are located 30 step-down transformers of large size. The power house is also connected to the company's Rathbone Place station, about eight miles away, by means of the British Insulated Wire company's paper-covered cables, enclosed in a cast-iron conduit.

An interesting feature of the plant is the cooling tower for the condenser water. This is a huge open iron tank, in which are suspended rows of galvanized-steel-wire screens, over which the heated water from the condensers is made to flow, while blasts of air are forced up between the rows of screens by powerful fans. In this way the company avoids the use of an excessive amount of circulating water, which would otherwise be required in the condenser.

A rather unusual adjunct to the plant is a brick machine and kiln. Good brick clay in large quantities was found on the premises, and this is being utilized in the extension of the plant.

The accompanying illustrations show views in the engine room and boiler house of the present plant. Fig. 1 represents the three 2,500-horsepower Westinghouse direct-connected engines and generators. Fig. 2 is another view of two of the same units and Fig. 3 is a view in the boiler house.

International Tramways Exhibition.

Writing on June 25th, the London correspondent of the Western Electrician says:

The International Tramways and Light Railways Exhibition, which was opened at the Agricultural Hall, Islington, on Friday last, is a most interesting display. It has the merit of being in a much more finished condition than is the case with some exhibitions on their opening day, and it will afford the visitor a good opportunity of seeing what is being done by British manufacturers in respect to electric traction. The firms who are exhibiting amount to nearly 100. The British Westinghouse company has some very beautiful cars that are intended for the Westminster route, showing much ingenuity in the combination of care and comfort with the smartest appliances. The arrangement of the stairs in these trams, which carry passengers on the roof, is much superior to the old method. Instead of the old winding staircase, which seemed specially designed to precipitate the passenger on to the street, we have a staircase in two flights which not only give greater comfort and security in mounting, but also has the advantage of giving additional room at the top. The exhibition of the Westinghouse company extends over the entire length of the hall, and includes an actual electric tramway in practical operation, complete in all details. No overhead wires are employed. The necessary current for this installation is supplied by a Westinghouse gas engine, coupled direct to a 75-kilowatt 500-volt generator. Several other makers exhibit electric tram cars, though they are not in motion, and other exhibits may appeal chiefly to the engineer and constructor, who can examine various types of permanent way, motors, motor trucks, wheels for cars, trolleys, cables, switchboards, testing instruments, etc., besides numerous other things whose connection with tramways is somewhat less direct.

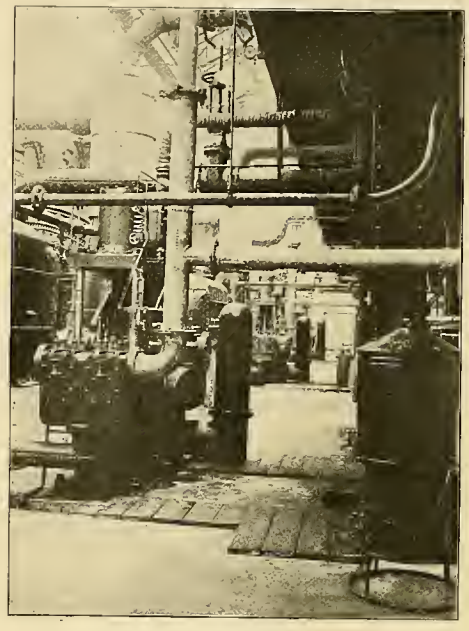


FIG. 3. WILLESDEN STATION OF THE METROPOLITAN COMPANY, LONDON —VIEW IN BOILER HOUSE.

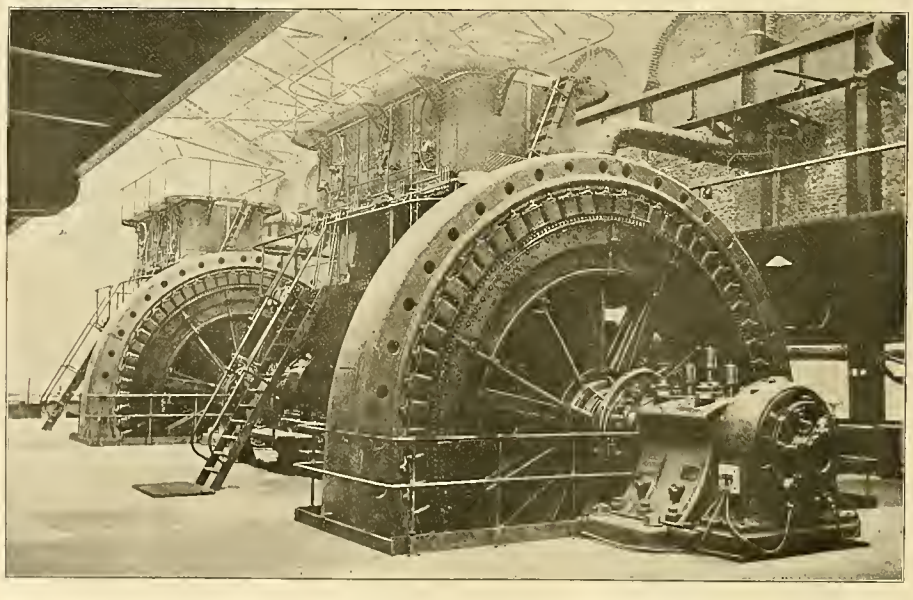


FIG. 2. WILLESDEN STATION OF THE METROPOLITAN COMPANY, LONDON —GENERATOR SIDES OF TWO LARGE UNITS.

Settlement of the St. Louis Strike.

The great street-railway strike at St. Louis ended, as was then thought, on July 2d. The victory was claimed by both sides. Following is the agreement signed by representatives of the St. Louis Transit company and by the executive committee of the strikers:

1. The provisions of the agreement of March 10, 1900, as to rates of pay and hours of service will be continued in force by the company.

2. Every employe of the company to be free to join or not to join any organization, and no discrimination to be made for or against him because of the manner in which he exercises his freedom.

3. Any attempt on the part of an employe to induce another employe by intimidation or threats to join or not to join any

union shall be cause for the immediate discharge of the person guilty of such attempt.

4. Any attempt to influence any employe by an official of the company to join or not to join any union shall be cause for the discharge of such official.

5. The company will meet any employe or committee of employes, whether representing themselves, other employes or an association of employes, regarding any matter of mutual interest.

6. For the purpose of filling vacancies which may now exist or hereafter arise, the committee of former employes, of which T. B. Edwards is chairman, shall prepare a list of the men who were in the company's service on May 7th last, and as the company now or hereafter needs additional men it will select them exclusively from this list until it is exhausted, not interfering, however, with men now in the service. No person shall be eligible to this list who has been guilty of any acts of lawlessness or violence.

United States Exhibits at the Paris Exposition.

By A. de Courcy.

The United States has a considerable number of exhibits on the lower floor of the Electrical Palace at Paris. The exhibit of the Western Electric company is one of the largest in the section, and contains a display of heavy material as well as telephone apparatus, arc lamps, etc. This company has a large generating set in operation, consisting of a 200-volt generator of 125 horsepower, direct-connected to a 110-volt, 75-kilowatt machine. For the circuits a handsome switchboard of several panels has been mounted. A number of motors is shown, ranging from one to 15 horsepower, of the direct-current type; both open and enclosed forms are seen. The arc lamps include types for various voltages for direct and alternating circuits. An interesting part of the exhibit consists of two models of the company's factories in Chicago and New York, which are very well executed. In another part of the exhibit is mounted a large board containing a great variety of telephones of different types, and a model telephone exchange has been erected, with all the necessary appliances. It connects with different telephones in the American section in the Champ de Mars, Invalides, and has a line to the United States section at Vincennes. For the exchange have been installed a number of telephone racks, a switchboard, a cabinet containing the accumulators, and a small generating set, with a marble switchboard of several panels.

Opposite is the exhibit of the General Electric company, of which the main feature is a large model of the works at Schenectady. This model is mounted on a large platform, and lighted from above and below; the lights underneath make the different buildings appear to be brilliantly lighted up in the interior, the windows being made of transparent material. This arrangement adds greatly to the attractiveness of the model, which is very well constructed. The company does not exhibit any apparatus, as it is represented in France by the Société Thomson-Houston, which has an exhibit in another section, besides the large 1,000-kilowatt alternator running in the main dynamo room. The remainder of the exhibit is taken up with a series of large photographs mounted in frames, showing the different plants installed in America and some of the factories. An interesting display is that of the Edison phonograph, which has instruments in operation during the greater part of the day, thus attracting a great many visitors. A collection of phonographs of different models is to be seen, with cylinders and batteries. In the exhibit are shown several early models of instruments, among which is the original phonograph made by Edison, using a cylinder covered with tinfoil. A part of the tinfoil is still to be seen. Two later forms are also shown.

The Bullock Manufacturing company has one of the largest exhibits of heavy material, showing a number of different types of direct-current machines and motors. In this display is also to be seen a small generating set, consisting of a 20-kilowatt machine mounted with a Forbes marine engine. The Lorain Steel company has two trucks for electric cars, showing the type of motor used. The exhibit of the Roebling company has two cases in front containing insulated wires and cables of different types, with a large display of lead-covered cables. In the center of the space is mounted a full-size section of a conduit system for electric traction, of the type used on the New York Metropolitan lines. The section is about 15 feet long and shows the details of the conduits, including the conducting rails and method of connecting by a type of rail bond devised by the company. A section of manhole shows the ends of the conduits for the feeder cables, which make connection with the circuits of the conducting rails. At the other end is a second manhole, in which is represented the method of laying the cable. The different pulleys, ropes, etc., are shown in position for drawing the cables through the conduits. At the back of the exhibit is a large panel containing a series of cables of different kinds, various forms of rail bonds, also a number of terminal boxes and heads for telephone and telegraph cables.

The American section, on the upper floor of the Electrical Palace, contains a number of exhibits of light apparatus. It occupies the greater part of the long gallery which extends from the main floor along the side of the dynamo room. One of the most interesting of these exhibits is that showing the new system of printing telegraph, invented by Professor Rowland of Johns Hopkins University. It is shown in actual operation. A table contains four transmitting instruments, which have a keyboard like that of an ordinary typewriter. The depression of the keys operates a series of levers which make contact at the outer end of the apparatus, sending a series of current impulses over the line. Each transmitter has a receiver placed at a short distance from it, and the reproduction is made by a type-wheel which gives a record exactly like that made upon a typewriter. The receiving apparatus is operated by a series of small electric motors, and the different manipulations, such as the shifting of the paper, etc., are entirely automatic, being made by the operator at the transmitting end by a suitable series of contacts. It is claimed that a number of messages can be transmitted simultaneously over the same wire. As yet the details of operation have not been made public. The H. Ward Leonard company has a large exhibit of rheostats, motor-starting boxes, units of resistance, and a collection of Carpenter enamel rheostats. This exhibit contains a switchboard upon which are mounted a number of circuit-breakers and other pieces of apparatus. The exhibit of the Gold Electric Heater company shows a variety of forms of heater adapted for general use or for car heating. To illustrate the system, a car seat is mounted in the rear of the exhibit, with two heaters arranged underneath. The Helios-Upton company shows the different forms of arc lamps manufactured, and in the same space is a collection of Hart switches of different forms.

A large number of American firms have not made individual exhibits, but have sent a number of specimens or panel boards of apparatus, etc. These are grouped together in one space, in which a number of double cases with shelves have been mounted. The panel boards and some of the specimens are ranged along the wall. Among the displays may be remarked that of the Carborundum company of Niagara Falls, showing different forms of wheels in carborundum, as well as different specimens of the raw material. A number of transformers are shown by the Pittsburg Transformer company, the Lakon company and others, besides a Wagner electric motor of three horsepower. The Ironclad Resistance company has a collection of resistance boxes. The Toerning arc lamp is also shown. This lamp is, besides, used for the lighting of the section, being mounted on a series of ornamental iron posts; with these the holophane globes are used. A number of Weston voltmeters and other station instruments are exhibited. Among the different types of primary batteries represented, those of the Gonda and the Gordon types occupy a prominent place. Among the telephones are specimens from the Western Telephone Construction company of Chicago, the Telephone Manufacturing company, the Farr company of Chicago and others. Partrick, Carter & Wilkins of Philadelphia are represented by a number of electric bells, push-buttons, annunciators, etc. The Sprague Electric company has a panel board showing different forms of iron conduit and junction boxes. The Eureka Tempered Copper Works show a number of specimens, notably commutator bars and brushes of different forms.

A display of micanite adapted to commutators, armatures, etc., is shown by Eugene Munsell & Co.

The United States section has a large space of ground at Vincennes Park, and in order to accommodate the machinery exhibits a large building has been erected, measuring about 340 by 130 feet. The appearance of the building is shown by the illustration. The structure contains a great number of the exhibits of machine tools and other representative American machines. An electric plant has been installed for the operation of the small motors which are used in the different exhibits. It consists of a Willans engine of the upright type, direct connected to a 150-kilowatt machine. The Ball engine which was originally intended for use here is in place, but the dynamo, of the Bullock type, which was to accompany it, has never been heard from since it was shipped in the Pauillac. The boilers are of the upright type, built by the Clonbrock company. Two of these have been installed. An overhead traveling crane has been erected; it has a capacity of 30 tons, and is of the Shaw company's manufacture.

UNITED STATES EXHIBITS AT THE PARIS EXPOSITION.—MACHINERY BUILDING AT VINCENNES.

Production of Cathode Rays by Ultra Violet Light.

P. Lenard announces [Annalen der Physik und Chemie, abstracted in London Electrician] an important development of the connection between electricity and light in the discovery that the discharge of electrified bodies by ultra-violet light is due to the production of cathode rays by the impact of the light. The hitherto-accepted theory that the discharge was due to the mechanical disintegration of the electrode is rendered invalid by the fact that this would require the transfer of an amount of material such as could not fail to be detected by the spectroscope, and the spectroscope makes no such indication. The constant increase of the discharge with the exhaustion, as well as the strictly one-sided character of the discharge, suggested the probability of cathode rays being concerned in it. This was as good as proved by the following experiment: A vacuum tube was furnished with two electrodes, and exhausted until it failed to allow any discharge to pass. One of the electrodes was exposed to the ultra-violet light furnished by a spark-gap with zinc terminals. When the electrode was charged negatively it was instantly discharged by the ultra-violet light. A positive charge, on the other hand, was retained indefinitely. The potential is of no account, except that the discharge is not so complete at low potentials, probably on account of a lack of energy of the cathode rays. That the electric charge proceeds in the form of rays is shown by the fact that if it is made to traverse a perforated electrode, a charge is received on an electrode in a line with the hole, but not on a lateral one. The beam can, however, be brought to impinge upon the lateral electrode by magnetic deflection. The ratio $\frac{e}{m}$ comes out as high as 11.5×10^{-6}, and the velocity as low as one-thirtieth of the velocity of light. The rays are not sufficiently intense to produce phosphorescence of the walls of the tube. But it is now possible to produce these rays in an "absolute" vacuum, and with any given difference of potential.

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CONVENTIONS AND EXPOSITIONS.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

A curious discovery is said to have been made in Germany, that land of never-ending research. It is that the lens of the human eye is diamagnetic, or possessed of the apparent property of being repelled by the poles of a powerful magnet. It is suggested as a possibility that this characteristic might be utilized in a magnetic treatment to flatten the lens and thus improve or perhaps cure near-sightedness. It is, of course, highly improbable that any permanent alteration in the curvature of the lens could be effected by magnetic repulsion, but the discovery, if confirmed by further experiment, is nevertheless of considerable interest and possibly of ocular importance.

In a recent issue of a German technical journal J. Stark discusses in an interesting manner the various theories advanced to account for the deposit of carbon on the inner walls of incandescent lamps. Moissan's hypothesis of a slow evaporation of the carbon of the filament is placed in doubt by the fact that the deposit does not depend upon the degree of exhaustion. Berliner's idea that gases are occluded in the filament and escape with explosive rapidity as soon as incandescence sets it is invalidated by the observation that the deposit is the same in continuously lighted lamps and in those which are often relighted. Mr. Stark attributes the disintegration of the carbon to vagrant currents between various parts of the carbon filament, which traverse the intervening gas as in a Crookes tube. He asserts that these vagrant currents can be placed in evidence by probes, but they are often made evident to the eye by an "aureole" between arms of the filament which is said to be nothing but the positive glow of a gaseous discharge. The internal currents are the stronger the greater the difference of potential between successive portions of the filament—i. e., the higher the voltage of the circuit. The disintegration of the carbon is strongest at the cathode part, which turns rough very soon and wears through quickly where continuous currents are used. However, while this theory seems to have elements of probability, it is to be remembered that it is largely based on speculation, like the assumptions which Mr. Stark discards. It cannot yet be taken for granted that the exact cause of the "blacking" of incandescent lamps is definitely known.

The question of the right to cut the branches of trees along highways in erecting wires is one of much interest to electric companies, and particularly to telephone companies. The decisions of the courts in the lawsuits that have grown out of disputes of this character are not uniform and vary in the different states. Thus, the Second Appellate Division of the Supreme Court of the state of New York recently held that the right of the electric company to touch the trees at all must be justified by an existing necessity, and if the purpose can be accomplished without extreme or extraordinary means, then no right exists to interfere in any manner with the trees.

But in Michigan the law is more liberally interpreted. The Supreme Court of that state points out that in a state where the erection of a telephone line along the highway is held to create an additional servitude upon abutting lands a different rule may well be held with regard to the cutting of the branches of trees from the proper one for a state where a telephone line is not deemed an additional servitude. It holds, in the case of Wyant against the Central Telephone company, that, in a state of the latter class, the right being given to erect the poles and wire, the company must of necessity have the right to remove obstructions, as the highway officers have authority to do when engaged in highway work within their jurisdiction.

Moreover, the Michigan court says that the judges may take judicial notice that poles must be set near the sides of the street or road, and that they are generally outside of the curb or ditch line, and therefore necessarily in line with the trees. Unless they are to be so high as to clear all of them, the wires must go through the trees. In cities and villages this may require the removal of large portions of the trees, if they are to go through them, and in such case it is possible that the company should use poles sufficiently high to avoid or minimize the injury to the trees. But, while it makes this suggestion, the court takes pains to state that this question was not before it for decision in this case.

Then it was contended in the Wyant case that the telephone company had no right to cut the branches of trees without first giving the landowner an opportunity to do so himself. But the Supreme Court answers that if the telephone company had the right to have the branches cut, to admit stringing and operating its wires, the Legislature has committed to no one, unless it be to the company, the authority to do this. No one could do this satisfactorily until the wires should be strung, and, until the Legislature provides otherwise, the court declares that it must think that the companies may do it, being answerable for any unnecessary, improper or excessive cutting.

In short, the court holds that it is the right of the company to cut branches in a proper case and manner, and in such case there is no liability to the abutting proprietor, who has no right to obstruct the public use of the highway. Yet it does not, in this, apparently, mean to sanction a trespass upon the premises of the abutting landowner.

Municipal ownership, or "municipal trading," as it is called in England, shows no sign of recession, either at home or abroad. On the contrary, it must be confessed that the tendency seems to be decidedly the other way. In his presidential address before the English Municipal Electrical association last month Mr. A. B. Mountain, the borough engineer of Huddersfield, showed that, from 1895 to 1898, inclusive, the capital engaged in private central-station work in England increased from £4,335,357 to £7,996,591, or about 80 per cent., while the corresponding figures for the municipal plants were £1,772,323 and £6,979,150, or 294 per cent. This seems, in the light of comparison with central-station progress, an extraordinary increase for the municipal plants, but the discrepancy is not so great as that noted in the state of Minnesota by Professor Shepardson in a paper presented to the Northwestern Electrical association last month. In less than six years, according to the figures gathered by Professor Shepardson, the number of municipal plants in Minnesota has increased 430 per cent. and the number of privately owned central stations has increased only 66 per cent. Of course, the Minnesota figures relate to number of plants only; the comparison would be more favorable to the central-station interests if made on the basis of capital expended, as in the English statistics.

The "municipalization" of tramways or street railways has proceeded to a much greater extent abroad than in the United States. A London news dispatch of July 4th, for instance, related that the London County Council, on the day before, had resolved to bring proceedings against two important tramway systems to compel them to sell their lines to the city. "Municipal ownership of street railways is spreading throughout England," continues the dispatch, "and in several cities where the lines are so owned the scheme has proved eminently successful." In Halle, Germany, a city of about 140,000 inhabitants, the city government intends to purchase the rights and property of the company which now controls the street railways of the town. This company's concession would otherwise remain in force until 1929. "The development and operation of street railways, the most important means of communication in a city," says the Magdeburg Zeitung, commenting on the situation, "can no longer be permitted to be dependent upon the private interests of a money-earning corporation. Moreover, it is one of the duties of a modern municipal government to avoid the increase of direct taxation by securing for the municipal treasury the profits of public institutions in which the citizens of the town have a personal interest, and which affect both their comfort and their business. Electric street-car lines operated by the town will, moreover, increase the profits of the municipal electric plants."

These facts are of the utmost significance, and show that central-station and street-railway men must give the subject of municipal ownership the most careful attention. Uniform accounts open to public inspection, moderate dividends and the best possible service at the lowest practicable price seem to be the indicated methods to convince the people that there will always be a legitimate place for the properly conducted quasi-public corporation.

Wet Steam.[1]

By William H. Edgar.

Wet steam is produced by two different causes in the boiler—one is priming and the other foaming. Priming I have nothing to do with; that comes under mechanical defects and belongs to the engineering profession. Priming is due, as you well know, to the lack of delivery surface or lack of steam space and to the mechanical construction of the steam dome, and especially the connections between the different domes in water-tube boilers. But wherever such a mechanical defect might exist, the water, you might say, would spatter the steam if your boiler water contained salts of soda.

Foaming is caused by saponification. I do not believe that foaming in a boiler is caused by mud or dirty water. I think it is due to the soda contained in the water, and, as a rule, wherever you have a river, that is to say, where you are using river water containing mud, you have more or less soda in the form not only of a carbonate but of a sulphate. You are probably well acquainted with well waters and the tendency they have to foam after running a week or two. I believe that in 90 cases out of 100 the moisture in your steam is due to saponification or due to the presence of soda.

You might have a great excess of lime and magnesia in solution in your feed-water, but when the water is introduced into the boiler and brought in contact with the heat, your lime and magnesia are thrown out of solution into suspension, and consequently you get no action whatever in the way of foaming. It does not increase the density of the water; it is not a part of the water; it is not in solution. Soda always remains in solution. Ninety per cent. of the waters throughout the country used in the boilers contain considerable lime and also some soda, and nine plants out of 10 are treated in one way or another with some one or the other salt of soda, and you get the same action in all such cases that you receive from the use of artesian well water and surface well water in certain places where the soil contains sulphate of soda and generally the carbonates.

Now, what I wanted to refer to was the fact that you all know that it is essential to get as dry steam as possible, and if you could get absolutely dry steam, you could use a straight mineral cylinder oil without requiring the admixture of any animal oil whatever. The animal oil is necessary only to take care of the water. The condensation washes off the mineral oil, necessitating the compounding with an animal oil to hold it, to give it the clinging, adhesive, film-cutting properties of a good cylinder oil.

The officers of a certain railroad system had considerable difficulty in getting an oil to meet their requirements. They finally got up to about 35 per cent. of tallow in the compounding. They were using soda ash in the boilers, and the more soda ash they used the more moisture they had in their steam, the more they saponified the water and the more moisture was carried over; and with this moisture came soda, and the more soda that came over the more it cut the animal oil, saponifying it, forming soap, and they had considerable difficulty before they found out really where the trouble lay.

I believe that throughout the country in different plants a great many good cylinder oils have been repeatedly condemned and all due to the well water used, carrying the water a little too high in the boiler or using some preparation of soda, and, of course, the higher you carried the water, and the more you agitated the water, from a sudden opening, I suppose, of the valve in the delivery of steam, the more readily it would foam; and I believe that in all your practice in the engine room, if you would watch your water level and the nature of your water, so as to know the amount of soda it might contain, it would enable you to better take care of the oil question.

Caustic soda in a saturated solution would contain 59 per cent. of caustic soda; a saturated solution of soda ash would contain 40 per cent. soda ash, when it would begin to cake; with salt you would have a 35½ per cent. saturated solution before it would cake. All sodium salts remain in solution until the solution is saturated, and then they cake and always cake at the hottest part of the boilers. It is quite common in Kansas and down in New Orleans and out in the Hawaiian Islands and along the seacoast, where they use salty water, to buckle the tubes and bag their sheets, due to salt.

As I said before, I believe that nine-tenths of the wet steam and cases of foaming are due to soda.

Discussion

Frank McMaster, Chicago: What is the most easily applied test to determine whether there is an excess of soda?

Mr. Edgar: An analysis of your feed-water is about the only course you can pursue. You can have that done at any state university. If you were running a condensing plant on the seacoast, using saltwater, and had trouble in your boilers, you would look for leaky condensers. I found out in San Francisco that they were testing by taste—they let it go until they could taste the salt. I rigged up an apparatus by which they could titrate and determine the salt. Their natural supply showed about four grains of salt to the gallon. When they found it to run six, eight or 10 per cent. they looked for a leaky condenser.

F. A. Copeland, La Crosse, Wis.: Wouldn't it be easier to examine the inside of your boiler when you clean it? If there is considerable scale, you have got considerable soda, haven't you?

Mr. Edgar: No; the scale would really give you no indication of the amount of soda.

Mr. Copeland: All that we purge a boiler for is to do away with the scale, isn't it? If your flues do not scale, you are about as near perfect as you can be, are you not?

Mr. Edgar: O, yes; but I was referring, not to the purgers, but to the natural conditions from the use of well waters.

Mr. Copeland: Wouldn't that be a good way to find out whether you have got good water or not—that is, for us country fellows who do not know anything about the technical practice of the thing?

Mr. Edgar: Yes, if you are not getting into trouble and have dry steam.

Mr. Copeland: I have a separator in my main steam pipe, and the amount of water that comes out of it is astonishing. What makes the condensation I don't know, but it will empty several gallons every 10 or 15 minutes.

Mr. Edgar: A great deal of that depends upon the boiler and its construction. Take the large units to-day in use in water-tube boilers, and when you are running up to full capacity, your steam is practically in your fire, and when you draw on that boiler suddenly, there must necessarily be quite an agitation, and you have a very small delivery surface, and in some of the water-tube boilers, I should say, although I am not an engineer, some of the connections are decidedly wrong.

William H. Schott, Chicago: Is it not a fact that this is usually caused by carrying the water too high?

Mr. Edgar: Yes.

Mr. Schott: In 90 per cent. of the cases?

Mr. Edgar: Yes, sir. It is a fault of firemen throughout the country to carry the water too high. In a Stirling boiler you ought to carry the water as low as possible on account of the back drum and steam delivery.

Mr. Copeland: How much water would you carry on top of your tubes in a horizontal boiler?

Mr. Schott: Three inches on the front end; and if the boiler is set properly, it should be about one inch or an inch and a half lower in the back end.

Mr. Edgar: What water have you been using?

Mr. Schott: Michigan Lake.

Mr. Edgar: That is an exceptionally good water.

Mr. Schott: Yes, sir; it will average about 20 grains to the gallon.

Mr. Edgar: Lake Michigan is a lime water, and a lime water will not foam.

Mr. Copeland: We use lime water out of the river (Mississippi), but it gets to foaming once in a while.

Mr. Edgar: It will show up some soda, too.

Mr. Schott: If you use soda ash as a purgent you will get violent foaming.

Mr. Edgar: I wish to say, in addition to what I touched upon, that oil coming back in the return condensation and causing considerable trouble, making the flues leak, buckling a tube or bagging a sheet, is quite common in the condensing plants of to-day.

Mr. Copeland: How will you get oil back in there?

Mr. Edgar: In your return condensation. They have tried it in a great many cases, and there are cases where they use all their condensation back in the boilers.

Mr. Schott: To what kind of condensers are you referring?

Mr. Edgar: I am referring to a condensing plant where they turn all their condensation back into the feed-water supply.

Mr. Schott: That can be done with a Wheeler surface condenser.

Mr. Copeland: I use a jet condenser.

Mr. Edgar: They have a great many times introduced soda ash and caustic soda with the object of cutting the oil and have saponified it. In the first place they had an insoluble soap as a result of the action of the oleic acid, forming oxide of lime, and they have used soda to cut that, and it forms a soluble soap which saponifies the water, causing violent foaming.

[1] Address delivered at the meeting of the Northwestern Electrical association at Waupaca, Wis., June 26, 1900.

The Making of Parabolic Mirrors.

Cowper Coles, an Englishman, is said to have invented a simple process for the preparation of parabolic mirrors for searchlights. He begins with a mold of glass possessing a carefully prepared convex surface whose curves are parabolic. Upon this he deposits a layer of metallic silver, which is polished before further steps are taken. Then he immerses the mold in an electro-plating bath and coats the silver with copper. The latter metal forms the backing of the future mirror, and the silver the front. While the last-mentioned operation is in progress the mirror is rotated slowly in the fluid. An average of 15 turns to the minute is sufficient. The copper adheres firmly to the silver, but the latter can easily be separated from the glass mold. The incomplete mirror is first immersed in cold water. The temperature of the fluid is then raised gently about 120 degrees of Fahrenheit. Owing to the unequal expansion of glass and metal, the one pulls away from the other.

Cable-laying in the Philippines.

Captain G. O. Squier, U. S. A., who is conversant with the work of the United States government in laying cable lines in the Philippines, gave an interesting interview on the subject to a reporter of the New York Tribune. He said:

"A large portion of the cable to be used in this undertaking is to be carried from this port to the Philippines on board the United States cable ship Burnside, which was formerly employed by the government as a transport. The Burnside is expected to sail on August 15th, and will make the voyage by way of the Suez Canal. Although this cargo of cable is only a portion of what will eventually be used, I believe its cost amounts to as much as $240,000. I cannot say what the ultimate cost will be.

"The purpose of the work is to connect the different islands of the Philippine archipelago so that they all will be practically joined into one. The center of communication will be Manila, which will be joined to the continent either directly or by way of Formosa. Not all of the islands, of course, are to be incorporated in this system, since many are of insignificant size or sparsely populated. Only the more important members of the group will therefore be connected.

"Some work has already been done. Those islands which have thus been joined with the chief island of Luzon are Leyte and Cebu. Iloilo was formerly connected with Luzon by the Spaniards. The system when complete will embrace not only these, but, among others, the islands of Negros, Bohal, Samas and the great southern island of Mindanao.

"The land connections also involve a great amount of work. The government has perhaps thus far accomplished more on land than on water. And it is to be remembered that the establishing of telegraphic communications through the jungles and swamps of this territory involves many difficulties unknown to the engineer at home in the United States.

"The first necessity of such communication is that of supplying information to the War Department. Accordingly, the cost of the work is being paid out of the war fund. Under existing conditions an insurrection may break out in one island and nothing be known of it at headquarters in Manila until the worst has happened. Again, the United States must herself own a line of direct-communication with the Philippines. The cable between Manila and Hongkong, the one which Dewey cut, is owned by English capitalists.

"Underlying all the details of the plans of the government for cable connection on these islands is the scheme to make this system a grand terminus of a Pacific cable, which will reach the American shore at San Francisco by way of Guam and the Sandwich Islands. If we are to hold the Philippines, such a transoceanic cable is an absolute necessity. This trunk cable would doubtless have its eastern terminus on the eastern shore of the island of Luzon, opposite Manila and distant from it but a few miles, since the island is exceedingly narrow at that point."

BOOK TABLE.

The Gas-engine Handbook. By E. W. Roberts, M. E. Cincinnati: Gas Engine Publishing company. 1900. Pp., 220, with 39 illustrations.

This little volume is intended to be a standard of reference for those interested in gas engines, and it seems to come well up to the aims of its publishers. Its chapters contain information that makes the book useful to both the designer and operator. Starting with a discussion of the principles of the gas-engine cycles at present in use, the advantages and disadvantages of each are explained. Fuels and tables of their heat values are followed by chapters on care and operation of engines and the troubles most likely to occur, igniters, valve mechanisms, governors and starters. A chapter is given to automobile engines and then follows a series of chapters on gas-engine design and testing. The whole subject is handled in a very thorough and scientific manner by one of the best authorities in the country and the book is a valuable addition to American engineering literature. It is not a compilation of trade descriptions of various makes of engines; all the illustrations and descriptions were made especially for this book and to meet the special requirements of a technical work of this kind.

Anderson Trolley Patent.

The General Electric company has secured permanent injunctions restraining the Vulcan Foundry company, Preston, Cohen & Co., the Creaghead Engineering company and the George C. Towle Manufacturing company from infringing on the Anderson electric-railway trolley patent No. 412,155. The claim held to have been particularly infringed is the eighth of the patent and relates to the combination with a trolley frame and trolley wheel of metallic conducting brushes between the hubs of the trolley wheel and the frame.

The promoters of the Portage Lakes Transit company, Ravenna, Ohio, have the necessary consents for the construction of the proposed electric line from Bedford to Ravenna and Kent. F. Rockfeller of Cleveland will furnish most of the capital.

DEVELOPMENT OF THE TELEPHONE FIELD.

Notes from Ohio.

Because of a difference of opinion as to the value of telephone instruments for taxation in the various counties of the state, Auditor W. D. Guilbert a few days ago submitted the question to Attorney-general Sheets for an opinion. After a careful deliberation and thorough examination of all the points in contention, the attorney-general gave it as his opinion that the instruments of the Bell Telephone company should be listed for taxation at $10 each, this being considered a fair average of the value of all in use in the state. This is a big reduction from the value placed upon them by former Attorney-general Monnett, who placed it at $100 each. It is the opinion of Mr. Sheets that this tax should be collected for the past five years, as well as for the current year. A decision of the Supreme Court some time ago placed the value at from $10 to $17, but affidavits have been filed since showing that the earning capacity of the instruments is on an average $2.90 each a year. This is the reason for the reduction. This will add more than $100,000 to the tax duplicate of the state and increase the tax income about $22,000 a year.

The Kent Home Telephone company of Kent, Ohio, has organized by the election of the following-named officers: President, S. T. Williams, Cleveland; vice-president, F. L. Allen; secretary and treasurer, George E. Hinds; manager, W. H. Butler.

Henry Canterbury of Ironton has been made manager of the Gallipolis, Ohio, exchange of the Central Union Telephone company in place of Fred Masters, who expects to go into business at Indianapolis.

The physicians of Portsmouth, Ohio, have adopted the Portsmouth Telephone company's service, and will do away with the Central Union instruments entirely. The former company has the police-patrol system also, and is getting many business and residence subscribers.

W. R. Montgomery has been made superintendent of the East Liverpool exchange of the Columbiana County (Ohio) Telephone company.

The Bell Telephone company is putting in an entirely new set of instruments at Salem, Ohio.

The United States Telephone company has reached Sugar Grove with its Lancaster, Ohio, line.

The Toledo (Ohio) Traction company has put in a complete telephone exchange at its offices in Toledo. This is connected up with the Central Union, which gives access both to the local exchange and to the long-distance lines.

The Findlay (Ohio) City Council has granted the Findlay Home Telephone company a franchise. This matter has been before the council for some time, but has been bitterly fought by the Bell company, which has been operating exclusively in that town for years.

The Central Union Telephone company has received over 500 new instruments at its exchange in Findlay, and all subscribers will be supplied with them. They are of the latest design and were furnished by the Western Electric company of Chicago.

The rentals on the Citizens' Telephone company's instruments in Columbus will not commence until August 1st, although there are nearly 3,000 of them in use. The company wishes to get its entire system in operation before it begins to collect rents.

The recent test of L. G. Wooley's alarm system over the Central Union Telephone company's wires between Columbus and Springfield was a success. The distance of the double line is 90 miles. The machine, instead of having batteries, is supplied with magnets of a peculiar kind, and Mr. Wooley has been working upon it for years. In the test a resistance equal to 500 miles of steel wire was placed upon it, but it worked as well as it did with the 45 or 90 miles of wire stretched upon the poles between the two cities named. This would make it fit for use for the fire-alarm system of almost any of the larger cities. But this is not all. The inventor thinks that his invention is good for a much greater distance than any it has ever been tested on yet. So, if he is correct, it will operate a single circuit that would supply the most extensive system used in any of the cities. W. S. Van Brocklin of Amsterdam, N. Y., and W. E. Powell of Johnstown, N. Y., both capitalists, were present and were well satisfied with the tests.

The officers of the Central Union Telephone company have agreed to pay the advance of 25 cents demanded by the Electrical Workers' union at Columbus. This brings the wages up to the standard paid for such work. C.

Municipal Project in Toronto.

The Board of Civic Control for Toronto, Ont., has passed a resolution recommending the city engineer to prepare an estimate of the probable cost of installing and operating a municipal-telephone system for 6,000 to 10,000 subscribers. The Bell company charges $45 yearly for business and $25 for house telephones, and refuses to put in new instruments except for a material increase of rates.

The Colorado Telephone company has increased its capital stock from $1,500,000 to $3,000,000.

New England Telephone Stock Issue.

The following circular has been issued to the stockholders of the New England Telephone and Telegraph company, under date of June 28th:

"At a meeting of the stockholders of this company, held on May 7th, 1900, it was voted that the capital stock be increased from $15,000,000 to $20,000,000. The issued capital now amounts to $13,759,100.

"The great and constant increase in the number of our subscribers, due in part to the low rates at which the party-line and measured service is furnished, has demanded a more rapid enlargement of our facilities than ever before, and extensive additions to the property are still required.

"To provide funds for extension of the plant and business of the company, and pursuant to the authority vested in them, the board of directors of this company have ordered that 17,200 shares of the capital stock of the company be offered to stockholders for cash, at par, in proportion to their respective holdings.

"Each stockholder of record at the close of business on Monday, July 9, 1900, will be entitled to take, at $100 per share, shares of stock in the proportion of one share for every eight shares then held; that is, a 'right' attaches to each share of the old stock to subscribe for one-eighth of a share of new stock, but subscriptions must be for full shares.

"Subscriptions under holdings that are not multiples of eight shares can be adjusted by the purchase or sale of rights. The company will neither buy nor sell rights.

"This right to subscribe will expire at one o'clock in the afternoon of Saturday, July 28, 1900.

"All subscriptions and all assignments of rights must be filed at the treasurer's office, before one o'clock in the afternoon of Saturday, July 28, 1900. Sellers of 'rights' will not subscribe thereunder.

"Payment for full shares equal to one-half of the shares so subscribed for, at the rate of $100 for each share, must be made to the treasurer at his office."

Telephone Service in Detroit.

An improved telephone service for the city of Detroit is in sight. A large force of men is at work rebuilding the lines and placing many of them underground. Mr. H. V. Pettengill, of the American Telephone and Telegraph company, will take personal supervision of the work. He himself expects to remain in Detroit for 30 days, but the work contemplated will keep a large force of men employed two or three months.

A number of prominent physicians have registered a "kick" against the service and the establishing of the slot-telephone service in hotels and drug stores, and have held a meeting at which an "Independent physicians' and druggists' exchange," was talked of with considerable vigor. However, Mr. Pettengill is undecided about granting special concessions to physicians. He says that in other cities the company does not publish a separate physicians' list in its directories, and as far as special terms were concerned, the service called for by physicians and druggists was so much heavier than that required by other subscribers, who do not use the lines at all hours of the day and night, that if any difference were made to terms for physicians, the reasonable thing to do would be to charge them more than the rate to other subscribers. G.

Bell Output For June.

Boston, July 7.—The American Bell Telephone company's June statement of the output of instruments to the 20th of that month makes comparisons as follows:

June:	1900.	1899.	1898.
Gross output	55,613	61,399	23,971
Returned	25,671	15,668	9,650
Net output	29,942	45,731	14,321
Dec. 21 to June 20:			
Gross output	346,146	341,026	166,333
Returned	132,660	91,737	73,295
Net output	213,486	249,289	93,038
Total output June 20	1,893,878	1,374,175	1,012,159

Toll-line Traffic.

Mr. J. B. Ware, of the Citizens' Telephone company of Grand Rapids, writes to correct an error in the stenographic report of the discussion of his paper on "Toll-line Traffic" at the recent telephone convention in Cleveland. "In the next to the last paragraph of your report," says Mr. Ware, "I am quoted as saying that we should encourage long-distance business 'without regard to whether we are making a success of our business or a loss.' What I did say was that the exchange 'could afford to handle the toll business without profit or even at an actual loss' rather than not secure the toll connections."

The Greenville telephone exchange at Greenville, N. C., passed into the hands of the Carolina and Virginia Telephone company on July 1st. The new company, it is said, will put in a new switchboard and make other improvements.

GENERAL TELEPHONE NEWS.

The Commercial Club of Louisville recently passed resolutions condemning the Bell rates in that city as "unreasonably and unnecessarily high."

The Erie telephone system made a net gain of 2,744 subscribers in June. The total number connected on June 30th was 126,455. The number waiting connection is stated to be 6,073.

The Wisconsin Telephone company (Bell) on July 1st extended its "minute" service to all points in Southern Wisconsin from Milwaukee. The practical effect of this is to reduce toll rates for three-minute talks to most points.

A movement is said to be on foot to consolidate the Independent telephone companies in the Piedmont section of North Carolina. A meeting of the stockholders of the Queen City Telephone company was held at Charlotte, N. C., recently, and it is understood that the matter was considered.

The Nebraska City Telephone Exchange company of Nebraska City, Neb., has been purchased by N. A. Duff, John W. Steinhart, E. K. Bradley, Charles DeGroff, Henry Schwake, A. M. Munn, H. C. Freeman, Paul Jessen, William Hayward, L. P. Utterback and others. The new company, which is composed of local capitalists, has not yet elected officers, but will do so in a few days.

At Rochester, N. Y., the Bell company complains that persons claiming to be employes of the company are going around among the Bell subscribers saying that they wish to examine the telephones to see if the instruments are all right. Then when the strangers make the examination, it is asserted that they put the instruments out of order. Subscribers have been warned against letting unidentified persons tamper with instruments.

The Central Union Telephone company has filed a supplementary mortgage deed to the Old Colony Trust company for $1,000,000. The original mortgage was dated January 2, 1899, and was for $6,000,000. It is protected by five per cent. bonds on all the company's property, real and personal. The amount of the supplementary mortgage is said to be less than the improvements and additional property acquired since the original mortgage was made.

NEW COMPANIES.

G. D. Jones of Wausau, Wis., is the moving spirit in the Marathon County Telephone company, which has been organized for the purpose of constructing a line from Wausau to Marshfield via Marathon City, Edgar, Fernwood and Stratford; also a spur line to Masinee and another to Athens.

The West Penn Long-distance Telephone company, composed of the same men that control the Pittsburg and Allegheny Telephone company, has been incorporated in Pennsylvania, to operate long-distance connections for the parent Pittsburg exchange. It expects to apply for franchises in 27 towns in western Pennsylvania.

An ordinance has been introduced in the New Orleans City Council granting to Edwin H. McFall and associates a 50-year franchise for a telephone exchange, the charges not to exceed $48 for business and $36 for residence telephones within two miles of the exchange, and $65 limit within the city proper. One peculiar provision of the ordinance is that 51 per cent. of the company's stock is to be held in trust by the city.

A charter has been issued to the Romney Telephone company of Romney, W. Va. The company is formed for the purpose of constructing and operating a telephone line from Romney to Rio, via Rock Oak, John Riggleman's, Kirby Ruckman's, Bethel Church and Fairview Church, with branch lines extending up Spring Run and from Kirby to intersect the main line. The incorporators are Jacob Shawholtze of Stoney; R. S. Davis, D. G. Holt, G. C. Ludwig and J. A. Ludwig of Kirby; E. L. Beane and John Riggleman of Rock Oak; Nathaniel Maphis and C. E. McDonald of Rio.

MANUFACTURERS AND DEALERS.

The Farr Telephone and Construction Supply company, Chicago, has just issued its bulletin No. 18, which contains announcements of special interest to users and buyers of telephones. A fine illustration of the Farr company's exchange telephone No. 6 is given. The company says that it is continuing to receive orders from all over the world for its well-known products.

The Peerless Electric Telephone company, Rio, Wis., manufacturer of telephones and dealer in general telephone supplies, reports a prosperous and growing business. The company states that it is having the best of success in placing its instruments on the market. The Robertson bipolar receiver, which is said to differ radically from any now in use, will soon be placed on the market by the Peerless company, and a large demand for this instrument is anticipated. The company has recently issued some attractive literature on the subject of telephones which it will be pleased to mail to anyone on request.

Why Some Municipal Electric Plants Do Not Pay Better.[1]

By Geo. D. Shepardson.

Part I.

Municipal ownership of electric-light plants has been the nightmare of many a station manager and also of many a taxpayer, according as the viewpoint is before or after taking. The reasons for and against municipal ownership have been discussed ad nauseam, and yet the agitation continues. This subject, like many another, exemplifies the old adage: "A man silenced against his will is of the same opinion still." He who begins with a belief in the desirability of municipal ownership finds plenty of argument to bolster his faith, while he who believes in private ownership finds other arguments, equally convincing, at least to himself and his sympathizers. It is doubtless true that each side has an element of truth and also that neither is entirely correct in every particular. Local conditions are the determining factor in many cases. Considered as an entirely abstract question, it is a difficult matter to decide what public utilities should be owned by the municipality, what should be owned and managed by private enterprise, and to what extent the municipality should control the latter. It is largely a matter of degree rather than of abstract right or wrong in the essence. With the above in mind, the writer has no idea that this paper will convince anyone either of the desirability or the undesirability of public ownership in his own locality. The only aim is to present certain phases of the subject that may not have received sufficient recognition, and to see how both sides appear.

The subject of municipal ownership has been discussed at almost every session of this association, and the general sentiment seems to be that the principal cause of the agitation in favor of municipal ownership is the circulation of incorrect figures as to the real cost of operating existing municipal plants. It is easy to see why the reports of such cost are almost invariably too low. The towns almost never know the real cost of the lights, on account of faulty records. Each town desires to make the best showing possible, for when a low figure is quoted, the general public immediately concludes that it is enterprising, while those who know how such reports are compiled smile at their ignorance of the real cost. The other principal cause is the general belief on the part of the public that the electric companies are making enormous profits, whereas, the painful fact is that probably few of the smaller companies at least are really earning any dividends. In towns of less than 2,000 or 3,000 inhabitants, it is a very difficult matter for an electric-light station to earn respectable dividends unless it is operated in conjunction with some other business, for example, a mill, so that the labor and administrative expenses are reduced to a minimum. Similar conditions hold in many plants in larger towns. The reports of some stations show larger profits than actually exist, which, while flattering to stockholders, are yet deceptive, if not positively harmful. A uniform method of keeping accounts, such as is being urged by the National Electric Light association, would do much to help station managers discover their own real situation. Did the municipal and private plants have correct methods of keeping records, so that it was generally known how much it actually costs to operate municipal plants and how small the net earnings of private plants really are, the agitation would probably die a natural death in a few years. As a matter of fact, the managers of some of the largest central stations advocate the public supervision of their accounts that the actual facts may be in the possession of the people. The ordinary citizen reads the report that the operating expenses of a large plant are only 50 per cent. of the gross income, and he believes that the remaining 50 per cent. is clear profit, forgetting about the numerous charges which reduce this to 15 or five per cent. He also compares the cost of a kilowatt-hour produced at the station with that charged on his bill for service, and then firmly believes that the company is making from 100 to 2,000 per cent. clear profit. The public generally have no objection if a reasonable dividend is earned, but there is objection to what are felt to be enormous profits.

Some Reasons Urged in Favor of Municipal Ownership.

Some of the reasons advanced by advocates of municipal ownership are:

The municipality should control the public utilities that affect the safety of the people. Therefore it is warranted in supplying water for fire and sanitary purposes, constructing sewers, maintaining fire, police and health departments. The town should see that the streets are lighted for safety at night. How can it be done better than by the town itself, rather than by contract?

Some claim the town has no moral right to place the furnishing of necessities of life in the hands of "a legalized private monopoly, with unrestricted powers" and leave the people helpless at the mercy of a corporation, whose very existence was originally by the grace and favor of the people—a free gift at the hands of its later victims.

Since there is room for only one waterworks system, it being perhaps "a natural monopoly," the town is warranted in furnishing water for private use. In smaller towns there is not business enough to warrant starting a company lighting plant, unless a favorable street-lighting contract is secured. Hence, if the town lights its own streets, it must also furnish electric lights for private use, if the citizens are to enjoy these luxuries at all.

The town can furnish electric lights cheaper than a company, since it need not earn any dividends and pays no taxes. Some maintain that the plant need not earn interest on the money invested, for the plant is bought with the proceeds of bonds, the interest on which can be charged up to general expenses of the town. Even if interest is charged against the plant, the municipality can borrow money at a lower rate of interest than can a private corporation, since the whole property of the town is security, and not simply that in the plant for which the bonds are issued, and the laws are such that taxes can be collected without fail. On the other hand, the plant alone is security for bonds or other funds hired by a company.

Some also maintain that the plant need not earn anything for depreciation, surplus or sinking fund, for this can also be provided for by an addition to the tax levy, and the people would never know the difference.

It is claimed that the plant can be operated more cheaply by the town, for it need cost nothing to handle the business, since the town officials can keep the accounts and make collections as a part of their regular duties.

When the town already has a waterworks plant in operation, or in prospect, it can supply electric light and power with little additional cost, since the building, boiler and men are there already, and it takes only a little more coal and wages to run the electric plant.

Perfect honesty may be expected in the administration of the affairs of electric-light and waterworks plants at all, except, perhaps, the largest towns, for in smaller places everyone knows everyone else and all his affairs, the public affairs are known to all, and there is no chance for stealing or other corruption. There may be aldermanic steals in large towns like New York and Chicago, but never in our town.

The large dividends on watered stock of gas and electric companies show that there is a large margin, which might be saved to the consumer in the case of municipal ownership.

By operating a municipal plant, prices will be so low that electric lights can be enjoyed by poor people, and not by the rich only. As a matter of fact, the prevailing prices for street and commercial lights are considerably lower with municipal plants than in other towns with private plants.

Some Results of the Agitation.

The extent to which the arguments in favor of municipal ownership have been accepted by the people is indicated by the notable increase in the number of plants recently installed. Take the experience in Minnesota as an example. According to Powers' central-station directory, in October, 1894, there were 10 municipal and 38 privately owned central stations in Minnesota. In this classification, the term municipal refers to public ownership, whether by a village or city, while a company plant refers to privately owned plants, which furnish light for public streets or for other than the owner's use, not including what are known as isolated plants, for supplying a single concern.

A similar directory, recently issued, when supplemented with information from other sources, shows, for 1900, 53 municipal plants and 63 company plants.

The writer does not know to what extent the earlier directory was complete, but it is fair to presume that the proportion of omissions was about equal for the two classes of stations. Comparing these statistics, we find the number of municipal plants has increased in less than six years from 10 to 53, a growth of 430 per cent. During the same time the privately owned central stations have increased from 38 to 63, a growth of only 66 per cent. The latter figure might be raised to a small extent by counting sub-stations of the larger companies as separate stations. On the face of it, there were six municipal plants installed in Minnesota for every privately owned central station during the past six years. These figures are not quite so significant as might at first be supposed, for many of the municipal plants are in towns so small as not to warrant putting in a private plant except in connection with some other line of business. Minnesota was pretty thoroughly exploited (some think over-exploited) in the booming days of early enthusiastic promoters, and all of the larger towns had electric plants prior to the date first mentioned above. On the other hand, during this period of six years, the existence of a number of companies has been threatened by practical confiscation through agitation for municipal ownership, although they have safely ridden the storm in most cases. At other towns franchises have been sought by prospective investors and have been refused in favor of municipal ownership.

Some Reasons Urged Against Municipal Ownership.

Let us next look at the other side and note some of the reasons urged against municipal ownership, or to meet arguments in its favor:

Public affairs are not usually administered as economically as private affairs, hence public utilities should be in the hands of private concerns for best economy. The administrators of a public institution, such as a waterworks or electric-light plant, do not have the self-interest of those operating a private plant, for they are not usually expected to earn dividends, nor are they so closely watched, as "everybody's business is nobody's business." "Private management, in comparison with public management, is at least 20 per cent. more efficient, saving and economical in every way, as a direct result of the self-interest in a profit-producing industry." All other things being equal, this 20 per cent. more than offsets any advantage public ownership may have in reducing costs, and it enables the private plant to earn a reasonable dividend, while not increasing the actual cost of service to consumers.

Even where the officials are perfectly honest, public affairs are always administered less economically than private, the hours being shorter, the pay being higher, as a rule, while the supervision is less exact.

Political "pull" usually puts the best men out and puts political loafers in positions where their ignorance, laziness and general incompetence militate against efficient operation of the plant.

The feeling that politics count for more than merit prevents the employes in a municipal plant from having the proper ambition to excel that would exist in a private plant or in a public plant where civil-service principles prevailed.

Even in the rare case where merit tells more than "pull," the City Council changes its make-up every one or two years and a new committee is appointed to have general oversight of the city water and lighting interests. These green committeemen must show their ability by insisting upon the superintendent following their notions, even against his own convictions. They stand in the way of his getting supplies and apparatus that he really needs, while they are quite willing that he should lay in large supplies of such sort as appeal to them. The superintendent is therefore apt to be extravagant in some directions while he must be niggardly in others, both of which militate against the economical operation of the plant.

While the municipal plant has no taxes to pay, the town is not the gainer thereby, for its treasury loses practically the same amount which the company plant would have paid. There may be an immediate saving to the town, since the company's taxes would have been divided among the town, county and state, so that the county and state lose some revenue in favor of the town owning a municipal plant.

The handling of municipal property is notoriously corrupt, even outside of the larger towns.

The periodical waves of "turning the rascals out," and reforming the public expenditures, generally mean that the salaries of the superintendent and engineer are cut to such a point that no competent man can afford to retain his position, and incompetent or dishonest men take their places. It is true that "the corporation that pays small salaries in order to pay larger dividends will have to pay larger salaries in order to maintain dividends." A similar statement is true regarding salaries in municipal plants.

As a result of the incompetence or lack of appreciation of the situation on the part of the superintendent or city recorder, the records of many municipal plants are in such shape as to give little information as to the exact condition of the plant. In some cases, there is not a complete record of bills receivable. Many have no record of the output of station, coal or water per kilowatt-hour, or even number and location of services, meters and lamps. Such things as pressure wires are unknown in many plants, and the lamp voltage varies to such an extent as to render the use of economical incandescent lamps out of consideration.

The reports of the low rates with municipal plants are due to several causes, usually to ignorance of the real cost. Expenses that should be charged against the electric plant are often placed against the waterworks or against the general fund, and are often ignored until it becomes necessary to pay some bonds. Depreciation is often not considered, and when something finally gives out, a special appropriation is made for renewals, and is charged against something other than the operating expenses of the municipal lighting plant. The result is that the rates received for electric lights are often considerably below actual cost to the town, and the saving to the people who take electric lights is made up by increased taxation of the whole people. If the town sells electric light below cost, it should in all reason furnish kerosene and candles at proportionally low figures. And why not groceries and dry goods likewise?

The argument as to the danger of placing the supplying of necessities of life in the hands of a private monopoly does not apply to electric-light plants. If the service and rates are not such as to seem fair and reasonable, customers will reject electric light and will fall back upon other illuminants. Self-interest therefore prompts public-supply companies to offer the lowest rates consistent with reasonable profit. Witness the active efforts of gas and electric companies to increase their business by all sorts of advertising, and note the continual reduction in prices as the earning capacity of the plant grows. It should be recognized, however, that the excuse for municipal ownership where private plants already exist is often charged to alleged un-

1. Paper presented to the Northwestern Electrical association, at Waupaca, Wis., June 28, 1900. The author is professor of electrical engineering in the University of Minnesota.

reasonable and monopolistic attitude of the local company.

Public sentiment is not always based upon ultimate truth, being molded often by specious arguments that later prove defective. In the end truth prevails. Much of the contention for municipal ownership of public utilities comes from the circulation of incorrect reports of relative cost. A number of municipalities have learned by experience that it is cheaper to obtain electric service by contract rather than by municipal operation. To this day there is open the standing challenge of a well-known advocate of private ownership, that "there is not a municipally owned gas or electric-light plant in the United States which private capital will not take over and operate under contract, at the same price the service is now costing, all factors of loss being correctly and fully considered, and all franchise rights enjoyed by the municipality being assigned to the purchasing private corporation."

The talk about giving away franchises is largely based upon a lack of appreciation of the benefits that accrue to a town by the investment of private capital in public utilities, increasing the advantages and facilities of the place, making it more attractive to other capital, bringing in new industries, increasing the population and greatly improving the conditions of living in the municipality. Concessions, percentages of income and other burdens are increasingly laid upon seekers for franchises. But it is also true that the companies recognize more than formerly the fact that obligations between the company and town are mutual.

In spite of the talk about large dividends on watered stock, it is probably true that the majority of central-station owners would willingly sell out to the municipality at a reasonable price, established by unbiased and capable appraisers.

[*To be continued.*]

G. I. High-tension Circuit-breaker.

The accompanying illustration (Fig. 1) shows the new high-tension automatic magnetic circuit-breaker of the General Incandescent Arc Light company mounted on the back of a switchboard panel for two generators or feeders. These circuit-breakers are of the oil type, and are especially adapted for high-potential polyphase systems. It is said that where these circuit-breakers are used no fuses are required. The manufacturer makes these statements: "The circuit is broken entirely under oil, and these circuit-breakers have demonstrated in actual practice their ability to open the circuit automatically, without injury to any part of the device or circuit. We furnish these oil switches with or without the automatic overload feature, and can furnish an automatic closing feature, so that the device can be opened or closed from a distance by a push-button, or opened automatically by an overload. The high-tension parts are all behind the boards and are highly insulated. There is absolute safety in manually operating the device."

Fig. 2 shows the throwing-in toggle arrangement placed on the front of the board.

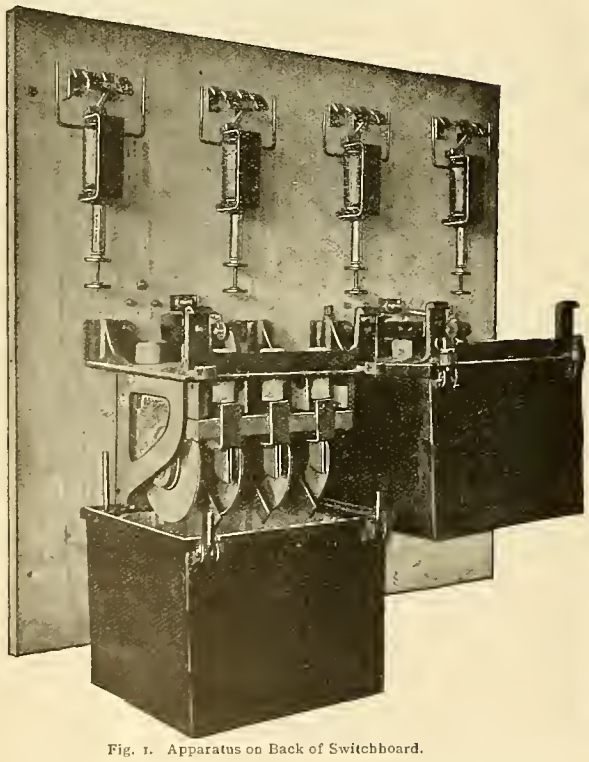


Fig. 1. Apparatus on Back of Switchboard.

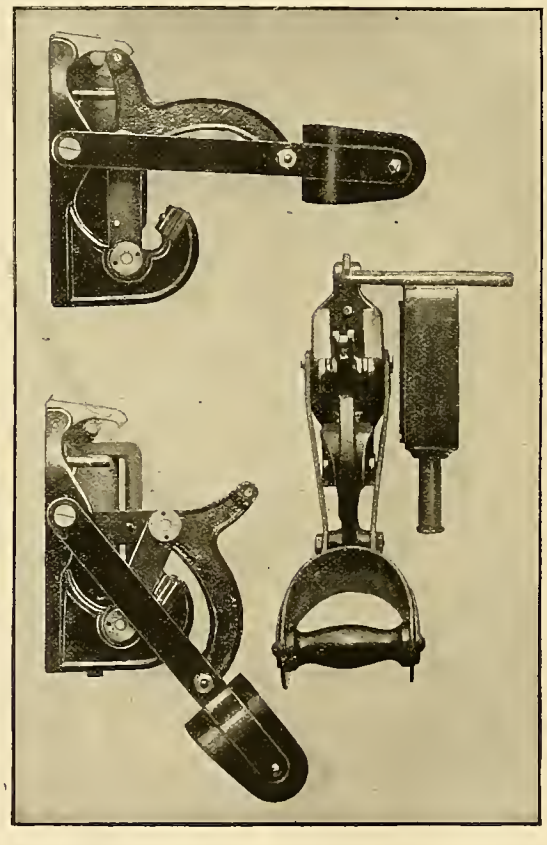


Fig. 2. Throwing-in Toggle Arrangement on Front of Board.

G. I. HIGH-TENSION CIRCUIT-BREAKER.

The Ravenswood, W. Va., council has granted to C. E. Chichester of Parkersburg a franchise to build an electric-light plant, and has contracted for 20 street arc lights at $1,000 a year.

American Bridge Company.

The newly formed American Bridge company has issued the following circular letter to the trade: "As a result of numerous conferences it has been deemed expedient to organize the American Bridge company, incorporated for the purpose of designing, building and erecting bridges and all classes of metallic structures. The facilities at our disposal are such that we have every confidence that we shall be able to give you the advantage of very favorable quotations, and at the same time be enabled to avoid dalys in delivery, which, in the past, have proved so vexatious in many instances. We solicit your inquiries, which shall have our very best attention."

Accompanying this is a list of the various bridge companies forming the consolidation, as follows:

American Bridge Works, Chicago, Ill.
Berlin Iron Bridge compaoy, East Berlin, Conn.
Buffalo Bridge and Iron Works, Buffalo, N. Y.
Carnegie Steel company (Keystone plant), Pittsburg, Pa.
Edge Moor Bridge Works, Wilmington, Del.
Elmira Bridge company, Elmira, N. Y.
Gillette-Herzog Manufacturing compaoy, Minneapolis, Minn.
Groton Bridge and Manufacturing company, Groton, N. Y.
Hilton Bridge Construction company, Albany, N. Y.
Horseheads Bridge company, Horseheads, N. Y.
Lafayette Bridge company, Lafayette, Ind.
Lassig Bridge and Iron Works, Chicago, Ill.
New Jersey Steel and Iron company, Trenton, N. J.
New Columbus Bridge Company, Columbus, Ohio.
Pittsburg Bridge company, Pittsburg, Pa.
A. & P. Roberts company (Pencoyd Iron Works), Pencoyd, Pa.
Post & McCord, Brooklyn, N. Y.
Rochester Bridge and Iron Works, Rochester, N. Y.
Schultz Bridge and Iron Works, Pittsburg, Pa.
Shiffler Bridge and Iron company, Pittsburg, Pa.
Union Bridge company, Athens, Pa.
Milwaukee Bridge company, Milwaukee, Wis.
Wrought Iron Bridge company, Canton, Ohio.
Youngstown Bridge company, Youngstown, Ohio.

This list contains all the leading companies that manufacture bridge and structural work in this country, with the combined capacity of 600,000 tons per annum. The Pencoyd plant of the A. & P. Roberts company also comprises one of the best and most complete rolling mills for structural material in existence, with a capacity of 200,000 tons per annum. This puts the American Bridge company in a position to furnish all classes of bridge and structural work at a minimum of cost and time, and this has already been announced as the future policy of the company. No advance in prices will be made, but the cost of production will be reduced; and, judging from the known facilities of the various plants, the facts would seem to justify the statement.

The directors of the company are as follows: Percival Roberts, Jr., A. & P. Roberts company; Alfred C. Case, Carnegie Steel company; William H. McCord, Post & McCord; Charles M. Jarvis, Berlin Iron Bridge company; William H. Connell, Edge Moor Bridge Works; Walter Hawxhurst, Elmira Bridge company; Charles Macdonald, Union Bridge company; Frank Conger, Groton Bridge company; James P. Kennedy, Youngstown Bridge company; Lewis S. Gillette, Gillette-Herzog Manufacturing company; John F. Alden, Rochester Bridge and Iron Works; Walter G. Oakman, Guarantee Trust company, New York, N. Y.; J. P. Ord, General Electric company, Schenectady, N. Y.; Robert Winsor, Kidder, Peabody & Co., Boston, Mass.; Robert Bacon, J. P. Morgan & Co., New York, N. Y.; Charles Steele, J. P. Morgan & Co., New York, N. Y.; Paul E. De Fere, New York, N. Y.; Robert S. Green, Jersey City, N. J.; J. W. Walker, Shiffler Bridge company; Abram S. Hewitt, Cooper, Hewitt & Co., New York, N. Y.; August Belmont, August Belmont & Co., New York, N. Y.

The majority of the members of this board are practical bridge men, who have in years past made a success of their individual companies. The financial end is unusually strong, being represented by firms and institutions of world-wide financial strength, thus forming a combination of practical and successful bridge men, backed by the strongest of financial resources.

The executive organization is made up entirely of men of large practical experience, headed by Percival Roberts, Jr., one of the leading rolling-mill managers of the country. The Pencoyd plant, already mentioned, has all been developed under his personal supervision and is the result of his energy and ability. Mr. Roberts is thus well fitted to be the head of an enterprise of this kind. Joshua A. Hatfield has been appointed as assistant to the president, and will also have charge of the sales of the rolling-mill products of the Pencoyd plant—a position for which his long connection with the rolling-mill interests of the country makes him especially adapted.

The engineering department is in charge of Charles C. Schneider, formerly chief engineer of the Pencoyd Iron Works, with the title of vice-president in charge of engineering. Mr. Schneider has full charge of all questions of engineering, including the preparation of all plans, estimates and working drawings. All engineers of the company, whether engaged in the contracting, operating or erecting departments, are under the vice-president in charge of engineering. At different localities throughout the country are stationed a corps of designing engineers to prepare preliminary plans and estimates, and at each plant will be located a full and complete corps of engineers and draughtsmen, to prepare plans for the work fabricated at that particular plant.

The operating department is in charge of Charles M. Jarvis, formerly president of the Berlin Iron Bridge company, with the title of vice-president in charge of operating. As soon as contracts for any work are taken, they are immediately turned over to this department for execution, and consequently all the plants and erecting forces of the company belong in this department. At each plant is a manager, with full charge over all employes and the operations of that particular plant. Where a number of plants are closely located, they are placed under one local manager, each plant being equipped with a superintendent. All managers are under the direct charge of a general manager, James P. Kennedy, formerly president of the Youngstown Bridge company, who moves about among the various plants in order to see that all are working in one harmonious whole, and that each has the advantage of the experience of every other plant. The erecting is also in charge of the operating department, and this is under William Wennas as superintendent. Mr. Wennas has had full charge of all the Pencoyd erecting for a number of years, and gained a world-wide reputation but a short time ago for the economical and expeditious manner in which he handled the erection of the famous Atbara bridge.

All the sales of the company are in charge of the contracting department. This is divided into three distinct parts—railway contracting, highway contracting and structural contracting. The railway contracting is in charge of Charles Macdonald, formerly president of the Union Bridge company. The highway contracting is in charge of Frank Conger, formerly president of the Groton Bridge and Manufacturing company, and the structural contracting is in charge of W. H. McCord, formerly of the Post & McCord company. The preparation of all proposals and contracts is in charge of this department. The company has opened contracting offices in different parts of the country, each office reporting daily, by wire, to various members of the contracting department. The contracting department of the American Bridge company is one of the most important, as here are made up the proposals and estimates on all work, and it might almost be said that on the careful judgment and management

of the members of this department depends chiefly the success of the company.

The mechanical department has been made of equal importance with all other departments, and has been placed in charge of James Christie, formerly mechanical engineer of the Pencoyd plant, with the title of vice-president. The mechanical details of all the various plants belong to this department, and the selection of Mr. Christie as the head insures the American Bridge company of mechanical equipment that will guarantee the production of a pound of finished bridge material at the absolute minimum expenditure of power.

The financial department is in charge of William H. Connell, formerly president of the Edge Moor Bridge Works, as treasurer, with F. M. Wyant, formerly general manager of the Wrought Iron Bridge company, and F. H. Schmidt, formerly secretary and treasurer of the Youngstown Bridge company, as assistant treasurers. The auditor of the American Bridge company is Charles C. Price, formerly with the Pencoyd Iron Works.

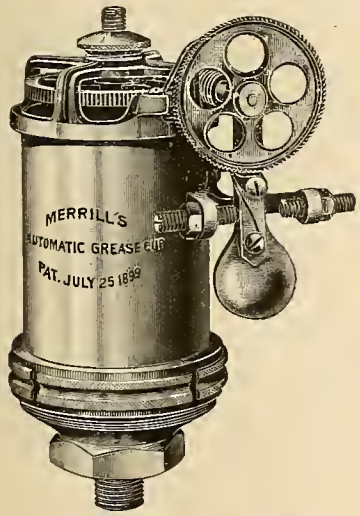
The purchasing department is in charge of Francis W. Heisler, formerly purchasing agent for the Edge Moor Bridge Works, with headquarters at No. 259 South Fourth street, Philadelphia, Pa. The assistant purchasing agent is E. A. Muench, formerly purchasing agent for the A. & P. Roberts company.

The secretary of the company is Douglas O. Morgan, formerly a member of the law firm of Seward, Guthrie & Steele. The general offices are at 100 Broadway, New York, with branch offices in Boston, Philadelphia, Chicago, Pittsburg, Baltimore, New Orleans, Cleveland and Minneapolis.

An Automatic Lubricator.

The lubricator illustrated is to be attached to any reciprocating or oscillating parts of engines or machinery requiring constant and reliable lubrication, as the cross-heads, connecting rods, eccentric straps, etc., of engines, pumps, air compressors, etc. As it feeds grease instead of oil, it may be attached in any position desired. It feeds only when the part to which it is attached is in motion, and no feeding or loss can occur after the motion ceases.

The base of the lubricator is screwed firmly into the part to be lubricated. The body is attached



AN AUTOMATIC LUBRICATOR.

to the base by the union nut or enlarged ring at the bottom. When this is unscrewed the upper part is all taken off together, the barrel is filled with a charge of grease and returned and securely clamped in the position again by the union nut. The feeding is accomplished by the pressure of the piston, and this pressure is applied by the vibrations of the pendulum seen in the front. By the adjustment of the stop-screws at the side, the pawl attached to the pendulum may be made to take from one to six or more teeth of the ratchet wheel for each vibration. On the ratchet-wheel shaft is a worm which meshes into the large worm-wheel at the top. The central screw or spindle is splined and revolves with this wheel, at the same time that it travels downward by the operation of its thread in the central nut which is screwed into the bracket or guide at the top. The feeding goes on if the vibrations continue, until the piston reaches the bottom and the grease is all expelled.

To raise the piston for refilling the barrel, the central nut, which has a milled and notched head, is unscrewed from the bracket, the piston is pulled, the nut is whirled down the screw by hand and screwed tight in its place again. The ratchet feed is fully established, and if at any time it is desirable to feed in an extra quantity of grease, this also may be done by turning the ratchet wheel. The lubricator may be made of any size and for any rate of feed desired. The one here shown will hold about 14 cubic inches, or somewhat less than half a pint of grease. The ratchet wheel has 100 teeth, the spindle wheel has 125 teeth, the central spindle is 24 threads to the inch and the travel of the piston is 3½ inches. If, then, the pendulum is set to take two teeth of the ratchet wheel for each stroke, the number of strokes required to empty the barrel will be (100 ÷ 2) × 125 × 24 × 3.5 = 525,000, and at 200 strokes a minute, the supply would last 2,625 minutes, or, say, 45 hours. Any of the usual kinds of grease may be used in the lubricator and any percentage of pure graphite may be mixed with it. The worm is of steel, the pawls are of steel, hardened, and the wheels are of hard bronze. The lubricator was designed and patented by G. U. Merrill of Paterson, N. J., and is made and sold by James L. Robertson & Sons, 198 Fulton street, New York.

COMMUNICATION.

Steam or Hot-water Heating from Central Stations.

To the Editor of the Western Electrician:

In a recent number of the Western Electrician Mr. Harry J. Frith describes his "ideal system" of central-station heating, the agent being hot water sent out by a complicated system of "exhaust heaters, live-steam heaters and pumps," entailing at the start a large investment at the station and a continual expense to operate in overcoming friction and the static head of the system.

Every invention is subject to improvements, and thus frequently useful methods are perfected, and the public benefited. But sometimes the investigator makes a hobby of his supposed discovery, and his zeal leads him to insist on the adoption of crude and expensive methods, which are far from being an improvement on the original discovery. Years ago Birdsill Holly of Lockport, N. Y., the inventor of direct pumping for the water supply of cities, conceived the idea that steam could be supplied from a central boiler station for heating and power in the same way that gas is distributed for lighting. The plan was found to be feasible and practicable, and now a large number of such plants are being operated successfully in different parts of the country.

The plan of distribution is simple and inexpensive. A single line of pipe leads from the boiler station and radiates to different sections of the territory which it is desired to heat. These pipes are an extension of the boiler, and the boiler pressure is the only force that is required to circulate steam to the extremity of the line.

Since the introduction of electric lighting or electric railways in almost every village and city in the country the managers of many companies have adopted the exhaust-steam heating system in connection with their electrical work. In this case the underground pipe is connected with the exhaust pipe from the engine, and the heating is with the exhaust steam instead of direct steam from the boiler. This utilizes a waste product, and from it the company derives a large revenue, in amount depending on the supply of steam available. The pipes being of proper sizes, only a small amount of back pressure, say, three to five pounds, is brought against the engine. This is not sufficient to impair, to any extent, the efficiency of the engines; in fact, the engineers in such establishments say that the engine runs steadier with its load on account of this steam cushion beyond the piston. Nothing could be more simple and inexpensive in operation. The station equipment is not interfered with beyond the setting of one or two valves, and work goes on the same as before.

Now comes along the plan adopted by Mr. Frith of converting the steam back into water and the circulating of hot water as the heating medium. This is not new, as such experiments were made years ago, and were flat failures. To start with, there must be an expenditure of not less than $5,000 for circulating apparatus, even in a small station. Water is a sluggish element, and will not circulate automatically, as in a house system, so there is a constant expenditure of force to keep up circulation. A pound of steam contains six or seven times as many heat units as a pound of water. The steam circulates automatically and parts with all of its heat at destination, even the condensation is utilized by a system of cooling coils and the water is deprived of its heat before going to the sewer. The water in Mr. Frith's system goes out at 150 degrees to 180 degrees and parts with, say, 30 degrees of its heat, when it must be forced back to the station for reheating. This is made necessary because of the large amount of radiation that would be required at the lower temperature. In any event, two or three times as much radiation is required for hot water as for steam, thus increasing the expense of house fitting. The mere statement of the case ought to convince of the weakness of such a system of circulation. Two pipes are required instead of one, and the return line will be subject to serious deterioration in the course of a very few years.

Mr. Frith's "ideal system" is liable to many adverse contingencies with a few years of experimental work. Does he know what his street-radiation losses are inside his insulating-box construction. Against a loss in properly insulated steam pipes of five per cent. one hot-water authority admits 15 per cent. to 30 per cent. loss. This is not an unreasonable supposition in circulating water at an initial temperature of 180 degrees, through a double line of pipes, and in which, after giving up 30 degrees of heat, it must be returned over and over for reheating. While under the Holly system steam at five pounds' pressure will part with 150 degrees of heat in the building after traversing a mile of pipe, the hot water must make the circuit five times through 10 miles of pipe before it rids itself of 180 degrees of heat. This is why the condensation loss is so great. While it may be physically possible to heat buildings in this way, and give fair satisfaction to customers, yet it may be financially impossible to do the work at a profit.

Does Mr. Frith know what amount of income he is receiving per horsepower of exhaust? As it is not possible to meter the heat from the hot water, how can he detect extravagance in the customer who leaves his doors and windows open while radiation is on, or who heats rooms that he is not paying for? A meter is as necessary in heating as in lighting, otherwise the producer is in the hands of the consumer. What is the rule for sizes of pipe requisite for heating a certain amount of space with water? Or will this be a matter of experiment, as in Toledo, where a large amount of pipe had to be dug up after two or three years, and enlarged? How can he avoid carrying the same pressure in houses as in the water mains, say 60 to 80 pounds, and what would be the result on walls and house furnishings if a break should occur in pipes or radiators?

There are many other points which might be suggested, and which the experimenter will encounter in the course of his experience.

I. H. BABCOCK.

Lockport, N. Y., July 9, 1900.

Electrical Prospects in India.

Mr. William T. Fee, United States Consul at Bombay, reports to the State Department as follows:

"Almost every mail brings me letters from American electric manufacturers and exporters asking for information and the names of agents to handle their productions. I would be glad to furnish these were they to be had in this consulate. In all India, Madras is the only city where electricity is used as a power for street railroads. Bombay's tramways are run by horsepower, and the city is lighted by gas. Electricity is used only in a limited way; in some of the better houses and bungalows and on an occasional fête or holiday, a public park may be lighted by a portable electric plant. The general merchant and dealer is not sufficiently acquainted with electric manufactures to make a successful agent, and, besides, the demand for goods of this line is quite limited.

"Bombay is an immense city, with land and sea shipping equal to the best. It has large commerce and trade and manufacturing interests. Its buildings are said to be the finest in India, and much wealth is centered here. The appalling density of its population and the exorbitant rates of rental must find relief in cheap and rapid electric transit. Electricity as motive power and light must come soon, and I hope our manufacturers and capital seeking new fields of profitable and safe investment will look well to this opportunity.

"The Bombay Tramway, an American company with head office in New York city, some time since applied to the municipality for the privilege of converting its power into electricity. This has not as yet been granted. The municipal commissioner, W. L. Harvey, has declared his intention of giving the city electric lighting, and the matter is now open for bids and offers. Three or four local firms have tendered bids. These firms, I understand, are simply representatives of European capitalists and electric-construction companies. I might further say that India possesses an inexhaustible supply of coal, and, while it is inferior to the Welsh coal, yet it is correspondingly cheaper and considered very good for steam purposes. It sells at this port for from 13 to 16 rupees ($4.25 to $5.25) per ton, according to the quality.

"The cost of transportation of electric supplies and apparatus from our shipping ports to Bombay could be greatly lessened by freighting in sailing vessels around the Cape. This would also avoid Suez Canal tolls, and, by judicious management in shipping, the extra time taken would not be felt. Under the Indian tariff code, a large proportion of an electric plant would enter duty-free. However, the question of tariff would not figure in competition for the contract, as all companies are treated equally.

"I wish to add that I will do all in my power to aid and further American interests, and would impress upon any company wishing to enter upon this field the absolute necessity of sending reliable agents to represent it."

United States Consul Hughes of Coburg reports that an Italian electrician has invented an electric cartridge, which he offers as a substitute for dynamite and smokeless powder in mines, rock blasting, and for heavy ordnance. The composition used in the cartridge is made up of carbonates of potash and chloride of ammonia, the proportion varying according to the use. The discharge is effected by an electric spark, which produces electrolytic effects upon the chemicals. The inventor claims that the cartridges, until subjected to the effect of electricity, are entirely inoffensive and perfectly safe, so that there will be no necessity for isolating the magazines where they are stored.

Municipal Electric Lighting in England.[1]

By A. B. Mountain.

Many present may remember that the Board of Trade proposed in 1895 to issue new regulations for controlling the supply of electricity; the engineers of the various municipalities affected met together, and, by combined efforts, were enabled to persuade the Board of Trade to modify considerably the regulations which were finally issued in 1896.

The engineers who were in consultation while the Board of Trade regulations were under consideration, decided to form this association, feeling that by combination they would be stronger and better able to bring those interested in municipal electricity supply undertakings together for the purpose of interchanging ideas and experiences, and, if necessary, take action to further or protect the interest of the undertakings in their charge. The association at its first meeting had only 24 members who were electrical engineers being permanent officials of municipalities. But since the association was first formed it has grown year by year in the most satisfactory manner. There are now 74 committee and 84 electrical engineer members, three associate members and 57 associates. The work accomplished by the association in the past has, I feel certain, been very much appreciated by the local authorities interested, and although we may with a certain amount of pride look back on past achievements, yet the future work of the association must be of still more importance to all those interested in electricity supply works owned by local authorities.

One of the first subjects discussed by the association was the control of both gas and electricity undertakings for one committee. Now, with very few exceptions, the electricity supply is controlled by a special committee, and, judging by the progress of both departments during the last few years, it would seem conclusive that the healthy competition has been in the interest of both undertakings.

At our first convention two or three corporations had attempted to increase the pressure of supply to consumers, and the pressure usually delivered was 100 or 110 volts; now it is quite unusual to find any three-wire system delivering a supply with a less pressure than 200 or 220 volts; in some cases the declared pressure is 250 volts. It is interesting to think of the enormous saving in copper which this increase in pressure has effected, and the saving of capital has, no doubt, in a great measure assisted the achievement of the magnificent results which have been obtained.

One of the subjects discussed by the association in 1896 was the question of extension to outlying districts. It largely influenced those members who attended our first convention to appreciate the fact that the residential lighting was worth cultivating, and that the best way to obtain it was to extend mains as rapidly as possible to all the outlying residential sections of a town, and I consider the rapid increase in the demand for electricity is largely due to the spirit of enterprise exhibited by municipalities in encouraging a demand, rather than waiting until the demand necessitated the extensions.

The consideration of wiring regulations which would be applicable to the whole of Great Britain was discussed at our first meeting, and has since occupied the time of the association considerably. The rules which have been prepared by the Institution of Electrical Engineers, embodying the views of this association are of very great value. Time has not, however, removed the man who does jerry work; indeed, it seems as if those workmen who are fit for nothing else become infatuated with wiring, and are really the cause of the bad work which is being done in so many towns. One way out of the difficulty would be to organize a system of examination in connection with our association, so that good men with a knowledge of their work could obtain a certificate. This would, I am inclined to think, check the engagement of unqualified men, and if the certificate could be withdrawn upon conclusive evidence of bad workmanship, it would add to its value. I believe this system would be much appreciated by the better class of workmen, and there would be no great difficulty in organizing a system such as that suggested, which would weed out the incapable men. Perhaps, however, some may think it necessary to go further and weed out some of the incapable wiring contractors.

Another subject which has been very freely discussed by the association is the supply of electrical energy for tramways and the advantages of combination over separation. The conclusion of the association was that if municipalities could combine, such combination would tend to reduce the cost of production of energy for both the lighting and traction.

Although it is, perhaps, early to draw conclusions, it is interesting to notice that the cost of production in those works where a combined supply is generated is enormously reduced, and that the committees have in some cases been enabled to materially reduce the price of energy to the consumer of electricity, and although there are three municipalities who, having had the opportunity of combination, have preferred entirely separate works, on the other hand, it is pleasing to find that 45 have accepted the views of the association.

The formation of the defense fund for resisting the patent action brought by Mr. Rucker, against the London Electric Supply corporation for the use of the alternating-current system of electricity supply, is instance of the success of combination. Individual action would almost certainly have resulted in failure.

When we held our first convention there were very few engineers responsible for works, having 50,000 lamps connected to the mains, and the output of very few generators exceeded 300 kilowatts. Owing, however, to the constantly increasing number of lamps connected year after year, it has become necessary to adopt larger units of plant, and now generators having an output of 1,000 kilowatts are quite usual; in fact, in many towns it has been found best to take out generators of small size and replace them with plants of very much greater capacity. This has entailed a large waste of capital, and I am inclined to think that the association might well devote its time to the consideration of the size of plant which should be adopted for new works and extension of existing ones. I would suggest, as a moderate figure, 15 eight-candlepower lamps per head of the population of the area supplied; this would mean that a town having a population of 100,000 would ultimately have approximately 1,500,000 eight-candlepower lamps connected to its electricity works. If we disregard for the moment the energy which will be required for driving motors, tramcars, and for many other purposes, which we should largely depend upon to find employment for our machinery during the daytime, and which would not materially increase our maximum load, we find that to supply energy to these lights, assuming one-third to be in use at the same time, we shall require, including spare plant, not less than 20 1,000-kilowatt generators. This would be an unnecessarily large number of generators, and undoubtedly much more economical results would be obtained by emoloying 10 generators having an output of 2,000 kilowatts each. One can only earnestly hope that when the demand for larger units arises our manufacturers of electrical plant will be in the position to supply thoroughly reliable machinery.

When we consider the probable growth of our works, one is forced to think seriously of the various systems in operation, and endeavor to ascertain the probable alteration or extension which will be necessary to meet the demand for energy in the future. Simplicity is, I think, the important point we should keep in view; it means reduced capital expenditure, reduced works' costs and reliability of supply.

I think the future demand in any town having a population exceeding 75,000 will necessitate the erection of generating works outside the central or densely populated portion of the town, and that such works will, if the town has a continuous current supply, generate alternating current, either single, two or three-phase, which will be converted to continuous current in suitably situated sub-stations. If, however, the town has a single-phase alternating-current system, I think it will have a distinct advantage over its neighbors having continuous current, in the fact that it will have a less complicated system, the capital expenditure upon which should be less, the cost of distribution due to the saving of labor should be lower, and the reliability of the system greater, unless accumulators are employed upon a large scale.

The facts and figures at present obtainable relative to two and three-phase alternating-current systems are not, in my opinion, sufficiently proved to be of much value, and we should watch with the greatest interest the results of some of the systems now being installed. In my opinion, the complications completely outweigh any advantage which two or three-phase systems may have over single-phase, and we must not let our engineering enthusiasm make us forget that we have to put down works for distributing electrical energy suitable for all purposes, at the lowest possible cost to the consumer.

During the last and present year much has been heard upon the subject of municipal trading, and the welfare of our electricity-supply undertakings are largely involved. It would seem, however, that the sins of local authorities are those of omission. When one considers that provisional orders for electric lighting have been granted to above 300 local authorities, and that only about half are beyond the period of consideration, it must be granted that enterprise is being seriously retarded, and that the idea of obtaining an order and then waiting, Micawber-like, for something to turn up, is neither in the interest of the would-be consumers nor the industry, and it can scarcely be surprising to find Parliament considering the granting of powers to companies to supply over large areas, and also contemplating competition.

There are, however, two strong factors impeding electrical enterprise in the areas of small local authorities, both of which are having the attention of the council of this association. The first is that no period being allowed for this construction of works, necessitates an immediate payment of interest on capital and sinking-fund contributions; the second point is, that the period of 25 years allowed for the repayment of capital is unnecessarily short, and increases the annual proportion of the sinking fund. The consequence is that some local authorities anticipating loss by the department during the first year or two, are anxious to avoid the risk of adding a burden to the rates.

I am, of course, aware that this is an excuse and not a solid reason for delaying the commencement of the work for years, and one can scarcely understand why the smaller local authorities who have obtained powers at considerable expense should not have proceeded with the work. Their want of enterprise has, in my opinion, brought into existence the larger companies who propose supplying electricity over extended areas.

A combined effort to alter the present regulations of the Local Government Board and obtain, if possible, a longer period for the repayment of loans, and also a period for construction of works can only be productive of good results, and will certainly enable many councils who are now hesitating to at once put down works and develop the supply of electrical energy for all purposes; it would also have another beneficial result in the fact that it would remove the temptation to reduce the initial capital expenditure by putting in a very small plant unsuitable for the works in a few years' time, but by the employment of which it may be possible to avoid a loss at the commencement.

While one is forced to the conclusion that the want of energy of many of the smaller local authorities is likely to produce unfortunate results, it is a pleasure to review the general progress made by electricity-supply undertaking, and the following figures representing the capital expended upon municipal and companies' works in the United Kingdom are most interesting:

	1895.	1896.	1897.	1898.
Municipal	£1,772,323	£3,392,229	£4,662,909	£6,979,150
Companies	4,335,357	5,370,134	6,338,744	7,996,591

I am sure our consumers will be interested to hear that the average cost of producing the unit of electrical energy, exclusive of capital charges, is being reduced year by year, and in municipal works was during 1898, 2.12 pence per unit, as against 2.7 pence per unit in companies' works, and that the average price obtained by municipalities during the same year was 4.35 pence per unit, as against 5.51 pence per unit obtained by companies. These results must be considered highly satisfactory, and it is interesting to notice the causes of the reduction in the average works' cost. The chief reason for the reduction of costs is due to the reduction in the selling price. This has induced consumers to use more energy per lamps fixed. The second important factor is the more general use of electric motors, which has helped very largely to increase the quantity of energy sold, and has found employment for a portion of our plant during the daytime. The supply of electricity for tramway purposes has also materially assisted the load factor, and has consequently reduced the average cost of production, and as the demand for energy for motive power and tramway purposes is developed, so will the cost of production be reduced.

Another opportunity of improving the load factor seems fairly near realization; that is, the charging of accumulators for motor cars. Tradesmen require something reliable for conveying their commodities to various points usually within a few miles of their premises, and do not require to cover more than about 20 miles per day; for these purposes the electric-motor car is most suitable, and the fact that its propelling machinery has no reciprocating parts should add to its reliability and reduce repairs, and if municipalities will arrange charging stations in convenient positions, such cars should be speedily adopted, and if the charging is done during the night and early morning, the energy used could be supplied at an exceedingly low price, and would still further reduce the average cost of production.

In Edinburgh, and in other places, motor cars are running in competition with tramways, and one is bound to consider what competition will mean. Motor cars running upon the ordinary road escape the heavy expenditure required for the permanent way of an electric or steam system of tramways, and consequently in a distriet having a scattered population unable to support a frequent service of cars, would have an immense advantage, in the fact that the capital charges would be very much reduced. This is, in my opinion, an extremely important point, as the financial charges upon a tramway undertaking frequently represent from 25 to 40 per cent. of the total expenses, and it is not at all unusual to find this important item neglected when the cost per car-mile is being discussed.

The last subject I will mention is the municipalization of the telephone system. The association and the council have devoted considerable time to the consideration of this subject, and now that Parliament has granted powers to local authorities to municipalize the local system, there should be an immediate effort made to make the telephone more popular; this can, I think, only be done successfully by the local authorities, who cannot help being keenly interested in anything which aids or adds to the convenience of its residents. They would undoubtedly be able to give a more efficient and cheaper service than that at present in existence.

It is sincerely to be hoped that corporations will assist the Postoffice to develop the service, and will not be either dismayed or delayed by the difficulties which may appear, and which will vanish as soon as a few corporations have their systems in operation.

The Princeton (Ind.) Light and Power company has increased its capital stock to $75,000.

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1. Abstract of presidential address before the Municipal Electrical association of Great Britain on June 20, 1900. Mr. Mountain is the borough electrical engineer of Huddersfield.

Electrical Development in Italy.

The Western Electrician has on several occasions called the attention of American manufacturers to the great opportunities offered to them by the steadily growing electrical development of Italy. This development continues unabated, and has naturally caused increased imports of the requisite plant and the creation, in the country itself, of new manufacturig enterprises. As mentioned in former articles, this plant comes chiefly from Germany and Switzerland, and foreign capital from these two countries enters largely into the companies which have been formed under Italian names for its production and application in Italy.

A New York company is now about to establish in Milan a factory for the purpose of producing the material required for electric traction on railways and tramways, which has hitherto nearly all been imported.

A new industry which has now assumed considerable importance in Italy is the manufacture of carbide of calcium, which is used chiefly for making acetylene gas.

At the Edison works at Paderno a force of some 13,000 horsepower is now derived from the River Adda and employed for producing electricity, which is carried by overhead cable to Monza and Milan. Another enterprise of a similar nature, but on a larger scale, is now on the eve of completion. The Societa Lombardia per Distribuzione di Energia Elettrica, a company formed in 1897 with a capital of $1,600,000, recently increased to $2,000,000, obtained a concession from the government on the River Ticino, at Vizzola, some miles below its issue from Lake Maggiore, and immediately set about constructing works for the development of water-power of no less than 20,000 horsepower (theoretical), which will give 10,000 effective horsepower of electric energy for industrial purposes, after making full allowance for loss in transmission. Since the works were began the sanction of the government has been obtained to a project for the construction of a movable dam across the river, some distance higher up, which would enable the company to increase its volume of water, and allow utilization during all seasons of the year. The theoretical hydraulic power would then be 24,000 and the effective electric energy 12,000 horsepower. This dam has not yet been commenced, but the works have been constructed on the basis of the larger supply of water. For the present seven turbines of 2,000 and two of 220 horsepower each have been put up. There are seven generating dynamos, three-phase, alternating current, of a capacity of 1,650 kilowatts at a tension of 11,000 volts and two exciters, continuous current, of a capacity of 145 kilowatts at a tension of 110 volts. Five of the larger, as well as the two smaller turbines have been made in Milan by Riva Monneret & Co., the same firm which made the seven turbines of 2,160 horsepower each now working at Paderno for the Edison company. The other two came from Germany. The dynamos and all the other electrical plant have been supplied from Germany.

It was originally intended to bring all this electric energy into Milan, a distance of 25 miles, but the whole of it has now been disposed of in and about the manufacturing towns of Gallarate, Busto Arsizio, Legnano and Sarsuno, which lie between Vizzola and Milan, a district which already, for the cotton industry alone, uses steam to the extent of 10,000 horsepower. The price varies according to the importance of the supply required, but the average at which the whole of the power has been contracted for is $20.50 a kilowatt per annum for use during 12 hours a day. Firms working 24 hours a day only pay a very slight increase. The electric current will be transmitted by overhead cables, separate cables being employed for what is required for public-lighting purposes.

This enterprise is said to be the most important of its kind in Europe. The plans are due to the initiative of Italian engineers, and were made as far back as 1887, but their execution must be attributed in a large measure to the assistance of a German firm, which has subscribed a considerable part of the capital of the company.

There is, to a certain degree, an unwillingness on the part of the government to grant new concessions of waterpower on rivers and canals to private enterprise and speculators. All demands for such concessions are now submitted to a commission specially appointed to consider them, on which the railway companies are represented, and in every case where it is at all likely that a particular waterpower may eventually be required by the state, the demands are refused. The railways are nearly all owned by the government, and are only leased to the companies actually working them.

The experiment in electric traction on railways which the Western Electrician described last year as being made by the Mediterranean Railway company on its line from Milan to Monza, with accumulators, revealed certain serious defects, which necessitated some considerable changes and a partial and temporary suspension of the service. It is, however, conjectured that the modifications now in course of application will be efficacious, and that the system of accumulators may prove to be best adapted to short-distance journeys. This company is now about to try an experiment on a much larger scale on its line from Milan to Gallarate, and thence to Varese, Lavens and Arona, about 73 miles of rail. The power for producing electricity will be obtained from the River Ticino, at Tornavento, where the necessary works are to be commenced immediately. The system to be adopted is that of the third rail, which is already working satisfactorily in the United States, but over much shorter distances. The electric current will be transmitted to the third rail at a tension of 600 volts. The electrical apparatus required for the trains has already been ordered, and is to be delivered in April next year. The carriages themselves will be built at the Mediterranean Railway company's own works. Contemporaneously, the Adriatic Railway company will apply the trolley system on its line from Lecco to Chiavenna and Sondrio, 66 miles of rail. The hydraulic power will be derived from the River Adda, near Morbegno, and the overhead wire will be supplied with a current at a tension of 3,000 volts. In this case the electrical machinery has been ordered from a Hungarian firm, and is to be delivered at about the same time as that for the Mediterranean company.

CORRESPONDENCE.

London Letter.

London, June 25.—Your correspondent was in Plymouth this week and heard that 14 new cars, which are to be added to the service in that town, are equipped after the style of the Westinghouse exhibit at the Tramways Exhibition.

Electric lights are now being used in the Lancashire coal mines.

At last the system of wireless telegraphy has been put to use in London. The Fire Brigade street station on the top of Sheatham Hill has been placed in communication with the fire-escape station in Mitcham Lane. A fire call received at the first-named station will be at once transmitted to the latter, and at the same time ring the bells in the sleeping quarters there. The Postoffice authorities, too, are conducting a series of experiments in wireless telegraphy between the Skerries Island and Anglesey.

It is hoped that the Central London railway will be opened for public traffic on July 2d. The occasion will be interesting for the early passengers, inasmuch as they will have the opportunity of using the carriage which the Prince of Wales has used before them. The prince has promised to open the line on Wednesday next. The lord mayor, the sheriff, the city members and other London worthies have been invited to join in the trip.

A committee of the House of Commons has declared proved the preamble of a bill incorporating a company for the supply of electricity in bulk over an area of 18 square miles, extending from Hornsey to St. Albans, on the one hand, and from Harrow to Chingford on the other, to local authorities for railway and lighting purposes and to manufacturers and traders for the various requirements of their businesses.

London to Gravesend in one hour and 40 minutes—by telephone. The telephone subscriber who paid the Postoffice threepence for this communication and might almost have ridden the distance in the time was no worse off than hundreds of others. Within one week over 700 complaints of delay in the use of the government telephone trunk lines have been received by the National Telephone company. These complaints referred to delays ranging from half an hour to two hours and to localities over the whole of Great Britain. For instance, it took two hours and six minutes to obtain an answer between London and Manchester to the question, "Are you there?" Between Edinburgh and Glasgow one hour and 30 minutes was spent in making connections. From Bolton to Bury, a 20 minutes' railway journey, 54 minutes were exhausted to say "Hello," and from Birmingham to Wolverhampton exactly one hour.

The premises of Siemens Brothers & Co., the electrical engineers of Woolwich, were the scene of a disastrous fire on Saturday afternoon. Bursting out in the T block, a building 120 feet long and 30 feet wide, used as a rubber-curing shop, the flames spread to the V block, which is a three-floored structure of similar dimensions, used as a wire-covering shop. The first building was practically destroyed; the second was badly damaged, and the other premises were only saved from destruction by very hard work on the part of a big force of firemen. W. H. B.

New York Notes.

New York, July 7.—Although the work of construction of the underground railroad has been going on now in eight or 10 places for many weeks, it has progressed so quietly that only those living in the immediate vicinity of the work have been aware of it. A good illustration of the smoothness with which it has so far proceeded is in the case of the lowering of the sewer in Bleecker street. This work was completed about 10 days ago—the first completed work of the big undertaking, by the way—and it was so well mapped out and executed that although the great ditch for the sewer had to be dug across Broadway, the immense traffic in that thoroughfare was not interfered with for a moment. The Rapid Transit commissioners and the contractor and his financial backers hardly expect to escape so easily, however, when the big work gets into motion all over the city. This will be in August, by which time the American Bridge company will begin to deliver to John B. McDonald, the contractor, thousands of tons of structural steel a month. Then the work of excavation will begin in earnest, and the streets soon will present the appearance of a field plowed by some monster meteor. Then the "adjacent property owner" will rise in his might and protest that his business or his health is being undermined, and the troubles of those in charge of the Rapid Transit work will be at hand.

Residents of Newport and Narragansett will not be allowed to transport automobiles operated by gasoline on American ferry boats. Supervising Inspector-general Dumont has decided that automobiles operated by gasoline engines cannot be carried by freight or passenger steamships. This decision was made upon inquiry by the Jamestown and Newport Ferry company. Mr. Dumont decides that Section 4,472 of the Revised Statutes absolutely prohibits the ferriage of naphtha, benzine, etc., under any circumstances, on either freight or passenger steamships, which includes ferryboats, and therefore would prohibit gasoline automobiles when their tanks are supplied with gasoline.

From Newburg, N. Y., word comes that Judge Betts of Kingston has appointed William H. Pouch, secretary and treasurer of the Newburg Electric Railway, as receiver of the company. The third mortgage bondholders, representing $75,000 of the $350,000 bonded indebtedness, are foreclosing the mortgage. The company has not been doing a paying business. It was reorganized in 1897 and has about 15 miles of tracks extending around the city and to Orange Lake and Walden. The Hamilton Trust company, as trustees for the bond holders, brings the suit.

The Union County (N. J.) Board of Freeholders granted last evening to Senator John Kean the right to operate his trolley line between Elizabeth and Cranford after Westfield avenue has been widened from 60 to 100 feet. The county exacts that Kean pay $73,000 to the property holders whose property will be taken between Elizabeth and Cranford, and demands that he pay to the county in installments the cost of widening the street. Senator Kean agrees to do this.

Fire-chief Croker has a new steam automobile which is said to be capable of remarkable speed, and some quick runs have been made to distant fires. The steam pressure carried is 250 pounds. The vehicle weighs about 800 pounds.

Conferences of leading steel and iron men of the country are being held at the office of the Federal Steel company, No. 71 Broadway, with a view to forming a pool to fix prices on a permanent basis and rescue the steel trade from the demoralization into which it has fallen since John W. Gates made his attack on values in Wall street last spring. The conferences have been attended by representatives of the Federal Steel, American Steel and Wire, American Steel Hoop, the Carnegie, the National Steel, Lackawanna Steel, Maryland Steel and Republic Steel companies. Charles M. Schwab, president of the Carnegie Steel company, was among the men on hand. It is the intention of the pool to make a further cut in Bessemer steel and pig iron, but there will be no further cut in steel rails. The steel men believe that they will be able to maintain the new schedules permanently. This action, it is believed, will serve to bring in orders that have been waiting for further breaks in prices, and result in a revival of business. M. L. G.

From the Buckeye State.

Columbus, Ohio, July 7.—The Columbus City Council came to its senses last Monday evening and voted to reconsider the motion by which the Columbus, Mt. Sterling and Chillicothe Railway company was defeated in its purpose to come into the city at a previous meeting. The wrath of the people had been called down on the heads of the councilmen and they were in a hurry to correct the mistake they had made. As an excuse for the action, the members who voted against the measure before said that the officials of the proposed line had agreed to abide by the decision of the chief engineer in regard to grade crossings, and that there were now no grounds for objections. Bids will be advertised now and the road will come in as others have been allowed to do.

Work on the Dayton, Springfield and Urbana road has been suspended temporarily because of the complaint of certain property owners. Cars ran to Springfield last Saturday for the first time.

The municipal light plant in Columbus has shut down according to orders from Director Kauffman. It is said that the City Council will take the matter up and appoint trustees to operate the plant. The matter has caused a great deal of trouble and not a little very uncomplimentary talk concerning Director Kauffman. He alleges that he has no authority to operate the plant and create a deficiency in the treasury. It seems that the appropriation was not sufficient to pay for the contract lights and operate the plant both, although several circuits of lamps which have been operated by the municipal

plant have been switched to the contract plan and will have to be paid for. It is believed that the City Council will provide some means by which the plant can be put in operation again.

R. H. Black has been at work for the past few weeks getting the right-of-way for an electric road from Elmore east to Oak Harbor and Port Clinton and from the same point south to Bradner and Fostoria. There is plenty of capital back of the enterprise and it will become part of the great electric-railway system of northern Ohio.

Word comes from Toledo that work on the new Toledo, Fremont and Norwalk road is progressing rapidly. The poles are now being put up and wires stretched.

Great improvements are being made on the Millcreek Valley electric road at Cincinnati. New roadbed, new rails and new power station are a part of the improvements now being made. Twenty new center-aisle cars have been ordered for the road.

The Zanesville Street Railway company has inaugurated the plan of awarding prizes to the motormen and conductors who have had no accidents every six months. In this way the company expects to make its men careful and at the same time avoid accidents and consequent lawsuits.

The Mahoning Valley Electric Railway company has made application for a franchise through Trumbull County from Tibbets' Corners to Warren.

W. T. Hurlburt, receiver for the Niles Electric company, has brought suit against a number of shareholders who have not paid in full on stock to collect the balance.

The Cincinnati Street Railway company is testing the storage battery at its Chester Park power house. If the test is successful storage batteries will be installed in both power houses of the company.

Kerr, Fox & Co. have received the contract for the stonework of the bridge to be built across Big Sandy River by the Ohio Valley Electric Railway company. It is thought that the railway will be completed within the next month or two.

The Findlay Street Railway company's line from Findlay to Mortimer Station on the Nickel Plate Railway has been completed and the first cars went over the line Saturday. This gives the town a connection with that line of railroad, which was badly needed. It is the plan to have coupons attached to the railroad tickets so that passengers may be transferred from one to the other and make through trips in that way with one ticket. This will be something rather novel in electric-railroad business in this state, as it is not often that the trolley companies make business arrangements of that kind with the regular railroad lines. In this case it will be of advantage to both to do so, since the Nickel Plate can reach Findlay in no other way. O. M. C.

Northwestern Notations.

Minneapolis, July 6.—The Electric Light company of Carroll, Iowa, proposes to invest $15,000 in a hot-water heating system in connection with its power station.

The Albert Lea (Minn.) Electric company contemplates laying mains and furnishing heat for business blocks by means of a hot-water heating system.

The General Electric company has brought suit at Seattle, Wash., against D. T. and John B. Denny and 37 other persons, to secure the collection of $6,269 alleged to be due on a promissory note. The defendants were stockholders of the Rainier Power and Electric company. The notes were given in payment of supplies for the Rainier company.

W. H. Morse, deputy county clerk at Billings, Mont., has invented and secured a patent for a bracket for electric lamps. It consists of an arm or holder made to receive the base of an electric bulb. The end of the arm has a turned end which fits a slot to be fastened to the wall or other convenient surface. The light can then be placed in any desired position. In addition there is a spring clamp which can be used to attach the lamp to a dresser, head of bed, or almost anything.

The street railway company of Winona, Minn., is fitting its cars with fenders.

The Gas and Electric company of Fargo, N. D., has applied for an injunction to restrain the Fargo Edison company from erecting electric-light poles in close proximity to its own poles. The plaintiff company alleges that the poles and wires will interfere with its own current.

The Albert Lea and Geneva Railway company has been incorporated at Albert Lea, Minn., to build an electric line to Geneva. The construction of the line depends upon the reception which the project is given by the people of Albert Lea, according to the statement of those behind the plan. If they will offer inducements it will be built. The power house will be located at Geneva. The line complete will cost about $250,000.

Horace Nichols, formerly superintendent of the electric-light plant at Waterloo, Iowa, died at Independence, Iowa, recently.

The Grand Forks (N. D.) Gas and Electric company has completed a circuit to supply the city with a direct current. When the new boilers and dynamos are in place the changes will be completed. A steam-heating plant to furnish heat for buildings in the vicinity by means of street mains will be operated in connection with the power plant.

The new engine and dynamo for the Fond du Lac (Wis.) Street Railway and Electric Light company have been set in place and put in operation. The plant has been rearranged and improved generally. The electric lighting and power service is also improved.

The Lac du Bonnet company of Winnipeg, Man., proposes to have a stock company formed to develop the power at Lac du Bonnet Falls and transmit electrically to Winnipeg. As the distance is but a few miles from the city it could be easily done.

The Keokuk (Iowa) Electric Railway and Power company has been incorporated by J. C. Hubinger, with $300,000 capital stock.

The council of Little Falls, Minn., is considering an appeal from the decision of the United States Circuit Court to the Supreme Court, in the matter of the Electric Light and Water company's franchise and contract for 30 years. The city contended that it was an unreasonable length of time and a council had not the power to bind posterity for such a length of time. The Circuit Court has just held that the action was valid.

Lightning entered the feed wires of the auxiliary power station of the Edison Electric company at Appleton, Wis., and burned out an armature. Since the destruction by fire of the main power house, this auxiliary station has furnished power for the street railway. This accident suspended power for a few days until a new armature could be secured.

The Madison (Wis.) Gas and Electric company will institute a system of profit-sharing with its employes next fall. It proposes to pay them the same percentage paid on its stock, the annual salary of each being considered as so much stock. The McMillin syndicate of New York owns the plant.

The Tribune of Great Falls, Mont., has been conducting a warfare against the electric-light company on account of the rates charged. At the meeting of June 18th the Tribune presented a communication to the council asking that the company be requested to make concessions in its charges. The paper pledged itself, if the company refused to concede something from its prices, to appear before the council and apply for a franchise to put in a competing plant. If granted, the plant would be installed and lower rates would prevail. The council at once notified the electric-light company of the communication and requested an answer to the appeal for reduced rates.

The council of New Whatcom, Wash., contemplates buying the Whatcom Falls mill and power for $40,000. It is the ultimate intention to establish a municipal electric-light plant. The present owners of the mill get power from Whatcom Creek, the outlet of Lake Whatcom, from whence the city secures its city water. The mill company has secured a restrainng order from the Superior Court to prevent the city from drawing water from the lake, on the ground that it has affected the power. The purchase of the power would settle the suit. But there are a good many citizens who claim that the falls can be condemned much more cheaply than $40,000, the price agreed upon for the purchase of the site. R.

Canadian Intelligence.

Ottawa, Ont., July 6.—The town of Brockville, Ont., has made an offer to the Brockville Light and Power company to purchase the plant of the company for $85,000. The company has accepted, and a by-law authorizing the raising of money by debentures to make the purchase will be submitted to the rate-payers.

The new electric-railway service between the city of Quebec and La Bonne Ste. Anne has been established between the city and Montmorency Falls. The cars are models of comfort, and an hourly service is promised. In the trial trip, the nine-mile run to the falls was made in 13 minutes.

The cable to connect the island of Belle Isle with the telegraph system of Canada will arrive at Quebec within a few weeks. The government steamer Newfield will at once go down the gulf in order to lay the cable, which will be carried across to a point on the north shore known as Pointe aux Esquimaux, and from thence, along the shore westerly, to Quebec. The government is now building the land line. In the month of September next, for the first time in its history, that terror to shipping, Belle Isle, will be in instantaneous communication with the world.

The Quebec government has just concluded the sale, to American capitalists, of two valuable waterpowers at Lake St. John for the sum of $15,000. The purchasers bind themselves to expend, within four years, the sum of $4,000,000 upon the erection of pulp and paper mills, power plant, etc., on the spot. The waterpowers sold are on the "Grande Descharge" of the lake.

Messrs. James Kent and B. S. Jenkins of the Canadian Pacific telegraph have completed a tour of inspection covering the whole line to the western coast, and including an examination of the British Columbia system throughout the Kootenay and along to Victoria. "When this season's work is finished," states Mr. Kent, "we will have a new line between Laggan and Fort William. We have been doing so many miles each year, and now we have completed that distance, besides accomplishing several hundred miles of renewals on the Pacific division. Additional wire facilities, to the extent of 1,000 miles, will be provided this year."

At the annual meeting of the Ottawa Electric Light company the old board of directors was re-elected. The members are Messrs. Thomas Ahearn, J. W. McRae, F. P. Bronson, D. Murphy, Hon. E. H. Bronson and Senator Clemow. Mr. Ahearn is president and Mr. McRae managing director. The annual report showed that, so far as the business for the year was concerned, it was in every respect satisfactory. The company, however, was a heavy loser in the recent fire, owing to which the dividend due on April 30th last was not paid. The company has now installed 87,114 incandescent lights, 644 arc lights, 163 motors and 23 heaters, all distributed among 4,357 customers. During the year there was installed an electric storage battery of 250 cells, which is employed as an auxiliary to the motor service.

The council for the town of Cannington, Ont., will submit a by-law to the ratepayers of the town for the purpose of effecting a loan with which to establish an electric-lighting plant to be owned and operated by the municipality.

The Cataract Power company of Hamilton, Ont., has installed two new generators in its power house at Decew Falls. By the additional plant thus provided the company will furnish the city with 6,000 horsepower.

The sub-station of the Lachine Rapids Hydraulic company, at the corner of St. Thomas and McCord streets, Montreal, has been destroyed by fire. The fire is said to have originated in a defective switch, and in a very short time the entire plant, which distributed the power received from the Lachine rapids to the various parts of the city, was completely destroyed. The loss will be about $30,000.

Some time ago the city engineer of Toronto was instructed to prepare an estimate of the cost of constructing buildings and all the necessary plant for the distribution of electric energy in that city. He states that the buildings and plant will cost $950,000, and the cost of installing an arc-lighting plant, with a capacity of 1,350 lamps, will be $300,000. If the wires were placed underground in the central portion of the city, the cost will be about $510,000. The annual cost of operating the plant with overhead wires will come to about $63 a lamp per annum, or about 17.2 cents a night.

Mr. George Johnson of Ottawa, the Dominion statistician, has compiled some interesting figures about the electric railways of Canada. During the year ended on December 31, 1899, the 632 miles of track were so used that the total number of miles run by cars was 26,646,847. The number of passengers carried was 104,033,659. Compared with the previous year, the number of passengers carried increased nearly 9,500,000, and the number of miles run by over a million. The amount of paid-up capital invested in electric railways in the Dominion is $21,700,000. The electric cars traveled over four million more miles than the passenger and mixed trains of the steam railways. Together the steam and electric railways carried over 120,000,000 passengers, and the proportion was about 13 by steam to 87 by the electric railways.

The ratepayers of Sault Ste. Marie, Ont., have adopted a by-law granting exemption from taxation and certain other concessions to the Lake Superior Power company, in return for which the company agrees to construct additional works, at a cost of $2,000,000, such works to include an additional waterpower canal, a railroad, railway station, wharves and docks, and the building of a street railway.

The Ottawa Electric Railway company has completed arrangements for the rebuilding of its power house, destroyed by the fire. The work of construction on this building will be rushed to a speedy conclusion. The power house will be an exact duplicate of the fireproof building at present in use, and will cost $150,000. An order has been placed with the Westinghouse company of Pittsburg, Pa., for a 2,000-horsepower generator. The machinery will be driven by four very large, directly-connected waterwheels. The building will be constructed with a view to solidity, and the furnishing of power for a completely up-to-date service. A. V. W.

PERSONAL.

George H. Godfrey recently began his fortieth consecutive year as manager of the Western Union telegraph office at New Albany, Ind., and his forty-fifth year as manager for that company.

Dr. Oliver J. Lodge, the well-known English physicist, has been appointed principal of the new University of Birmingham. Dr. Lodge, who has been professor of experimental physics at the University College, Liverpool, has accepted the place.

The directors of Purdue University have elected Dr. Winthrop E. Stone president of the university, to succeed Dr. James H. Smart. Dr. Stone has been vice-president of the university and has served as president since Dr. Smart's death. The board also made William F. M. Goss dean of the school of engineers.

ELECTRIC LIGHTING.

A municipal lighting plant has been voted at Hedrick, Iowa.

Benjamin Strong is building an electric-light plant at Woodhull, Ill.

The Dutchess Light, Heat and Power company of Rhinebeck, N. Y., has been incorporated, with $20,-

000 capital stock, by G. N. Miller, T. A. Traver and F. Herrick of Rhinebeck.

Wellington, Kan., has sold $14,000 bonds for building an electric-light plant.

The voters of the city of Neoga, Ill., have decided to put in an electric-light plant.

Celina, Ohio, is floating bonds for a $25,000 electric-light plant. R. Le Blond is clerk.

The Galena, Ill., City Council has voted to advertise for bids for a city lighting plant.

The city of Port Gibson, Miss., will issue $12,000 bonds to improve its electric-light system.

The council at Columbus, Ind., has decided to spend $25,000 building a new power house.

The Ashland (Ill.) City Council will soon let a contract for erecting an electric-light plant.

The Deming (N. M.) Ice and Cold Storage company is to put in an electric-light plant.

Coffeyville, Kan., will vote on the question of issuing $20,000 in bonds for a lighting plant.

Macey & Hancock will soon erect an electric-light plant at Adel, Iowa, if reports are true.

The city clerk of Riverside, Cal., asks bids, until July 17th, for the proposed municipal light plant.

The special election at River Falls, Wis., resulted in favor of the issuance of bonds for an electric-light plant.

The town of Elsinore, Cal., contemplates the purchase of an electric-lighting plant. J. D. Hoff may be addressed.

The Atlanta (Ga.) Railway company has an ordinance before the council allowing it to supply heat, light and power.

County supervisors at Marshalltown, Iowa, have decided to erect an electric-light plant to light all the county buildings.

The Vanceburg (Ky.) Light and Power company has been incorporated, with $5,500 capital, by J. W. Mathewson and W. A. Hodge.

The city of Lawrenceburg, Ind., will receive bids, until August 1st, for the erection of an electric-light plant. J. F. Frazer is clerk.

An election will be held July 21st at Kirkwood, Mo., to vote on the question of issuing $17,000 bonds to build an electric-light plant.

Hall & George of Strakville, Miss., have the contract for the engineering work in the erection of the electric-light plant at Clayton, Ala.

The Masontown (Pa.) Electric Light, Heat and Power company has been incorporated, with $10,000 capital, by C. K. Hartley and W. O. Blackshore.

The executive committee of the reorganized public lighting commission will recommend extensive improvements to the city lighting plant of Detroit.

Tiffin, Ohio (J. B. Ehrenfried, clerk), asks bids until July 30th for furnishing and maintaining 160 2,000-candlepower and 250 1,200-candlepower arc lights.

The Lebanon County Electric Light, Heat and Power company of Lebanon, Pa., with $25,000 capital, has been incorporated by B. D. Coleman, Ed R. Coleman, A. Brock and H. Brock.

The General Construction company has been organized at New Albany, Ind., to build electric-light, street-railway and waterworks plant, by H. M. Geiger, T. W. Perry and W. Watson.

The city of Massillon, Ohio, asks for bids, until July 27th, for installing one 150-horsepower engine direct-connected to a 100-kilowatt generator and a 350-horsepower water-tube boiler. S. J. McMahon is president of the board of trustees.

The Purcell (I. T.) Electric company, with $20,000 capital stock, has been granted a charter. This company proposes to supply Purcell and Lexington with light and power. The directors are L. C. Wantland, O. J. Nichols and W. G. Blanchard.

The Richmond County (N. Y.) Power company has been incorporated, with a capital stock of $500,000. The directors are General S. Thomas and W. E. Findley of New York city, M. L. Ryan of New Brighton and F. T. Lewis, A. B. Proal and N. P. Findley of West New Brighton.

The St. Lawrence International Electric company, an electric-lighting company recently formed at Alexandria Bay, N. Y., has been reorganized, its capital stock being increased from $20,000 to $30,000. The company has secured a contract to light the village of Alexandria Bay for five years. The lighting capacity of the plant will be increased at once to 6,000 lights, giving a total of 8,500 lights, and cables will be laid to the Thousand Islands in the vicinity of the place.

ELECTRIC RAILWAYS.

The Rockford, Beloit and Janesville Railroad company has been incorporated, with $20,000 capital stock.

T. Meyr and A. H. Smith of St. Louis are interested in the St. Louis and Illinois electric railway, which is applying for franchises on several St. Louis streets.

Preliminary arrangements have been completed for the proposed electric railway between Ft. Worth and Dallas, Texas. H. C. Edrington is interested.

J. E. Sawyer of Pontiac, Mich., is now working on securing franchise for the extension of the proposed Pontiac and Flint street railway from Flint to Saginaw.

The council of Rushville, Ind., has granted a 35-year franchise to the Indianapolis, Morristown and Rushville Traction company. The power house is to be at Rushville.

The York County Traction company has been incorporated in New Jersey by Frank R. Hansell, William Eidell and George Martin of Camden. The capital is $1,500,000.

J. Smith Butrum of Decatur, R. B. Hennigh of Prairie Home and R. H. Woodward of Macon, Ill., are the incorporators of a new company which is to build lines near Macon.

The application for the appointment of a receiver for the Chicago Consolidated Traction company by Sutro Bros. of New York will be considered by Judge Gibbons on July 18th.

The McCloud River Electrical Power company, Redding, Cal., has been granted a franchise by county commissioners to build an electric road between Redding and Copper City, 30 miles.

The Queen City Railway company, Sioux Falls, S. D., has been incorporated, with $1,000,000 capital, to construct a street-railway system. C. M. Harrison, G. Sclosser and P. F. Sherman are interested.

The Albert Lea and Geneva Railway company has been organized in Minnesota to construct an electric railway between Albert Lea and Geneva. G. L. Carrington and L. P. Lawson of Geneva are interested.

The Chicago, River Forest and Western Railway company, with $50,000 capital, has been incorporated by S. Spaulding, R. L. Davis, W. A. Rawson and A. Petterson, to construct a road to Melrose Park.

The Aurora, Wheaton and Chicago Railway company is seeking franchises to connect with the Metropolitan West Side elevated railway of Chicago. The former company has already secured right-of-way through Maywood.

The Chicago and Milwaukee Electric Railway company has long been hindered in its construction by failure to secure right-of-way through Kenosha. The Kenosha council has at last passed an ordinance, and the gap in the road is finally to be closed.

At the meeting of the Chicago City Council on July 9th the council chamber was literally "snowed under" with petitions from North Side property holders and business men asking the substitution of the trolley for the cable on North Clark and Wells streets.

The Detroit, Oxford, Lapeer and North Branch Railway company has been organized in Michigan, with R. G. Hart of Lapeer as president and treasurer, P. R. Curry of Rochester, vice-president and general manager. The general offices will be located at Lapeer.

The stockholders of the Metropolitan Street Railway company of Kansas City will hold a meeting on August 6th for the purpose of raising $2,800,000 for the change of motive power from cable to electric and for the construction of new lines and extensions of old ones recently authorized by council.

The Indianapolis, Greenwood and Franklin Electric Railway company and the Indianapolis Board of Public Works have agreed on a franchise which is to be a model for all the interurban lines reaching that city. The principal stipulations of the interurban franchise are: Five-cent cash fares in the city; six tickets for a quarter; 25 for $1. The companies may haul a limited amount of freight and express, but may haul nothing that might be offensive. No freight or express packages may be delivered except at the depots of the companies. The companies must pay $50 for each passenger car entering the city, $25 for each freight, express or baggage car, these amounts to be an annual tax based on the average number of cars entering the city; at the end of five years the city may increase these rates to not more than $250 for passenger and $125 for other cars.

The Board of Railroad Commissioners of Massachusetts has granted the petition of the Boston Elevated Railway company for the additional issue of capital stock to the amount of $9,500,000, the proceeds of the sale of the stock to be applied only as follows: $3,100,000 shall be applied to construction and equipment of the elevated structure of the railway, including foundations, tracks and electric system; $1,200,000 to payment of equipment of terminal and other stations, exclusive of lands; $50,000 for equipment of subway; $1,100,000 for equipment of power houses, exclusive of lands; $600,000 for rolling stock and the equipment of same; $300,000 for engineering and miscellaneous expenses, incurred during the construction of railway; $3,150,000 for real estate and to the payment of damages occasioned by the construction of the railway, including the amount of the second deposit of $200,000 required to be made to the treasurer of the commonwealth.

PUBLICATIONS.

The American Electrical Works, Providence, R. I., sent its friends a happily worded and tastefully arranged reminder of July 4th.

The Electric Vehicle company of New York illustrates 20 different types of electric and gasoline automobiles in a tasteful catalogue just issued.

"A List of Plants Now Operating Wood Apparatus" is the title of a booklet published by the Fort Wayne Electric Works, Fort Wayne, Ind. The character of the publication is indicated by the title, and the list is a long one.

ELECTRICAL SECURITIES.

The directors of the General Electric company have issued notices for a special meeting of the stockholders of the company to be held on Tuesday, July 17th, for the purpose of voting on a proposition to increase the capital stock of the company by $4,415,000. This proposed new issue of stock is for the purpose of paying off $5,298,000 in debenture bonds. These bonds are a part of a $10,000,000 issue of 1892, all of which was sold, with the agreement that the holders might at any time exchange the bonds for common stock at the rate of $100 in stock (par value) for every $120 in bonds. Of the $10,000,000 bond issue the company has purchased and canceled already $4,702,000, leaving outstanding at the present time $5,298,000, which latter amount it is intended to cancel by issuing stock.

SOCIETIES AND SCHOOLS.

At the annual meeting of the British Institute of Mechanical Engineers in London on June 27th about 70 members of the American society were present. President C. H. Morgan of Worcester, Mass., replied to an address of welcome, and G. C. Hemming of New York participated in the discussion of the papers read.

The American Association for the Advancement of Science elected the following-named officers at its annual meeting in June: President, Professor Charles Sedgwick Minot of the Harvard University Medical School; vice-president for mathematics and astronomy, Professor James M'Mahon, Cornell University; for physics, Professor D. D. Brace, University of Nebraska; for chemistry, John H. Long, Northwestern University; for mechanical science and engineering, E. S. Jacoby, Cornell University; for geology and geography, C. R. Van Hise, University of Wisconsin; for zoology, Professor D. S. Jordan, Leland Stanford Jr. University; for anthropology, J. Fewkes, Bureau of Ethnology, Washington; for economic science and statistics, John Hyde, Department of Agriculture, Washington; treasurer, Professor R. S. Woodward, Columbia University; permanent secretary, L. O. Howard, Washington.

MISCELLANEOUS.

Bids have been advertised for by the Pittsburg Bureau of Electricity for placing underground a number of the wires belonging to the city.

The Scientific American has information that 41 gas engines using blast-furnace gas are working in Germany, the total horsepower aggregating 21,950. The horsepower of such engines in Belgium is 3,700, France 3,250, and England 2,060.

The Chicago Brotherhood of Electrical Mechanics is now a branch of the International Brotherhood of Electrical Mechanics. The international union now includes linemen, inside telephone construction men, arc lamp trimmers and cable splicers.

Alfred R. Goslin, Eugene L. Packer and Charles T. Davis, accused of conspiring to depress the price of Brooklyn Rapid Transit stock, were convicted. Charles L. Bogert was acquitted. The sentences were fines of $500 and $250 and imprisonment for three to six months.

The Merchants and Manufacturers' Twentieth Century Exposition will hold its exhibition at Mechanics' Hall, Boston, October 1 to 27, 1900. The exhibition will be open to all manufactured products. October exhibitions in Boston have averaged 350,000 paid admissions for each fair. Changes recently made in the Mechanics' building enable the establishment of a new department, that of working exhibits.

TRADE NEWS.

Flint & Lomax, electrical manufacturers of Denver, Colo., recently had a $30,000 fire. The insurance was $21,900

BUSINESS.

The John A. Roebling's Sons company of New York is sending its friends a neat pencil sharpener for the desk.

The Electric Appliance company, Chicago, desires to call attention to the fact that the rush for Dayton fan motors is now on, and that orders for immediate delivery should be received at once.

The Central Electric company of Chicago is just in receipt of the following unsolicited communication from a customer to whom it shipped a 12-horsepower type "N" enclosed-end Bullock motor, the Central Electric company representing the Bullock Electic Manufacturing company as general sales agent: "The 12-horsepower motor is perfectly satisfactory, in fact, too good for the mining company by whom it is used, as the following will show: The motor is working on a pump 250 feet down in a mine, and, owing to the condition of the mine, it is sometimes half covered with water. It lifts a stream of water three inches in diameter 250 feet. It handled the load nicely until one day a new man, with very little experience in handling pumps and no experience in electric motors, started the pump without first letting the water out of the pipe. The result was that the pump was broken almost beyond repair, while no damage whatever was done to the motor. It seems this is an accident that very often happens, but in every other case the motor has gone up in smoke. After this one experience all electricians here have a great deal of respect for the Bullock motor."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 3, 1900.

652,748. Manufacture of Electrical Fuses or Current Arresters. Francis A. Coté, Ottawa, Canada, assignor of four-fifths to Toussaint C. Coursolles, Ottawa, Canada, and Frédéric L. Béique and Charles F. Sise, Montreal, Canada. Application filed March 31, 1899.

An electrical fuse or current-arrester made with gold leaf printed or embossed on an insulating body, having the form of two strips terminating in an obtuse angle, which are connected together to form the fusing point.

652,753. Electrical Time Recorder. Edward Davis, Boston, Mass., assignor to Meyer A. Bernheimer and Ralph W. Gordon, New York, N. Y. Application filed June 12, 1899.

The combination of a type wheel, a mechanically driven clock train adapted to rotate the wheel, an escapement for the train, an electromagnet for operating the escapement, an electrical make-and-break device in circuit with the magnet, and a time mechanism for operating the device.

652,754. Register. Edward Davis, Boston, Mass., assignor to Meyer A. Bernheimer and Ralph W. Gordon, New York, N. Y. Application filed June 24, 1899.

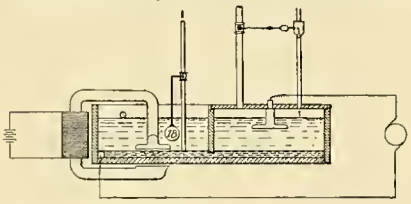
In a register, means for horizontally guiding a record strip, a punch bar, guides supporting the bar in a substantially vertical position and constructed to permit a sliding vertical punching movement thereof transversely of the strip, and a horizontal movement thereof, longitudinally with the strip, and an electromagnet having its armature independently guided and adapted to impart the punching movement to the bar.

652,761. Electrolytic Production of Caustic Soda, etc. Justus B. Entz, Philadelphia, Pa., assignor to the American Alkali company of New Jersey. Application filed May 6, 1899.

The process which consists in passing a current through mercury, electrolyzing a superposed fluid to effect deposition on the mercury, and subjecting the mercury to the influence of a magnetic field to cause it to move and transfer the substance deposited. (See cut.)

652,775. Alternating-current Regulator. Daniel O. Hull, Port Clinton, Ohio. Application filed March 1, 1899.

In a regulator for alternating currents, a pair of mains, an auto-converter connected across the mains, a series of contact pieces connected with the windings of the converter, a movable brush in the circuit to be controlled adapted to contact with either of the contact pieces, a solenoid in the circuit, a normally open branch circuit, connected with the auto-converter, a reversible induction motor in the branch circuit, driving connections intermediate the motor and the brush; and in the branch circuit a switch controlled by the solenoid.



NO. 652,761.

652,806. Flexible Electrical Conduit. Harry G. Osburn, Chicago, Ill. Application filed December 8, 1898.

A conduit consisting of a helix of semi-flexible material and a binding material interwoven therewith.

652,846. Process of Purifying and Strengthening Brine for Use in Electrolytic Cells. James Hargreaves, Farnworth-in-Widnes, England. Original application filed February 12, 1898. Divided and this application filed August 29, 1898.

In the electrolysis of salts, a process for separating soluble from insoluble matter for strengthening weakened brine solution from electrolytic cells and for conducting the strengthened brine to the electrolytic cells is described. It consists in conducting the weakened brine from the electrolytic cells, forcing the brine upward directly through and in intimate contact with a mass of impure salt contained in a sealed vessel by means of a steam jet, and then conducting the strengthened brine solution from the upper end of the vessel back to the electrolytic cells.

652,856. Speed Governor for Electrical Controllers. James H. McGurty, Jersey City, N. J. Application filed March 31, 1900.

In a speed governor for electrical controllers the combination with the controllor shaft of a friction-producing appliance and a train of gears connecting the two, the appliance involving the use of a number of springs with attached weights.

652,875. Electric-clock Pendulum. Ernest K. Adams, New York, N. Y. Application filed November 7, 1899.

The combination with a conical pendulum of a retarder consisting of a closed conductor and a magnet, one being stationary and the other adapted to be rotated by the pendulum.

652,934. Electric Device for Indicating the Awakening of Persons Buried Alive. Walter J. McKnight, Buffalo, N. Y. Application filed May 20, 1899.

An electric device for indicating the awakening of persons buried alive, comprising a casket, two arms arranged above the supposed corpse and normally out of contact, an electric alarm, cell or battery, wires connecting the alarm cell or battery, and the arms in the casket, and an angular wire attached to one of the arms and having its lower end arranged in close proximity to the chest of the person and adapted to be lifted into contact with the opposing arm to complete the circuit to operate the alarm upon the elevation of the chest of the buried person from breathing.

652,952. Magneto-electric Motor. Everett M. Andrews and Melvin N. Andrews, Des Moines, and Charles M. Conger, Adel, Iowa. Application filed May 10, 1900.

In a magneto-electric motor the combination of two or more series of permanent magnets, arranged to encircle the armature, and having the opposite poles of the adjacent series of magnets magnetically connected.

652,990. Electric Transformer. James J. Wood, Fort Wayne,, Ind. Application filed March 31, 1900.

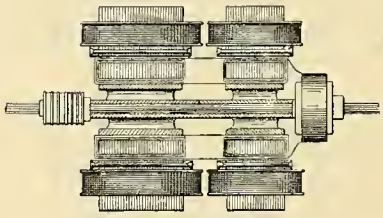
A transformer punching having end limbs of unequal length and an intermediate or core limb which is longer on one side of its middle than on the other, and having the shorter end limb adjacent to the longer side of the intermediate limb.

653,038. Incandescent Electric Lamp. Josef Plechati, Berlin, Germany. Application filed November 13, 1899.

In an incandescent electric lamp, a socket, a lamp bulb having a contracted portion or neck, points or teats projecting from the neck, and a helical spring interposed between and in frictional contact with the socket and the lamp bulb, the points or teats entering between the convolutions of the spring and preventing the turning of the lamp relatively thereto.

653,068. Electric-lamp Socket. Walter A. Church, Pittsburg, Pa. Application filed December 21, 1899.

The combination with an electric lamp, of a socket provided with a transversely extending opening, an auxiliary contact spring secured to the top of the opening and suitably connected to a lamp, a main contact spring arranged upon the bottom of the opening and adapted to be connected to a suitable source of electrical supply, a binding post secured to the top of the opening and suitably connected to the lamp, and means suitably arranged in the opening and constructed of non-conducting material and adapted when operated to bring the contact springs in engagement with each other.



NO. 653,088.

653,087. Electric Controller. Slaughter W. Huff, Baltimore, Md., assignor of one-half to Jesse Helles, Baltimore, Md. Application filed July 12, 1898. Renewed June 9, 1900.

In an electric controller the combination of a plane back, a plane carriage parallel to the back and supported vertically upon the sliding bearing in front of the back, the parts carrying terminals and bridging contacts, and a shaft lying transversely to the path of travel of the carriage and having connections with the ends of the carriage, whereby uniform movement is imparted to the latter. Means of rotating the shaft are provided.

653,088. Apparatus for Exciting Alternating-current Dynamo-electric Machines. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed April 13, 1899.

An exciter for alternating-current machine having its field magnetism supplied by two relatively moving elements, the one having dephased alternating excitation, the other, in the armature circuit of the exciter, producing a driving flux and a flux compensating for armature reactions. (See cut.)

653,089. Exciter for Alternating-current Dynamo-electric Machines. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed November 22, 1899.

The first claim reads as follows: An exciter comprising series and shunt fields, an armature having an image winding connected to a commutater, with one of its sections under the influence of these fields, and a field in series with the brushes on the commutator acting on the other section.

653,093. Apparatus for Supplying Currents of Predetermined Voltage from Main Lines of Higher Voltage. William W. King, Huntsburg, Ohio. Application filed October 30, 1899.

The combination with a line circuit of a high degree of tension and a lamp circuit of lower tension of a battery of storage cells, a battery switch constructed and arranged to automatically maintain a constant voltage in the cells, a series of contact points connected respectively with each storage cell, two switch arms adapted to move in unison over the contact points, the switch arms being so placed upon the contact points as to include between them the contacts of cells having in aggregate the voltage required in the lamp circuit, means derived from the battery circuit for adjusting automatically the distance between the arms, whereby the lamp circuit can be maintained of constant voltage in spite of variations in the cell voltage, and means for automatically moving the switch arms over the entire series of contact points at regular intervals, one point at a time, and from one extreme end of the series to the other, whereby all the cells are charged and discharged in succession and the times for charging or discharging each cell shall be maintained equal in all.

653,159. Electric Headlight Lamp. Harlan P. Wellman, Ashland, Ky. Application filed December 14, 1899.

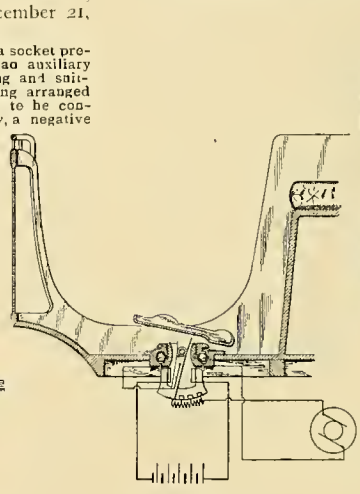
The reflector of the lamp described has a spiral groove on its exterior. A resistance coil within this groove is provided. (See cut.)

653,167. Motor Vehicle. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed August 11, 1899.

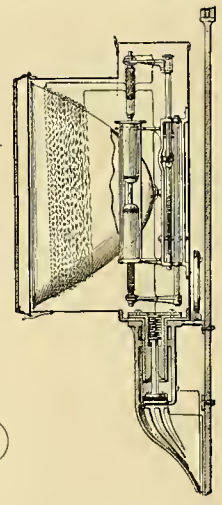
In a system of electrical propulsion for motor vehicles the combination of a circuit controller, a current-reversing switch, means capable of independent actuation carried by the movable member of the current controller and having operative connection with the switch, and a single grip for operating the circuit controller and the reversing switch.

653,168. Motor Vehicle. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed August 11, 1899.

In a system of electrical propulsion for motor vehicles, the combination of a circuit controller, comprising duplicate stationary members in parallel and separated relation, a movable member common to both, and means for insuring the return of the movable member to its starting position before a reversal of the current can be effected.



NO 653,172



NO. 653,159.

653,169. Motor Vehicle. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed August 11, 1899.

In a motor vehicle the combination of a steering handle having a combined horizontal and vertical movement, and a disconnected brake-actuating mechanism having operative connection with the steering handle and adapted to be actively actuated by a downward movement of the steering handle.

653,170. Motor Vehicle. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed August 21, 1899.

In an electrically propelled vehicle, the combination of a steering handle, an electric brake and an electric brake-actuating mechanism mounted upon the handle in convenient relation to the grip portion of such handle, substantially as set forth.

653,172. Motor Vehicle. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed October 2, 1899.

In a system of electrical propulsion for motor vehicles the combination of a current controller, a current-reversing switch, and a pedal capable of a combined rocking and swiveling movement, and operatively connected with such controlling and reversing mechanisms, substantially as set forth. (See cut.)

653,199. Motor Vehicle. John H. Munson, Chicago, Ill. Application filed May 16, 1898.

The combination, in an electric-motor vehicle, of the running gear or truck, with a suitably connected storage battery and electric motor thereon, the latter being adapted to drive the vehicle, and an explosion engine of less power than the motor and adapted to drive the same to recharge or replenish the battery when the motor is disconnected from the vehicle.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, JULY 21, 1900. No. 3

Electrical Features of the Merchants' Loan and Trust Building.

The new 12-story steel structure erected by Marshall Field at the northwest corner of Clark and Adams streets has perhaps the most thorough and complete electrical equipment of any large office building in Chicago. This building was erected in accordance with the plans and specifications of the architects, D. H. Burnham & Co., and all of the electrical and mechanical apparatus was installed under the supervision of their engineer, Mr. C. M. Wilkes. The edifice occupies a ground space of 18,000 square feet and has a floor area of about five acres. No pains have been spared to make this a perfect example of a thoroughly equipped modern office building, and, accordingly, electricity has been called upon not only for light, but also for power throughout the building. The exterior appearance of the building is shown in Fig. 1.

One of the first questions that arose to be decided was that as to the source from which electricity should be provided. After a careful consideration of the cost of installing and operating an independent plant for generating electricity, the owners of the building decided to use the central-station service of the Chicago Edison company for all power and lighting purposes throughout the building, and the wiring was therefore laid out on the Edison three-wire system, adapted to the use of Edison three-wire service. The system of wiring has a capacity for 5,000 16-candlepower incandescent lights and 475 horsepower in motors. The lights and motors are distributed as follows:

For the lighting there are about 500 16-candlepower lights in the Merchants' Loan and Trust company's bank on the second floor, upward of 200 lights in the safety-deposit vaults in the basement, 300 lights in the halls, corridors and public portions of the basement, and the remainder, 4,000 lights, are distributed in the offices and stores throughout the building. The architects have striven to secure as effective an arrangement of the lights as possible, and the accompanying illustration (Fig. 2) shows the method of lighting the main entrance.

For the power there are, in the first place, the motors for the Fraser double-motor-type elevators. Each of the five passenger elevators has two 30-horsepower motors, while the combination freight and passenger elevator is provided with two 50-horsepower motors, the latter, together with some of the compressing and pumping plant, being shown in Fig. 3, on the next page. There is one 15-horsepower motor for an Otis elevator running between the bank and safety-deposit vaults and one 10-horsepower motor for sidewalk hoist. Two two-horsepower motors are used for running an air pump in connection with the ejector pit; one 2½-horsepower motor operates the pump for cold water; one 10-horsepower motor drives the ammonia compressor; one one-horsepower motor is used for the vacuum pump in connection with the Paul heating system; two three-horsepower motors operate house pumps; two 3½-horsepower, one 2½-horsepower, one two-horsepower and one three-fourths-horsepower motor are connected to the blower system. Finally, one four-horsepower motor is used for the air pump, which supplies compressed air for the automatic door openers.

All the motors are located in the basement, except two of the fan motors, which are in the attic.

The arrangement of the wiring, which was laid out and installed by the engineering and construction departments of the Chicago Edison company, is as follows:

A tap is taken from the main distributing board in the basement of the adjoining Edison building and is run directly to this building. This direct service makes a failure of current impossible, except in the very remote contingency of a complete breakdown of the Edison system. It is, however, open to the objection that as the pressure rises and falls at the distributing board of the Edison building to suit the varying load on the Edison system, there would be a tendency for the pressure to rise and fall in this building. To overcome this, a special resistance has been inserted, so that as the load gradually increases in the building in the afternoon, the drop in this feeder will be proportioned to the drop in the outside street feeders, and will, therefore, secure a correspondingly constant pressure in the building.

There are two main-service switches to the building—one for power and one for light—and from these switches two sets of cables, having a total

FIG. 1. MERCHANTS' LOAN AND TRUST BUILDING.

cross-section of 6,500,000 circular mils, are run in iron conduits over to the main distributing switchboard, located in the basement near the elevator shaft. This switchboard, as may be seen in the illustration (Fig. 4), consists of two main panels, the one on the left controlling the lighting feeders and the other the power feeders. The five switches controlling the lighting feeders are as follows: Two for the offices, one for the stores, one for the corridors, and one for the bank and safety-deposit vaults. The switches for the power feeders are six in number and provide for the passenger elevators, bank elevator, ash lift, fans in attic, fans in basement and pump motors.

Above these switches are mounted, for convenience, three of the meters, viz., the bank meter, the meter for corridor lights and the meter for fans in the attic. These meters have polished copper cases, corresponding to the polished copper border on the switchboard. The remainder of the meters throughout the building are located at the various cut-out centers controlling the lights and motors.

All feeders in the building are encased in loricated iron-armored conduit, and all vertical feeders are run in a shaft built of tile and especially designed for this purpose, the feeders being mounted on porcelain insulators. Wherever mains or submains are run horizontally on any floor of the building they are encased in iron-armored conduit. These feeders connect on each floor with cut-out cabinets, built of steel and lined with polished marble. Fig. 5 shows the appearance of one of these cabinets, with meter-board above, and it should be noted that the marble pieces in front are fastened with screws, so that it is easy at any time to get at the wires in case it is desired for any reason to rearrange them. In the illustration the wattmeter and demand meters for only one office are thus far installed.

On the office floors of the building there are independent circuits for every office, and the wiring of the cut-out box is so arranged that an independent meter can be connected up for any office, or any combination of offices on any floor may be connected on one meter at each of the two distributing centers. The distributing circuits are drawn into loricated, iron-armored conduit, and for this purpose over 12 miles of conduit have been used.

At both the light and switch outlets the conduits terminate in special cast-iron outlet boxes, securely fastened to the walls and ceilings through lugs. At the cut-out cabinets the conduits are firmly fastened to the side of the cabinets with lock nuts, so that there is a complete iron raceway for all tap circuits. Great care was exercised in installing this conduit, so as to avoid a multiplicity of bends and elbows, and, accordingly, any wire in the building may be withdrawn and a new one inserted at any time.

The wiring for tap circuits throughout is of Hab-

FIG. 2. ELECTRICAL FEATURES OF THE MERCHANTS' LOAN AND TRUST BUILDING —MAIN ENTRANCE, SHOWING LIGHTING FIXTURES AND A GLIMPSE OF THE ELECTRIC ELEVATORS.

irshaw duplex double-braided wire, while Simplex cables are used for all mains and feeders.

In the bank the wiring, not only for the lights, but also for telephone, telegraph and watchman-clock stations, was installed in conduit. Special waterproof outlet boxes are used for floor outlets, and where conduits are extended from the floor up to desks, they consist of brass piping with dull finish.

As has been stated above, most of the machinery of the service plant is located in the basement. Here also are situated four 125-horsepower locomotive-type boilers, which are used exclusively for heating. They are operated at a low pressure and furnish heat, not only for this building, but also for the Edison office building adjoining.

The surface drainage in the basement is taken care of by Shone ejectors, which are operated by compressed air. The tank for compressed air is kept at a certain pressure automatically by an electrical device which starts up a two-horsepower motor, and then shuts it off as soon as the required pressure in the tank is secured. This plant which provides for the surface drainage is installed in duplicate, thus reducing to a minimum any chance for a breakdown.

The house pump for the tank on the roof is also installed in duplicate, and each pump is operated by a three-horsepower motor, which starts up automatically whenever the water falls below a certain level, and is shut off automatically whenever the water rises above a certain level.

An unique feature is the special apparatus for supplying ice water to the offices throughout the building. A large filter is installed in the basement and through this filter is pumped lake water, both for drinking purposes and for the tank at the top of the building. The water for drinking purposes is cooled by direct expansion, a 10-horsepower motor being installed to run the ammonia compressor.

The arrangements for heating and ventilating are very complete. The offices throughout the building are heated by steam, the steam-heating apparatus being installed on the Paul vacuum system. The ventilating system is arranged so as to draw in fresh air from the roof, and in winter this air is passed over steam coils located in the attic, providing warm air for heating the bank and safety-deposit vaults. The elevator doors are all operated by compressed air. This air is pumped into a tank by means of a four-horsepower motor, installed in the basement by the Burdett-Rowntree company, the inventor of the door-opening apparatus.

The electric elevators are of rather a novel type, and one which is for the first time installed in this city. As may be seen by the illustrations, they require double the ordinary amount of motor installation, there being two motors to each elevator, and each motor is as large as the size ordinarily installed for one elevator. These motors are both in operation when the elevator is running, and the difference in the speed of these motors determines whether the elevators shall move up or down. This is accomplished by an endless cable, which is looped on to each of the motors, and is also connected to pulleys at the counterbalance at the elevators and at the supporting beam at the top of the shaft. The principle upon which these differential elevators operate may be made a little more clear by the diagram, Fig. 6, in which, for the sake of simplicity, many of the actual parts have been omitted and the cable from the motors is shown as directly attached to the car and counterweight. When both motors are at the same speed the car stands still.

Fig. 7 shows a view of the pulley side of a pair of these motors. The Western Electrician was unable to secure information as to the details or efficiency of these machines. Inquiry at the office of the Otis Elevator company revealed an unwillingness to supply data regarding this installation. The manifest theoretical advantages of this type of elevator are, however, that the elevator should be able to start and stop more promptly and smoothly, because the motors do not have to start from a standstill, and an absence of winding drums and multiplying sheaves in the basement, no matter how high the building. There is a special marble switchboard for the large elevators. Upon this switchboard is mounted a recording wattmeter, also a double-pole, double-break switch, with D. & W. enclosed fuses for each elevator.

In looking over this building one is impressed by the small amount of space occupied by the mechanical plant. Most of the basement is utilized for the safety-deposit vaults of the Merchants' Loan and Trust company, and even in the small amount of space remaining for the power plant, there is none of that crowded, cramped condition which may be seen in the basement of many office buildings. Every portion of the machinery is easily accessible, and, as has been stated above, some of the more important machines are installed in duplicate. The amount of labor required in operating the building has been reduced to a minimum, and at present it is not necessary to even fire the boilers. The basement is as cool and quiet there as in any portion of the building. All the various pumps and elevators are provided with electric automatic devices, so that power is used only when required.

When it is remembered that it would require nearly 1,000 horsepower to operate all the lights and motors in the building, it is interesting to note that the source of all this power, as far as the building itself is concerned, is a small switchboard about three feet square, on which are mounted two knife switches.

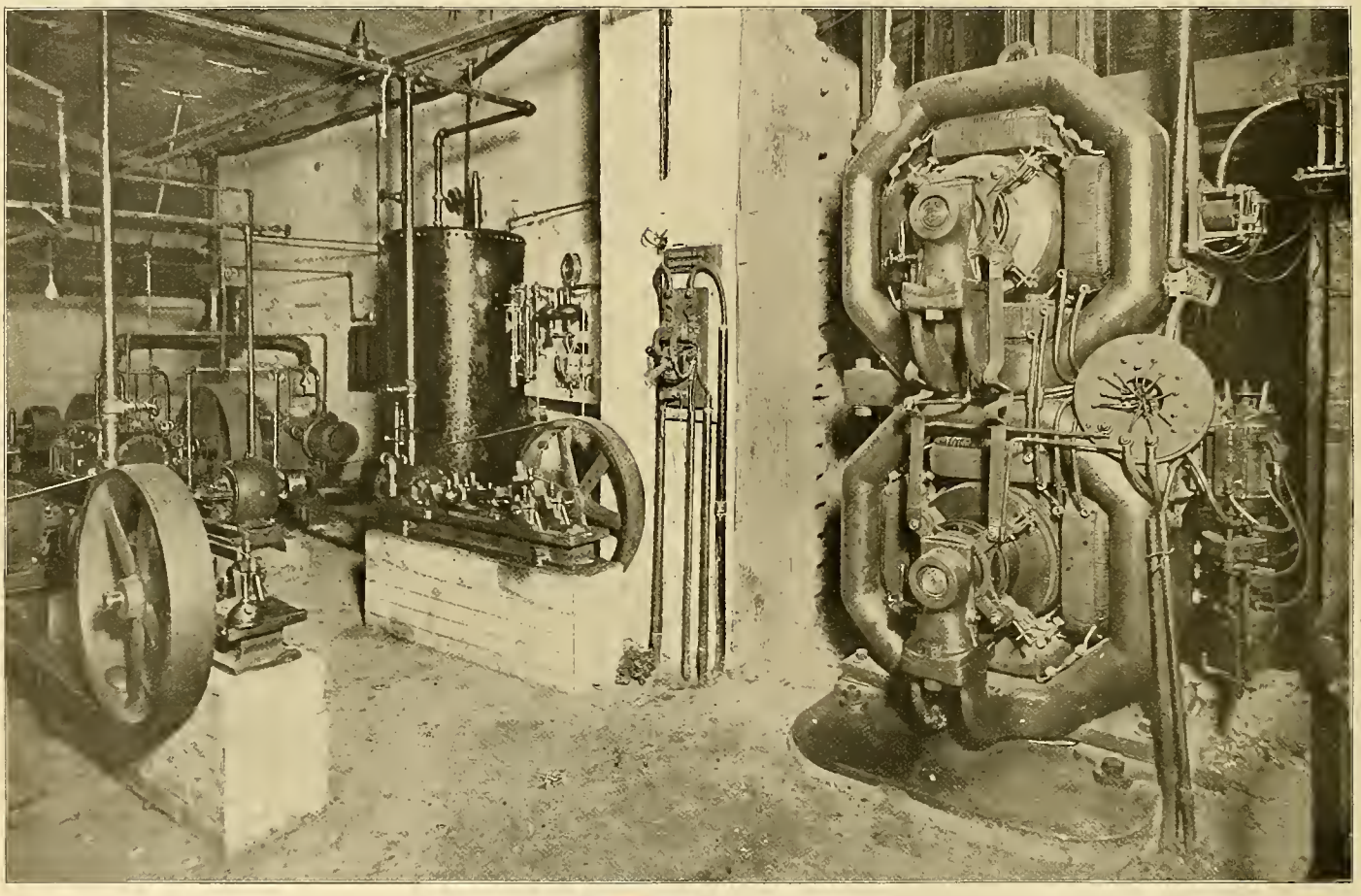


FIG. 3. ELECTRICAL FEATURES OF THE MERCHANTS' LOAN AND TRUST BUILDING.—BASEMENT PLANT WITH ELEVATOR MECHANISM AT THE RIGHT.

American Electrical Exhibitors at the Paris Exposition.

From the official catalogue of the Paris Exposition the following list of the United States exhibitors, under the grouping "Electricity," is taken:

GROUP V., CLASS 23—MACHINES FOR THE PRODUCTION AND UTILIZATION OF ELECTRICITY.

Advance Packing and Supply company.....Chicago, Ill.
Anderson (Albert & J. M.) Manufacturing company.. ....Boston, Mass.
American Commercial Rubber company..... ....Elizabethport, N. J.
American Hard Fibre company.....New York, N. Y.
American Vitrified Conduit company..New York, N. Y.
American Woven Wire Brush company..Peabody, Mass.
Anchor Electric company .....Boston, Mass.
Automatic Switch company .....Baltimore, Md.
Bates, D. L., & Bro. .....Dayton, O.
Belknap Motor company .....Portland, Me.
Billings & Spencer company .....Hartford, Conn.
Bossert Electric Construction company.....Utica, N. Y.
Bullock Electric Manufacturing company..... ....Cincinnati, O.
C. & C. Electric company.....New York, N. Y.
Central Union Brass company.....St. Louis, Mo.
Chase-Shawmut company .....Boston, Mass.
Chicago Rawhide Manufacturing company.....Chicago
Circular Iron company .....Boston, Mass.
Clark, James Jr., & Co. .....Louisville, Ky.
Cleveland Electric company .....Cleveland, O.
Commercial Electric company .....Indianapolis, Ind.
Cook Mercantile Trust company.....Philadelphia, Pa.
Crocker-Wheeler Electric company.....New York, N. Y.
Cronse-Hinds Electric company.....Syracuse, N. Y.
Crown Woven Wire Brush company.....Salem, Mass.
Cutter Electric and Manufacturing company..... .....Philadelphia, Pa.
Dayton Electrical Manufacturing company....Dayton, O.
Delaware Hard Fibre company.....Wilmington, Del.
Diehl Manufacturing company .....Elizabethport, N. J.
Dixon, Joseph, Crucible company.....Jersey City, N. J.
Eck Dynamo and Motor Works.....Newark, N. J.
Edison Manufacturing company.....Orange, N. J.
Emerson Electric Manufacturing company..... .....St. Louis, Mo.
Empire China Works .....Brooklyn, N. Y.
Eureka Tempered Copper Works .....Northeast, Pa.
Fagan, J. C.....Watertown, N. Y.
Falcon Electric Manufacturing company.New York, N.Y.
Falk company .....Milwaukee, Wis.
Fisher Electric Manufacturing company...Detroit, Mich.
Forest City Electric company.....Cleveland, O.
Galvanic Metal Paper company.....New York, N. Y.
Garton-Daniels company .....Keokuk, Iowa
General Equipment company .....Camden, N. J.
Hartwig & Miller .....Detroit, Mich.
Hazard Manufacturing company .....Wilkesbarre, Pa.
Hobart Electric Manufacturing company.....Troy, Ohio
Holmes Fibre Graphite company.....Germantown, Pa.
Holtzer-Cabot Electric company .....Brookline, Mass.
Insulating Saddle Staple company.....Brockton, Mass.
Iron Clad Resistance company.....Westfield, N. J.

Jeffrey Manufacturing company .....Columbus, Ohio
Jenney Electric Manufacturing company.....
.....Indianapolis, Ind.
Johns, H. W., Manufacturing company..New York, N. Y.
K. & W. company .....Pittsfield, Mass.
Kartavert Manufacturing company ....Wilmington, Del.
Kester Electric Manufacturing company.....Chicago
Klein, M., & Sons .....Chicago
Lakon company .....Elkhart, Ind.
La Roche & Co. .....New York
Locke, Fred M. .....Victor, N. Y.
Lorain Steel company .....Lorain, Ohio
Manhattan Electrical Supply company.....New York
Marshall, William .....New York
Milwaukee Electric company .....Milwaukee, Wis.
Mnsell, Eugene, company .....New York
National Conduit and Cable company.....New York
New Process Rawhide company .....Syracuse, N. Y.
New York and Ohio company .....Warren, Ohio
New York Insulated Wire company.....New York

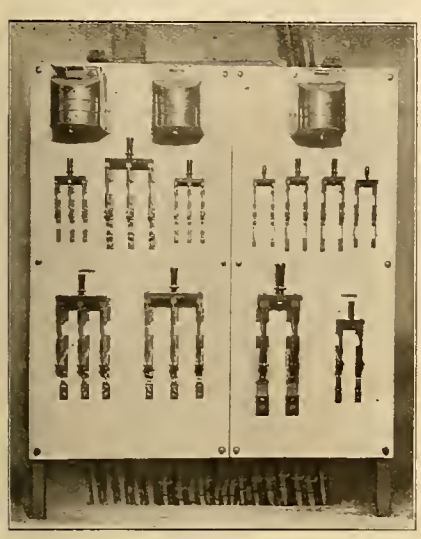


FIG. 4. ELECTRICAL FEATURES OF THE MERCHANTS' LOAN AND TRUST BUILDING.—MAIN DISTRIBUTING BOARD.

Ohio Electric Specialty company .....Troy, Ohio
Okonite company .....New York
Onondaga Dynamo company .....Syracuse, N. Y.
Otis Elevator company .....New York
Partrick, Carter & Wilkins .....Philadelphia, Pa.
Partridge Carbon Works .....Sandusky, Ohio
Phœnix Battery Manufacturing company..St. Louis, Mo.
Philadelphia Electrical and Manufacturing company..
.....Philadelphia, Pa.
Pittsburg Transformer company.....Pittsburg, Pa.
Robbins & Meyers company .....Springfield, Ohio
Royal Electric company .....Peoria, Ill.
Shaw Electric Crane company .....Muskegon, Mich.
Silex Insulation company .....New York
Sills, W. H., Mica company .....Chicago
Speer Carbon company .....St. Marys, Pa.
Sprague Electric company .....New York
Standard Paint company .....New York
Steward, D. M., Manufacturing company.....
.....Chattanooga, Tenn.
Stow Manufacturing company .....Binghamton, N. Y.
Thomas, R., & Sons company.....East Liverpool, Ohio
Thresher Electric company .....Dayton, Ohio
Triumph Electric company .....Cincinnati, Ohio

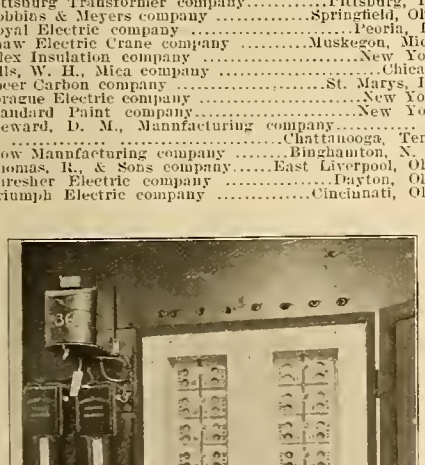


FIG. 5. ELECTRICAL FEATURES OF THE MERCHANTS' LOAN AND TRUST EUILDING.—CUT-OUT CABINET AND METER BOARD.

Union Porcelain Works .....Brooklyn, N. Y.
Van Wagoner & Williams Hardware company.....
.....Cleveland, Ohio
Vulcanized Fibre company .....Wilmington, Del.
Warren Electric and Specialty company....Warren, Ohio
Warren-Medbury company .....Sandy Hill, N. Y.
Wagner Electric Manufacturing company..St. Louis, Mo.
Western Electric company .....Chicago, Ill.
Ward Leonard Electric company .....Bronxville, N. Y.
Westinghouse Electric and Manufacturing company..
.....Pittsburg, Pa.
Wirt, Charles, & Co. .....Philadelphia, Pa.
Zimdars & Hunt .....New York

GROUP V., CLASS 24—ELECTRO-CHEMISTRY.

Abbott Electric and Manufacturing company.....
.....Cleveland, Ohio
Acheson, E. C. .....Niagara Falls, N. Y.
American Hard Rubber company.....New York, N. Y.
Edison Manufacturing company .....New York, N. Y.
Edison, Thomas A., Jr. .....New York
Electric Gas Lighting company .....Boston, Mass.
Federal Battery company .....New York, N. Y.
Gordon Battery company .....New York
Gould Storage Battery company .....New York, N. Y.
Leclanche Battery company .....New York
Manhattan Electrical Supply company .....New York
New Excelsior Dry Battery company.....New York
Non-Polarizing Dry Battery company.....New York
Reliance Lamp Electric company .....New York
Roche, William .....New York
United States Battery company .....New York
Voltamp Electric Manufacturing company.....
..... Baltimore, Md.

GROUP V., CLASS 25—ELECTRIC LIGHTING.

Adams-Bagnall Electric company .....Cleveland, Ohio
Almond, T. R. .....Brooklyn, N. Y.
American Electric Meter company.....Philadelphia
American Electric Specialty company.....New York
American Endoscopic company .....Providence, R. I.
American Hard Rubber company.....New York
American Miniature and Decorative Lamp company..
.....New York
Baker & Fox .....Brooklyn, N. Y.
Barron, J. S., & Co. .....New York
Belden-Larwill Electric and Manufacturing company
.....Fort Wayne, Ind.
Bossert Electric Construction company.....Utica, N. Y.
Bristol company .....Waterbury, Conn.
Bryant Electric company .....Bridgeport, Conn.
Buckeye Electric company .....Cleveland, Ohio
Chicago Edison company .....Chicago, Ill.
Chicago Fuse Wire and Manufacturing company....
.....Chicago, Ill.
Colonial Electric company .....Youngstown, Ohio
Columbia Incandescent Lamp company....St. Louis, Mo.
Creaghead Engineering company.....Cincinnati, Ohio
Dale company .....New York
Davis Incandescent Lamp company.....Syracuse, N. Y.
Devere Electric company .....Cincinnati, Ohio
Edwards & Co. .....New York
Electric Gas Lighting company .....Boston, Mass.
Electric Motor and Equipment company....Newark, N. J.
Faries Manufacturing company .....Decatur, Ill.
Fisher Electric Manufacturing company..Detroit, Mich.
Frink, I. P. .....New York
General Electric company .....Schenectady, N. Y.
Gilmore Electric company.....South Boston, Mass.
Goehst, J. Henry .....Chicago, Ill.
Hardy Lamp company .....Pittsfield, Mass.
Hart Manufacturing company .....Hartford, Conn.
Hartwig & Miller .....Detroit, Mich.
Hart & Hegeman Manufacturing company.....
.....Hartford, Conn.
Hecla Iron Works .....Brooklyn, N. Y.
Helios-Upton company .....Peabody, Mass.
Henderson, H. .....Peekskill, N. Y.
Holophane Glass company .....New York
Huebel & Manger .....Brooklyn, N. Y.
Incandescent Electric Light Manipulator company..
.....Boston, Mass.
Inglis, William, Wire and Iron Works....Detroit, Mich.
Jewell Electrical Instrument company.....Chicago
Kinsman, F. E. .....New York
Lea Electric Manufacturing company.....Elwood, Ind.
Lynn Incandescent Lamp company.....Lynn, Mass.
McLeod, Ward & Co. .....New York
Malcolmson, Charles T. .....Chicago, Ill.
Meyrowitz, E. B. .....New York
Morris Arc Lamp company .....Chester, Pa.
National Carbon company .....Cleveland, Ohio
New York and Ohio company .....Warren, Ohio
Onota Manufacturing company .....Pittsfield, Mass.
Orient Electric company .....Youngstown, Ohio
Oxley & Enos .....New York
Pacific Electric company .....La Crosse, Wis.
Paiste, H. T., company .....Philadelphia, Pa.
Pass & Seymour .....Syracuse, N. Y.
Robbins & Meyers company .....Springfield, Ohio
Schiff, Jordan & Co. .....New York, N. Y.
Solar Carbon and Manufacturing company.....
.....Pittsburg, Pa.
Speer Carbon company .....St. Marys, Pa.
Splitdorf, C. F. .....New York
Stanley Instrument company ..Great Barrington, Mass.
Sterling Arc Lamp company.....New York
Stewart, Frank H., & Co. .....Philadelphia, Pa.
Syracuse Electric Instrument company..Syracuse, N. Y.
Tiffany Glass and Decorating company.....New York
Toerring, C. J., company .....Philadelphia, Pa.
United States Carbon company .....Cleveland, Ohio
Vought, M. I. .....La Crosse, Wis.
Washington Carbon company .....Washington, Pa.
West, H. S. .....Chicago, Ill.
Western Electric company .....Chicago
White, O. C., company .....Worcester, Mass.

GROUP V., CLASS 26—TELEGRAPH AND TELEPHONE.

American Electric Telephone company ....Chicago, Ill.
American Hard Rubber company .....New York
American Steel and Wire company.....Worcester, Mass.
American Wireless Telegraph company..Milwaukee, Wis.
Aoderson, H. .....Peekskill, N. Y.
Ansonia Brass and Copper company .....New York
Central Telephone and Electric company..St. Louis, Mo.
Chicago Insulated Wire company.....Chicago, Ill.
Connecticut Telephone and Electric company.....
.....Meriden, Conn.
Crefeld Electric Works .....Providence, R. I.
Crehore, A. C. .....Cleveland, Ohio
Dicke Tool company .....Chicago, Ill.
Eureka Electric company .....Chicago, Ill.
Farr Telephone and Construction Supply company..
.....Chicago
Fisk, H. M., Manufacturiog company.....Wheaton, Ill.
Foote, Pierson & Co. .....New York, N. Y.
Gordon, A. Y. .....Massillon, Ohio
Huebel & Manger Manufacturing company.....
.....Brooklyn, N. Y.
Illinois Insulated Wire company.....Sycamore, Ill.
India Rubber and Gutta Percha Insulation company..
.....Yonkers, N. Y.
India Rubber and Insulated Wire company.....
.....Jonesboro, Ind.
Insulating Saddle Staple company.....Brockton, Mass.
International Cable Directory company.....New York
Kokomo Telephone, Electric and Manufacturing company
.....Kokomo, Ind.
Klein, Mathias, & Son .....Chicago
Knsel Telephone and Electric company....St. Louis, Mo.
McDermid Manufacturing company.....Chicago
Mianus Electric company .....Mianus, Conn.
National Automatic Telephone company.....
.....Bloomington, Ill.
National Conduit and Cable company.....New York
National India Rubber company.....Bristol, R. I.
New York Insulated Wire company.....New York
North Electric company .....Cleveland, Ohio
Okonite company .....New York
Ostrander, W. R., & Co. .....Brooklyo, N. Y.
Pacific Electric company .....La Crosse, Wis.
Partrick, Carter & Wilkins .....Philadelphia, Pa.
Pennsylvania Electric company .....Marietta, Pa.
Peru Electric Manufacturing company.....Peru, Ind.
Pettingill-Andrews company .....Boston, Mass.
Phillips Insulated Wire company.....Pawtucket, R. I.
Pittsburg Reduction company .....Pittsburg, Pa.
Rawson Electric company .....Elyria, Ohio
Roebling's, John A., Sons company.....Trenton, N. J.
Rowland Telegraphic company .....Baltimore, Md.
Safety Insulated Wire and Cable company....New York
Simplex Electrical company .....Boston, Mass.
Simplex Interior Telephone company....Cincinnati, Ohio
Sprague Electric company .....New York
Squier, George L. .....Cleveland, Ohio
Standard Telephone and Electric company..Madison, Wis.
Stromberg-Carlson Telephone Manufacturing company.....Chicago
Telephone Manufacturing company .....Sumter, S. C.
Varley Duplex Magnet company.....Jersey City, N. J.
Viaduct Manufacturing company.....Baltimore, Md.
Western Electric company .....Chicago
Western Telephone Construction company.....Chicago
Williams-Abbott Electric company.....Cleveland, Ohio
Williams Electric company .....Cleveland, Ohio

GROUP V., CLASS 27—MISCELLANEOUS APPLICATIONS OF ELECTRICITY.

Abbott Electric and Manufacturing company.....
.....Cleveland, Ohio
American Electric Heater company .....Detroit, Mich.

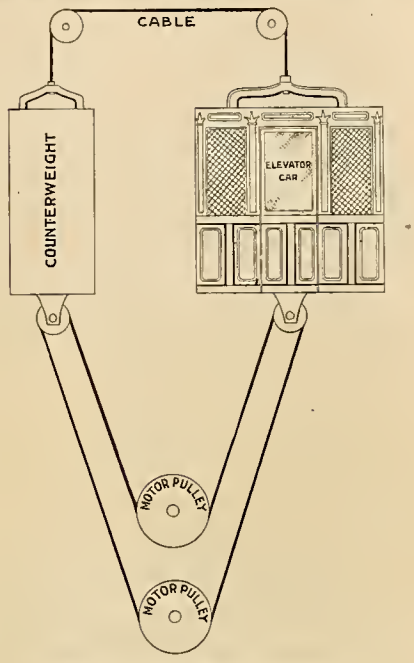


FIG. 6. ELECTRICAL FEATURES OF THE MERCHANTS' LOAN AND TRUST BUILDING.—DIAGRAM OF ELEVATOR GEARING.

American Electric Heating Corporation.....
.....Cambridgeport, Mass.
American Electric Specialty company.....New York
Automatic Electric Clock company.....Chicago, Ill.
Bristol company .....Waterbury, Conn.
Consolidated Car Heating company.....Albany, N. Y.
Dale company .....New York, N. Y.
Eastern Electric Cable company .....Boston, Mass.
Eldridge Electric Manufacturing company.....
.....Springfield, Mass.
General Incandescent Arc Light company.....New York
Gold Car Heating company .....New York
Gordon Battery company .....New York
Gray, Elisha .....Highland Park, Ill.

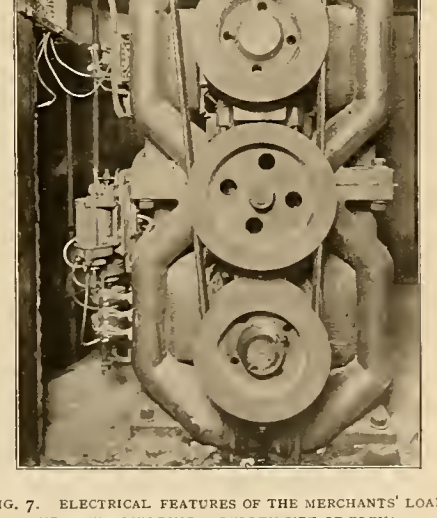


FIG. 7. ELECTRICAL FEATURES OF THE MERCHANTS' LOAN AND TRUST BUILDING.—PULLEY SIDE OF ELEVATOR MOTORS.

Hadaway Electric Heating and Engineering company
.....New York, N. Y.
Iron Clad Resistance company .....Westfield, N. J.
Johns, H. W., Manufacturing company.....New York
Jewell Electrical Instrument company .....Chicago, Ill.
McCay Engineering company .....Baltimore, Md.
McGraw Publishing company .....New York
Marshall, William .....New York
Meyrowitz, E. B. .....New York
Montauk Multiphase Cable company.....New York
Mundy, Arthur J. .....Newtonville, Mass.
Norton Electrical Instrument company.....
.....Manchester, Conn.
Onota Manufacturing company .....Pittsfield, Mass.
Queen & Co. .....Philadelphia, Pa.
Ritchie, E. S., & Sons .....Brookline, Mass.
Sempire Clock company .....St. Louis, Mo.
Stanley Instrument company ....Great Barrington, Mass.
United Electric Heating company .....Detroit, Mich.
Wagner Electric Manufacturing company..St. Louis, Mo.
Weston Electrical Instrument company....Newark, N. J.

Evershed Frictionless Meter.

At a recent meeting of the British Institution of Electrical Engineers a paper entitled "A Frictionless Motor Meter" was read by Mr. S. Evershed. In the course of his paper the author described a meter of this type designed by himself, in which the friction has been, as compared with other types, greatly reduced. The meter is a refinement of the well-known Thomson-Houston type, and, according to the author, the friction moments only vary from 1.7 dyne-centimeters in a new meter to 3.5 dyne-centimeters in one which has run for many million revolutions, as compared with 57 dyne-centimeters to as much as 1,400 dyne-centimeters in other well-known types.

The essential working parts of the meter are shown in Fig. 1. The armature (A), brake dish (F) and train-driving coils (D_1 D_2) are mounted on a mild-steel axle (a). The axle has a hard-steel point at its lower end resting in jewel cup (J); its upper end has no mechanical support, but is maintained in position by the magnetic attraction of an iron rod (R), which is magnetized by the brake magnets (M M) through an iron yoke (Y) and forms the supporting pole. The distance between (R) and the end of the axle is adjusted by screwing (R) in the yoke (Y), until the vertical force nearly suffices to lift the whole weight of the armature, brake, and other parts attached to the axle. The arrangement is more clearly seen in Fig. 2, which is a section through the magnetic pivot. A mag-

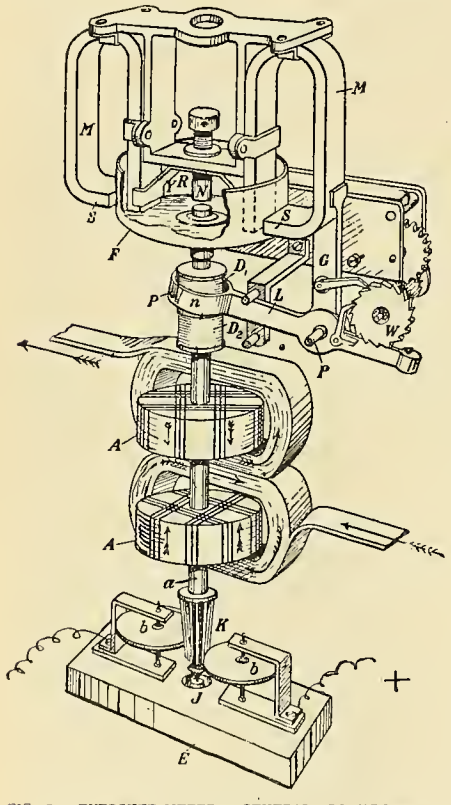


FIG. 1. EVERSHED METER.—GENERAL ARRANGEMENT.

netic pivot of this type may easily be made to support a weight of from 100 to 200 grams. In Fig. 2 (M) is the brake magnet ; (Y) iron yoke between the brake magnets; (R) iron rod forming supporting pole (N); (a) iron axle having upper end (S) beneath pole (N); (e) end plate (non-magnetic); (g) guard ring to prevent axle from being displaced; (F) brake dish; (B) step bearing with jewel cup (J); (L) axle-bearing frame.

The commutator (K), as shown in Fig. 1, is placed beneath the armature, and the wheel brushes (b b) are pivoted in frames attached to an ebonite plate (E). The commutator and brushes are shown on an enlarged scale in Fig. 3. The segments are fine iridio-platinum wires, supported at one end by an ivory collet and entirely free at the other end, where they impinge and roll on the brush wheels. The commutator is about three millimeters in diameter at the rolling circle; the wheels are about 36 millimeters in diameter, so that they make one revolution to 12 revolutions of the commutator. The pressure current is led to the brush wheels through their frames, and, to insure good contact between frame and wheel, the step bearing of each wheel is an iridio-platinum pivot, resting on a flat plate of the same metal.

A drum winding is used for the armature, a break being made in the ordinary course of winding, in each parallel, in order to insert the two little coils (D_1 D_2). Thus (D_1) is in series with one of the two parallels of the drum winding, and (D_2) in series with the other; they are consequently each traversed by one-half of the whole armature current, and since they are, electrically, a part of the armature circuit, the current in them is reversed twice in each revolution of the axle. (D_1) and (D_2) are inserted at corresponding points of the drum winding, so that their currents reverse at the same instant, and they are coupled up so that the two currents flow in the same direction, and to all intents and purposes (D_1) and (D_2) behave like one coil.

Fig. 4 shows the connections of the train-driving coils in diagrammatic form, a Gramme winding being substituted for the drum for the sake of clearness. Surrounding the train coils (D_1) and (D_2), but not touching them, is a ring of soft iron (P), (Fig. 1) forming part of an iron lever (L), mounted on a horizontal axle (p). (L) is magnetized by induction from one of the brake magnets, an iron bar (G) serving to complete the

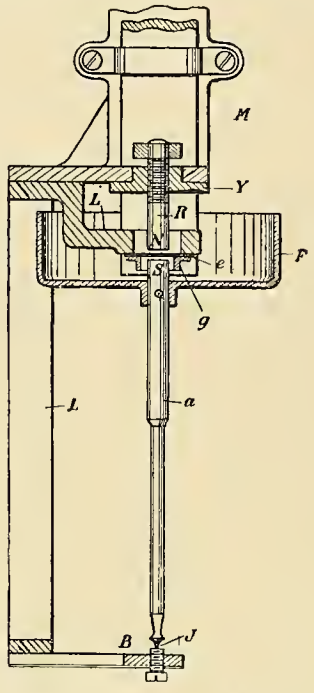


FIG. 2. EVERSHED METER.—SECTION THROUGH MAGNETIC PIVOT.

magnetic circuit between (S) and (n). The induction leaves the ring pole (P) and passes radially through the train coils into the axle, and (P) consequently experiences a vertical force, alternately upward and downward, as the currents in the train coils periodically reverse. The result is that (L) oscillates on its axis, making a double stroke or complete cycle once in every revolution of the armature. The motion of the lever is limited by stops, and is communicated by means of a pawl to a ratchet wheel (W), which is attached to the first axle of the counting train (T).

It will be seen at once that this device opposes no retarding moment on the armature axle. The only mechanical force called into play is in a vertical direction, and has no component tending to turn the axle. The train coils and magnetized lever form a reciprocating electric motor, and, during the time the ring pole is moving up (or down), there is a back electromotive force in the train coils, and the product of this back electromotive force into the armature current and the time gives the consumption of electrical energy per stroke. It is, of course, equal to the mechanical work done—product of force on (P) into length of stroke. The force actually provided is far greater than that necessary to drive the train. The

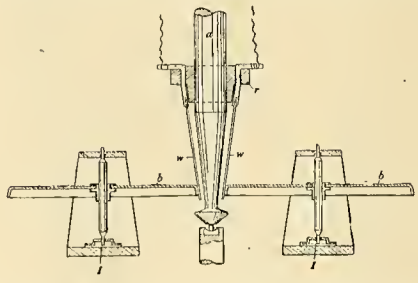


FIG 3. EVERSHED METER.—COMMMUTATOR AND BRUSHES.

friction of an ordinary train is just overcome by a turning moment of about four dyne-centimeters applied to the worm or pinion commonly used on a meter axle to gear into the first wheel of the train; six dyne-centimeters will generally keep a train running at a speed a good deal higher than anything save a short-circuit can produce. The author has tested many trains taken out of different electric meters, and, curiously enough, they differ very little as regards friction.

Now, if the train were geared to the axle in the usual manner, and required a moment of six dyne-centimeters to keep it going, the work done by the meter in driving the train being, of course, twice this moment in each revolution, would be about 38 ergs. The stroke of the train-driving lever is about 1.0 centimeter, so that the force upon it must be at least $\frac{38}{1.0} = 38$ dynes. The force actually obtained is about 750 dynes, which leaves an ample margin for accidental friction. It is assumed that the lever does no useful work on its return stroke.

A number of different forms of this train driver have been designed, and several of them have been tested in actual work. Fig. 5 shows a modification characterized by the same fundamental principle, namely, a coil producing an alternately upward and downward force upon the free end of a lever. In this modification the two train coils (D_1) and (D_2) are coupled back to back, so that they produce a consequent pole in the space between them, and the movable coil attached to the end of the lever is alternately forced up and down. This coil forms part of the series resistance in the armature circuit, and carries the whole of the pressure current. Fig. 5 is intended for alternating-current meters, when a permanently magnetized lever would, of course, be useless.

The whole of the working parts of the meter, with the exception of the main-current coils, are attached to a light framework, which is bolted to the top of the casting which forms the back, top and bottom of the meter case. The other three sides of the case are formed by a bent sheet of zinc, which is screwed and sealed to the casting. The terminals project below the bottom, and are covered by an insulating box, which may be sealed after connecting up on the consumer's premises. The Foucault brake is in the form of a shallow dish, and the two brake magnets are fixed in posi-

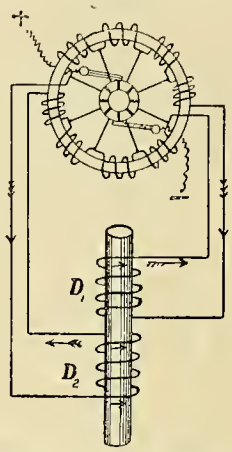


FIG. 4. EVERSHED METER. — CONNECTIONS BETWEEN ARMATURE AND TRAIN COILS.

tions which make it impossible for any excess of current in the main coils to demagnetize them.

Opening of the Central London Railway.

[From the London correspondent of the Western Electrician.]

A large number of guests were invited to take part in the opening of the Central London railway by the Prince of Wales. Assembling at the Bank Station, in front of the Royal Exchange, where awnings and displays of flowers attracted the attention of the crowds, the great underground station, light and airy, and provided with five elevators, was examined, and a descent made to the platforms where a typical train was in waiting. At one end was the odd-looking electric locomotive. It was totally different from anything seen in this country before. My neighbor described it as resembling a miniature torpedo boat, but it is well known in the United States, for, like the carriages, it is of an American type and runs on eight wheels, driven by four motors. The run to Shepherds Bush, the terminus, was quickly made, the journey being a through one. The Prince was much interested with the generating station, which possesses the largest electric-railway power plant in Europe. There are six generating units, each of 1,300 horsepower, four of which are capable of supplying all the current needed on the line, the other two being held in reserve. At the luncheon the Prince of Wales, in declaring the line open, congratulated the engineer, Sir Benjamin Baker, under whose directions the railway has been constructed.

Consolidation at Dubuque.

All the street-railway and electric-lighting companies of Dubuque, Iowa, have been consolidated under the name of the Union Electric company. The new officers are: President, Frank O. Stout; vice-president, Bart E. Linehan; treasurer, George W. Kiesel; secretary, E. A. Engler; superintendent, W. J. Browne. The companies entering the consolidation are the Dubuque Street Railway, the Home Electric, and the Star Electric Lighting companies. The capitalization is $500,000.

BOOK TABLE.

PHOTOMETRICAL MEASUREMENTS. By Wilbur M. Stine, Ph. D. New York: The Macmillan company. 1900. Pp., 270, 5x7½, with 67 diagrams and illustrations. Price, $1.60.

Professor Stine does whatever he has to do thoroughly and well. His book on photometry is no exception to the rule. The sub-title indicates that the work is a "manual for the general practice of photometry, with especial reference to the photometry of arc and incandescent lamps." The book is therefore of particular interest to electrical students and to those interested in the diffusion of electric light. It is clearly written, apparently with the constant idea of formulating a hand-book of real usefulness for students and workers in photometry. Simple, concise statements are made, and while certain topics have been mathematically treated, there are also, in these cases, collateral paragraphs which set forth the practical applications of these discussions. Frequent references to the literature of photometry are made by footnotes, and thus the student who so desires may use the manual as a stepping-stone to an exhaustive study of the subject. There is little doubt, however, that nine out of 10 persons who desire a work of reference on photometry will find Professor Stine's book complete in itself. Cross-references and indexes of subjects and names add to the value of the book.

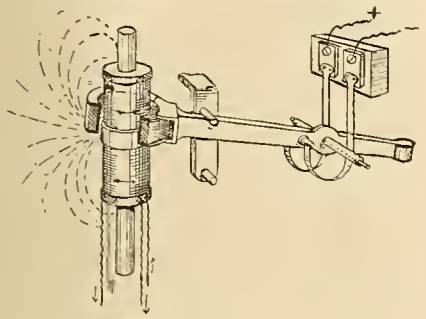


FIG. 5. EVERSHED METER.—TRAIN COIL AND LEVER FOR ALTERNATING CURRENT.

The author considers first the general principles of photometry and points out how many errors originate in the measurement of light-giving sources. He next takes up photometrical quantities and units and then devotes much attention to photometers—their elements and various types. Standards of illuminating power are next considered at length, and, while discussing this branch of his subject, the writer concludes that "The photometrical unit must eventually be arbitrarily chosen, and may or may not be the value of the standard of illuminating power. Attention is given to secondary standards of illuminating power, and chapters on the photometry of incandescent and arc lamps conclude the body of the book. Appendixes on globes and reflectors and a table of ratios for a 100-part photometer are given.

Mechanically, the book is well made. It is clearly printed on a fair quality of paper, and the illustrations, with a few exceptions, are excellent. The observer will note the English spelling of such words as "colour," which is probably due to the transatlantic relations of the publishers, for the sturdy Americanism of the author himself is unquestioned. On the whole, Professor Stine has given to technical literature a useful book which can hardly fail to find an appreciative audience.

THE KNIGHT OF THE GRIP. New York: David Williams company. 1900. Pp., 181, 5x7½. Price, 60 cents.

This book comprises a series of sketches, reprinted from the Iron Age, relating to the work, surroundings, temptations and idiosyncrasies of traveling salesmen. It is discursive, of course, but it is readable, and it is wholesome and manly. In a modest prefatory note the author says that the book is not intended to instruct. The style is not, in fact, "preachy" at all, but the trend of the rambling articles that make up the little volume is nevertheless toward those things that are lovely and of good report. Traveling men can read the book with profit, as well as entertainment, and others will find it not uninteresting.

UNIVERSAL ELECTRICAL DIRECTORY (J. A. BERLY'S). London: H. Alabaster, Gatehouse & Co. 1900. Pp., 1,271, 6x9½. Price, in England, 7s. 6d.

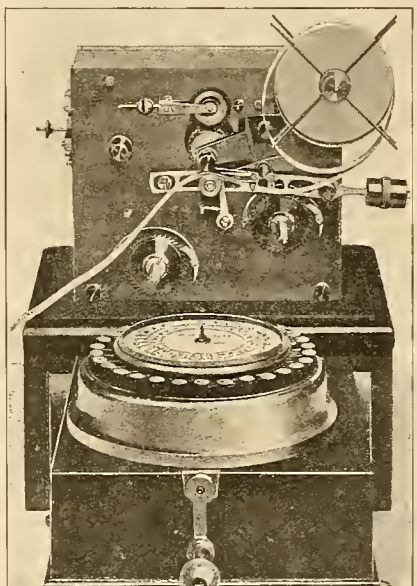
This is the nineteenth year of publication of the well-known "Red Book," which gives a directory of electrical addresses for Great Britain, India, the British Colonies, America and the Continent, with much other valuable information. In the preface it is stated that the capital involved in electrical undertakings in Great Britain alone is £105,997,719. The book is valuable as a work of reference. It is already announced that the 1901 edition is in course of preparation.

At a meeting of the St. Clair County board of supervisors at Belleville recently an application for franchise to connect East St. Louis, Lebanon, O'Fallon and French Village with an electric road was made by A. W. Morris, S. Smiley, J. C. Eisenmeyer and R. H. Horner.

Steljes Typewriting Telegraph.[1]

Two factors affect the design of type-printing telegraphs—two factors which appear to a great extent antagonistic, viz., speed and simplicity. The ingenious Hughes instrument is valuable for public-telegraph service, but the speed is attained at the expense of complication, which not only makes the instrument costly, but necessitates the employment of a skilled operator. In the latest addition to this class of instruments the mechanism and action are reduced to extreme simplicity compared with that of the Hughes instrument; but the speed of working is slow, viz., that of the Wheatstone A B C instrument, which is estimated by Preece and Sivewright to be 20 words a minute in the hands of very expert manipulators, but in ordinary practice to fall short of 10 words, and in the average not to exceed five words a minute.

The Steljes type-printer is, in fact, a modification of the A B C receiver, by means of which the letters, instead of being merely momentarily recorded by a pointer, are printed on a tape. An ordinary Wheatstone A B C transmitter is employed, of the pattern still in use by the British Postoffice in many rural offices. It is only necessary here to refer briefly to the action of this well-known instrument—shown in the lower part of the illustration. On turning the handle in front, the armature of a simple magneto generator is revolved, and slowly alternating currents are sent to line, the pointer on the dial moving around from one letter to the next for each alteration. The key opposite to the desired letter is depressed, and the pointer is stopped on reaching the corresponding position, while at the same time the current to line is cut off. In the Wheatstone pointer receiving instrument, the pointer moves in synchronism with the pointer of the transmitter, by means of the alternating currents; in the Steljes instrument a type wheel takes the place of the pointer. The escapement driving the type wheel is moved by a pair of electromagnets similar to those of a magneto bell, the power being obtained by a weight (or if greater portability is required, by a spring, as in the illustration). The type wheel is double, the rim of one disk containing 30 letters, and the other containing numerals, etc.



STELJES TYPEWRITING TELEGRAPH.

A simple mechanism is employed to move the type wheel against the paper tape at the moment the current stops. In addition to the escapement magnets and armature, there is a very light aluminum armature attracted by a non-polarized magnet, which is traversed by the alternating line current. The reversals of the current are sufficiently sharp to keep this armature attracted until the current stops. At this moment, which is, of course, the one at which the type wheel is in the position for printing the desired letter, the armature drops and permits a cam at the end of a train of wheels (driven independently of the other escapement train by a weight or spring) to make a complete revolution. The cam, as it turns, lifts the arm holding the roller over which the paper passes, presses it momentarily against the type wheel and releases it again. On the downward movement of this arm, a click fixed in the frame engages in a ratchet, and this turns the printing roller one space forward, leaving the paper ready for the next letter.

For setting all the instruments to zero there is an arm placed friction-tight on one of the wheels in the type-wheel train, which is knocked down each time the printing lever is worked, so that if the type wheels are allowed to go two or more revolutions without printing, all the instruments will be brought to zero.

The arrangement for moving the type wheel parallel to its shaft for printing either letters or numerals is as follows: At right angles to the type wheel, and rotating with it, is a blade with a nose, and the type wheel is kept up against this blade by a light spring. When the zero key is depressed the printing lever comes in contact with this blade, and presses upward, and the type wheel prints on the letter band. If the key opposite the zero key (between the letters N and O) is depressed, however, the blade is pushed up, and moves the type wheel forward parallel to its spindle, so that the numerals, instead of the letters, come in position above the paper.

The instrument has, we understand, undergone a trial of several months at the Postoffice (in whose service Mr. Steljes formerly was), and has been used successively on several underground circuits in different parts of London—the longest being from Hampton to Westminster through three intermediate stations. It has also been tested on a 200-pound copper overhead-telephone circuit between London and Manchester, with an additional resistance of 2,000 ohms in series. The Belgian government has also tried it with good results, we are informed, on some of their lines which are employed for simultaneous telegraphy and telephony. Steljes instruments, although not adopted by the Postoffice for general telegraphic service, have been put in on several private lines. They are also included in the official exhibit of the British Postoffice at the Paris Exhibition.

1. From the London Electrician.

Electrolysis Ordinance in Chicago.

Acting in collaboration with City Electrician Ellicott, the committee on judiciary of the Chicago City Council prepared and recommended for passage the following ordinance to meet the electrolysis problem in this city. The ordinance was passed by the council July 16th.

Section 1. Every person, firm or corporation operating, owning, or controlling any surface or elevated railroad or any street railway within the city of Chicago, upon which cars are now or hereafter operated by electricity as a motive power, with a grounded-return circuit for conveying the electricity, shall install and maintain a metallic-return circuit of such cross-section and conductivity for conveying the electricity so used as a motive power, that the maximum difference of potential will not at any time exceed one volt between any part of such metallic-return circuit and any water pipes, gas pipes or other metals not installed for the purpose of forming a part of such metallic-return circuit, and that there will not be a variation in difference of potential exceeding one-half volt between any two measurements made at the same time at points along and upon said metallic-return circuit within a distance of 300 feet or less from each other. Such metallic-return circuit shall be installed and maintained in accordance with the provisions of the general ordinances of the city of Chicago, now or hereafter in force.

Sec. 2. Such metallic-return circuit shall be installed and in use within one year from the date of the passage of this ordinance.

Sec. 3. Every person, firm or corporation who violates the terms of this ordinance, or who fails, neglects, or refuses to comply therewith, shall, upon conviction of any such violation, failure, neglect, or refusal to comply, be fined not less than $100, nor more than $500, and such person, firm or corporation shall be deemed guilty of a separate and distinct offense for every day during which such person, firm or corporation violates, fails, neglects, or refuses to comply with any or all of the requirements of this ordinance.

Sec. 4. This ordinance shall be in force and take effect from and after its passage and publication in the manner prescribed by law.

Spider-web Leakage on Telegraph Lines.

A peculiar and interesting source of trouble on long-distance telegraph lines is reported from the Argentine Republic. According to the New York Sun, the country is full of a small variety of spider, which spins a long floating web, and these webs settle on the wires in great quantities. This causes little trouble until a shower or a heavy dew moistens these webs, and then every web becomes the source of an extremely small leak. The effect of thousands of these leaks is quite perceptible, and it is said sometimes almost stops operations. It is reported that, as a last resort, the government has decided to run an underground cable 150 miles long on the important line from Buenos Ayres to Rosario, although why an overhead cable would not answer is not explained.

The new owners of the Home Electric Light and Power company of Elkhart, Ind., held a meeting a few days ago and elected the following-named officers: President, H. L. Crawford of New York; vice-president, P. F. Thompson of New York; secretary, James DuShane of South Bend, Ind.; treasurer and general manager, A. M. Barron of Elkhart. The above, with C. H. Tenney of New York, constitute the directorate.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

Among the interesting suggestions relating to the possibilities of the Philippines is the statement that the islands is the proper place to grow guttapercha cheaply and profitably. This assertion is not made by some optimistic American expansionist, but is found in a work just published in Germany and mentioned by United States Consul Hughes of Coburg. The writer notes that the supply of guttapercha is almost exhausted, owing to the reckless and primitive way in which the trees were treated in Sumatra and Borneo, whence the principal output has come. As these trees will flourish in only a very few places, the question has become serious. The book adds that the Philippines supply the proper place to grow guttapercha cheaply and profitably. If this is a truthful statement, as seems likely, it is of much importance to the wire insulators of the United States, particularly in view of the growing importance and encouraging outlook for the submarine-cable manufacturing industry in this country.

That was a graceful reference to the approaching reunion in Chicago of the soldiers of '61 which was made by President Roach in his recent circular to the employes of the Chicago Union Traction company. "Next month," said Mr. Roach, "you will meet with thousands of strangers from all parts of America, here to attend the annual encampment of the Grand Army of the Republic. I wish particularly to request that each of you take pains to act in so gentlemanly a manner that any visitor who patronizes our lines will carry away with him a pleasant memory of courteous treatment at your hands. Give them any assistance in your power so as to make their visit to Chicago a pleasant one." The ranks of the Grand Army are thinning rapidly now, and it is the agreeable duty of all good Americans to make the declining days of the veterans days of pleasantness and peace. It is, of course, "good business" for the employes of street-railway companies to treat all travelers courteously; but Mr. Roach's particular reference to the Grand Army was nevertheless pleasant and timely.

Trolley-car riding has many advantages, of course, but that it may be resorted to as a soporific is a lately discovered benefit. However, a Louisville physician, who is said to have made a careful investigation of the subject, advocates it as a cure for insomnia. "Two hours before bedtime," this doctor is reported as saying, "put on your most comfortable clothes, your easiest shoes and your least choky collar. Then walk to the nearest car line, take a front seat in the first open car that comes along, and sit there till time to go to bed, riding from one end of the line to the other, with the cool night wind blowing in your face. An hour's street-car riding scarcely ever fails to bring on a feeling of drowsiness, and it has actually been able to bring sleep to the most nerve-wrecked of insomniacs." Truly, this is not an uninviting programme for a hot night, and one which many persons carry out merely for pleasure riding, with no thought of the sleep-inducing adjunct. After the buffet street cars that were lately proposed come into being, we may, perhaps, further enhance the comforts of street-railway travel by putting sleeping-cars on the lines.

Readers of the Western Electrician who remember the interesting article on "The Electrolysis Problem in Chicago," by Mr. E. B. Ellicott, the city electrician of Chicago, published in this journal on February 10th last, will be interested in the knowledge that an ordinance embodying Mr. Ellicott's ideas, as therein expressed and as previously embodied in the franchise of the Northwestern Elevated Railroad company was introduced in the City Council and passed last meeting. The text of this ordinance is given on another page. As will be seen, it limits the maximum difference of potential between the return circuit of any electric-railway company and adjacent metallic substances to one volt, with the added provision that the variation in potential shall not exceed one-half volt between any two points in the return circuit within a space of 300 feet, measuring along the line of the railway. To some electric-railway men the requirements of this ordinance will seem rather severe, but Mr. Ellicott contends that every electrical company is morally bound to provide a complete return circuit for its current, using an insulated return, rather than a grounded circuit, if necessary. However, the ordinance recognizes grounded circuits and allows a slight leakage, provided the escaping current is not concentrated in any one spot with sufficient potential to do damage to water pipes or other buried metallic structures. The railway companies will be able to meet the requirements of the new standard without great difficulty by a more liberal use of copper, and some of them will need to make no changes in construction.

Race distinctions are proving troublesome to the street-railway men of Virginia. In last January the Legislature of that state passed a law requiring separate cars for negroes on all "railroads propelled by steam"—the law familiarly known as that requiring "Jim Crow" cars. The statute went into effect on July 1st and it is feared that electric roads are included in the classification of those "propelled by steam," for some lawyers have declared that it makes no difference whether steam is used in the power house or on a locomotive. Of course, water-power systems are exempt, and for that reason, if for no other, the intent of the Legislature is in doubt. However, most of the electric-railway companies are complying with the law in some way, either by trailers or by a "every-other-car-for-negroes" rule. Of course, the law, if upheld in relation to street railways, will ultimately result in less-frequent service for both whites and blacks, because most of the companies cannot afford to add any more cars, and if the existing number must be divided between two classes of service, the frequency must suffer. The original idea of the law was for application to sleeping-cars on steam roads. However, if the street-railway patrons on Virginia lines think the change is an improvement in spite of the poorer service that must inevitably result, it is not for the people of other states to object, although the Virginia street-railway managers are deserving of sympathy these days, confronted, as they are, with a ruinously expensive policy of increasing car mileage on one hand and the prospect of losing traffic through decreased frequency of cars on the other.

The importance of recording wattmeters on switchboards for measuring the total output of the station has been recognized more and more in the last five years, as a review of convention papers and discussions and actual inspection of central stations will prove. The necessity for the usual indicating instruments on the switchboard has been recognized from the first. But there is one very important consideration, which, in the case of far too many central stations, both large and small, receives but little attention. And this is the importance of keeping all switchboard instruments correct, so that their readings will be of some practical constant value. Once an instrument is placed on a switchboard, very few persons, except those conversant with electrical-instrument making, who know the chances for error to creep in, will give the question of the accuracy of the instrument another thought for years.

While it would be far from true to say that most switchboard instruments, both indicating and recording, are unreliable, it is well known to those familiar with such instruments that many circumstances may arise that will alter their readings and that it is not safe to depend on their accuracy, unless they are compared at regular intervals with some standard instrument and recalibrated. Such regular comparison of station instruments with standard portable instruments is a part of the regular work of the testing department in a large company. It is not necessary, as a rule, to take down any of the station instruments for correction, as the slight changes necessary to make them give correct readings can be done usually with the instrument on the board.

The greatest difficulty in small stations is in getting correct portable standards. However, in this day and generation, there are several reliable portable instruments that even the smallest central station should have, and these, if well taken care of and compared with other standards whenever possible, will furnish a good basis for keeping the regular working instruments correct. In the working of a central station dollars and cents depend on the accuracy of the voltage and output measurements, and if these measurements are not correct they are hardly worth taking.

Improved Induction Coils.

By James Asher.

For a long time electricians have earnestly striven to invent means whereby sparking might be suppressed at the current interrupter of the induction coil. These efforts have hitherto been attended with but comparatively little success. A condenser, consisting of many sheets of tinfoil, insulated from one another by paper and paraffine, in a big box beneath the larger instruments, is employed in order to diminish sparking at the interrupter, and thereby to increase the length of the spark from the secondary coil of fine wire.

The writer will herein describe several simple, original methods of suppressing sparking. In none of these is a condenser employed.

Several methods of winding straight electromagnets will first be considered. The first and fourth methods are believed to be original, and the rest are not generally known. The primary wire and the core of an induction coil should be regarded as constituting a straight electromagnet. It is well known that when the ordinary winding is used on an electromagnet furious sparking occurs at the interrupter or contact breaker, at each breaking of the circuit. Sparks are generated also at each closing of the circuit, but these sparks are comparatively small. Sparking at the interrupter is due to the currents of self-induction, or extra currents, in the wire which is wound around the core of the electromagnet. At closing the circuit these currents oppose the current from the battery, but at breaking the circuit they flow in the same direction as the current from the battery. These extra currents are of considerable tension. The powerful sparking injures the contacts of the current interrupter.

First Method.—Two insulated wires of the same length and kind are wound as one strand on the bobbin throughout their entire length. The two ends of one of these wires are firmly fastened together. The two ends of the other wire are connected with the interrupter and the battery in the ordinary manner. The extra currents in the winding, which is connected with the battery, are completely annihilated by the induced currents, which are generated at their expense in the closed winding, which is similar and similarly situated to the winding, which is connected with the battery. Hence we have no sparking at the current interrupter.

Second Method.—This was invented by Carlier. It consists in simply winding the bobbin with bare copper wire and separating each layer from the next by paper. When electric currents of low voltage are employed the lateral contacts of the coils of wire are sufficiently imperfect to prevent much passage of current from the battery by direct flow from coil to coil, while they easily allow the lateral passage of the extra currents which are always of comparatively high tension. These become self-canceled in passing through the coils of bare copper wire. Du Moncel states that this method is very effective, and he expresses his surprise that it has not been more frequently employed. Perhaps if the wire were dipped into very thin varnish before winding we might use the magnet in connection with a battery capable of generating a current of high voltage.

Third Method.—The magnet has two separate windings of the same length and of the same kind of wire. These two wires should be wound together as one strand on the bobbin throughout their whole length. The two ends of one wire are fastened to the terminals of the battery, consequently there is a closed circuit in this winding during the whole time of operating the electromagnet. The two ends of the other wire are connected with a circuit interrupter and the battery. The interrupter in this case must either be operated by hand or by some other suitable external method. The connections of the two wires are made in such a manner that the current in the winding connected with the interrupter flows round the core in the opposite direction to that of the current in the other winding which is connected with the battery. The two equal currents, passing round the core in opposite directions, fail to develop magnetism in the iron. On opening the circuit of one of the wires the core becomes magnetized. The effect on the core is directly opposite to that in the common method. We get absolutely no spark whatever, either at closing or at breaking, according to Professor Silvanus P. Thompson.

Fourth Method.—Two insulated wires of the same kind and of the same length are wound as one strand on the bobbin. The first two ends of the wires are fastened to a wire which extends to one binding-screw of the battery. The last two ends of the wires are fastened to a wire which extends, by way of the interrupter, to the other binding-screw of the same battery. The extra currents in the two windings at breaking circuit are neutralized by their mutual reactions.

Fifth Method.—This is a simplification of Billet's winding. Du Moncel described Billet's winding in his book which is entitled "Electricity as a Motive Power." Instead of a two-legged electromagnet like Billet's we need for our present purpose a straight electromagnet. We begin at the middle of the bobbin and wind, say, from us enough wire on the left half of the bobbin. We next wind an The unbroken wire at the middle of the bobbin is fastened to a wire which extends to one binding-equal length from us on the right half of the bobbin, screw of the battery. The two ends of wire at the ends of the bobbin are fastened to a wire which extends, by way of the interrupter, to the other binding-screw of the same battery. The extra currents at breaking circuit are suppressed by mutual inductive reactions in the two windings. The weak extra currents at closing circuit, however, are not destroyed by this method. Consequently, a small spark appears on closing circuit.

Sixth Method.—This was invented in England by Langdon Davies. Each wire is wound as only one layer, and the ends are allowed to slightly project. After all the layers have been wound the separate ends, at one end of the bobbin, are joined to a wire which forms one terminal of the battery, while the separate ends of wire at the other end of the bobbin are joined to a wire which constitutes the other terminal. On interrupting either terminal the sparking is found to be weaker than is usually the case. The extra currents in the different layers are not quite simultaneous, because the length of wire is not the same in any two layers.

Seventh Method.—This was invented by an American named Paine. After winding each layer of wire around the bobbin a thin sheet of metal, usually so thin that it may be regarded as foil, is wrapped around the layer. At breaking circuit the extra currents in the wire develop currents in the sheets of foil and in the opposite direction. In consequence sparking at the interrupter at each closure of the circuit is greatly diminished.

Eighth Method.—A sheet of copper is wrapped aronnd the bobbin before winding wire thereon. At breaking circuit induced currents are generated in the copper sheath. The sparking is considerably weakened. This method was either invented or adopted by Mr. Brnsh.

The core of an electromagnet, especially when used as the heart of an induction coil, should consist of a great number of the purest and softest iron wires. I think that these should not be round and in metallic contact with one another, as is usually the case, but that they should be square and laid in neat rows in the hollow bobbin, after having been dipped into thin varnish. If we use square wire we can introduce about one-fifth more iron into the hollow bobbin than we could by using round wire. Having insulated the wires of our core by means of varnish, we shall find almost no loss of energy due to eddy currents in the iron core. A further improvement for use in induction coils consists in making the core about 40 per cent. longer than the secondary coil. Gooding stated that the spark from the secondary coil could be increased in length from 1½ to three inches by this improvement alone.

We may now suppose electromagnets constructed according to the methods herein described to be surrounded with a bobbin of fine, insulated wire, to constitute improved induction coils. The cores should consist of square, varnished, soft iron wires, laid in neat rows, and the core should be 40 per cent. longer than the secondary coil.

The methods herein proposed enable us to entirely dispense with the clumsy condenser.

Third Rail in B. & O. Tunnel.

The third rail will replace the overhead-trolley construction used for conducting current to the heavy electric locomotives in the Baltimore and Ohio railroad tunnel at Baltimore. The overhead construction on this work was quite elaborate, consisting of two channel irons, forming a trough, through which the trolley shoe slid. The third rail will probably be simpler and easier to keep clean. The rail to be used will weigh 75 pounds to the yard, and a plank will be laid alongside the rail to protect it, the edge of the plank being higher than the top of the rail. In stations and at crossings the rail will be charged in sections, being dead except under a train, on the Murphy system of construction.

An election will be held at Westplains, Mo., on July 28th to vote on the question of issuing $27,500 in bonds for an electric-light plant.

Illinois State Electric Association.

It is hoped that a large proportion of the electric-lighting companies of the state of Illinois will become members of the new Illinois State Electric association before the annual meeting in Peoria, on November 27th next. Applications for membership should be addressed to H. E. Chubbuck, Quincy Gas and Electric company, Quincy, Ill. The association was organized in Springfield on April 24th for the mutual benefit of those engaged in the manufacture and sale of electric current in this state. The membership, to quote the constitution, "shall consist of the Illinois electric-light companies or individual owners of electric-light plants doing a general commercial-lighting business from a central station; but no person or company operating an isolated or block plant shall be eligible to membership." The membership fee is $5 and the annual dues are the same amount. The following-named gentlemen signed the roster at the organization: H. S. Greene, Morrison Electric Light and Power company; E. B. Hillman, Warsaw Electric Light company and E. B. Hillman & Co., Barry, Ill.; E. P. McClure, Rushville Electric Light company; L. A. Ferguson, Chicago Edison company and Commonwealth Electric company, Chicago; R. L. Allen, Economy Light and Power company, Joliet; C. E. Hay, Springfield Electric Light and Power company; H. E. Chubbuck, Quincy Gas and Electric company; C. L. Gerould, Galesburg Gas and Electric company; X. Caverno, Kewanee Electric Light and Power company; W. A. Bixby, Decatur Gas and Electric company; W. B. McKinley, Urbana and Champaign Gas and Electric company; C. A. Vallette, Edwardsville Electric Light and Power company; W. E. McCullough, Beardstown Electric Light and Power company; B. G. Smith, Kankakee Electric Light company; G. R. Sever, Milford Electric Light and Power company; J. S. Daily, Chillicothe Electric Light and Waterworks company; D. Davis, Litchfield Electric Light and Power company; H. J. Frith, Watseka Electric Light company; C. H. Langford, Paxton Electric company; J. J. Frey, Hillsboro Electric Light and Power company; J. N. C. Shumway, Taylorville Electric company; J. D. Gerlach, Chester Light, Water and Ice company; E. X. LeSeure, Danville Gas, Electric Light and Street Railway company; C. R. Robinson, Wenona Electric company; J. C. Robinson, Atlanta Electric Light and Power company; R. H. Abbott, Petersburg Electric Light plant; H. M. Warner, Centralia Light and Power company; W. J. Day, Bement Electric Light and Power company; V. G. Fuller, Toulon Light and Power company; George D. Locke, Jerseyville Electric Light, Gas and Power company; S. J. LeFevre, Gibson Electric plant; F. D. Crane, Mount Sterling Electric Light and Power company; George E. Macomber, Peoria.

Officers and committeemen were selected as follows: President, J. D. Gerlach, Chester; vice-president, E. B. Hillman, Barry; secretary, H. E. Chubbuck, Quincy; treasurer, D. Davis, Litchfield; executive committee, E. X. LeSeure of Danville, W. B. McKinley of Champaign, R. L. Allen of Joliet, H. S. Greene of Morrison, D. C. Copley of Aurora; committee on insurance, B. G. Smith, J. C. Robinson and J. J. Frey; committee on program for Peoria meeting, C. H. Langford, H. M. Warner and J. N. C. Shumway; committee on coal, freight rates and transportation, J. S. Daily, V. G. Fuller and Charles E. Hay.

Rumors of Consolidation.

The Stanley Electric Manufacturing company of Pittsfield, Mass, it is rumored, is taking steps to combine with the Northern Electrical Manufacturing company of Madison, Wis. In connection with the report is given a statement in the Springfield (Mass.) Union of July 11th, in the Pittsfield correspondence of that paper, to this effect:

Announcement was made yesterday that the Stanley company had been successful in negotiating with a large electrical concern in Madison, Wis., for a consolidation. The western corporation is capitalized at about $500,000 and it is one of the most substantial electrical companies of the West. It is understood that, with this coalition, the capital stock of the Stanley company is to be increased by $500,000. It has been known for several weeks that F. W. Roebling, the principal owner of the stock of the company, and Dr. Perrine were negotiating with a western concern with a view to consolidation, and Dr. Perrine recently took a trip for the purpose, so it was understood, of completing the negotiations. When seen last evening about the matter he said he had nothing to make public at present.

There are also other rumors of the prospective consolidation of several electrical manufacturing companies, and the names of both eastern and western companies have been mentioned. The reports are of a vague character, however, and may be unfounded.

Word comes from Elizabeth, N. J., that the Union County Board of Freeholders has accepted the proposition of Senator John Kean to build a double-track trolley road and 100-foot boulevard from Elizabeth to Cranford, seven miles.

DEVELOPMENT OF THE TELEPHONE FIELD.

Notes from Ohio.

The ruling of the attorney-general in regard to the value of the instruments of the Bell Telephone company for taxation has caused considerable comment among the people, and he was compelled to make a statement as to how he arrived at the valuation. He said that the testimony submitted to him showed that the average net rental of the instruments was only $2.90 a year, and that the average life was four years. He estimated the present worth of all the instruments to be $10.35. There are reports from different parts of the state that the county auditors will pay no attention to the attorney-general's opinion in regard to the taxable value of the instruments, holding that no one has authority to fix a value but the county auditors. This idea they get from the practice of appraising railroads, it seems, where the county auditors make a trip over the lines once a year and have a good time, afterward making out a valuation which varies somewhat from year to year, but not enough to make any material difference. Word has been received from the Bell Telephone company that the valuation placed upon its instruments by the attorney-general will probably be accepted.

At Akron, Ohio, the city's police and fire-alarm wires will be placed in the Central Union Telephone company's conduits. The Standard Underground Cable company will furnish the cables.

The Newark (Ohio) Telephone company has made a proposition to put in an exchange at Utica, if 25 subscribers can be obtained. This company now has an exchange at Granville, and if the one is put in at Utica free service between the towns will be given.

There seems to be a plan on foot among the officials of the Pennsylvania Railroad company to adopt the telephone for use along its lines for many purposes. It is said that a complete system will be installed along the main lines and many of the principal branches, the wire being strung on special arms attached to the poles that are already in use for the telegraph wires.

At a meeting held a few days ago the physicians of Akron decided to use the service of the People's Telephone company after August 1st. There will be no double use of the two systems, but the new telephones will be used exclusively. They added strength to the action by deciding that there would be no change, no matter what inducements might be offered by the old company.

The Home Telephone company of Cambridge, Ohio, has moved its exchange to Eighth street, opposite the court house, where there are more advantages than in the former location.

The Home Telephone company of Portsmouth, Ohio, is building a tower at the foot of Washington street, that city, for the purpose of stringing wires across the Ohio River.

Some of the druggists of Columbus suggested the plan of keeping both the Central Union and Citizens' instruments in their stores on the pay-station plan, but the majority favor the Independent company, and its system will likely be the one adopted by all.

The Columbiana County Telephone company has filed articles with the secretary of state, notifying him of an increase of capital stock from $200,000 to $300,000. The meeting was held in the Electric building, Cleveland, on June 14th, when the action was taken.

Since action was taken at Columbus by the grocers and physicians adopting the Citizens' telephone service, that company has had a busy time. Many other persons have changed in order to avoid confusion, and, as a result, the new company will have a larger business than it would otherwise have obtained.

W. A. Jackson and M. J. Carney, respectively president and general manager of the Central Union Telephone company, were visitors at the Columbus, Ohio, office last week. O. M. C.

London (O.) Telephone Company.

The second annual meeting of the London (Ohio) Telephone company was held last week. The company's lines now ramify Madison County, and have connections with all the cities and important towns surrounding. The company has over 800 subscribers, over 400 being connected with the London exchange. The Plain City Home Telephone company's line between London and West Jefferson has been purchased by the company and will be put in first-class condition at once. The London Telephone company's system, with the various farmers' lines in Madison County, has been a source of great convenience and benefit to the people of the county, and is highly appreciated by them. The regular quarterly dividend was declared at this meeting and the following-named directors were elected for the ensuing year: Ed. L. Barber of Wauseon, Ohio, and William M. Jones, R. W. Boyd, J. L. Haner and A. S. Bell of London. The board of directors organized by electing William M. Jones president, R. W. Boyd treasurer, and F. W. Peirce secretary and manager.

The Bell Telephone company, at Columbia, S. C., is expending about $20,000 on its new plant, which will be completed by September 1st.

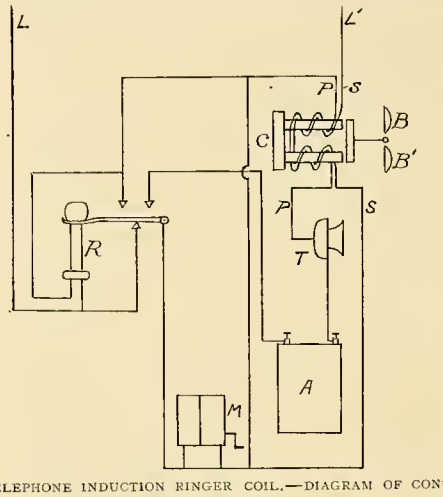
Te lephone Induction Ringer Coil.

By F. X. Wolfe

The writer has devised an apparatus, which he has called a telephone induction ringer coil, that he deems of sufficient interest to telephone men to merit a description. The apparatus consists, essentially, of an induction coil separated in two equal halves, the two halves being fastened to a soft-iron yoke, which in turn is mounted on an ordinary magneto bell-ringer frame, with the laminated-iron cores facing the pivoted polarized armature. This induction ringer coil has a double effect, viz., the transmitting of speech with the same winding that magnetizes the cores which ring the bells.

The accompanying diagram shows the induction ringer coil represented by (C). The primary winding (P) is connected in series with the transmitter (T) and the battery cell (A). The secondary winding (S) is connected in series with the receiver (R) and outgoing lines (L) (L') when speaking, and in series with the magneto (M) when signaling, the bells being represented by (B) (B').

Such a combination as this simplifies the telephone. It requires less material and labor in its manufacture, fewer parts to become defective, and it is easily repaired. The induction coil arranged in this manner has a higher inductive effect and



TELEPHONE INDUCTION RINGER COIL.—DIAGRAM OF CONNECTIONS.

therefore requires less wire for the same purpose than the common separate induction coil needs in practice at the present time.

It was the writer's intention (in theory) to make the induction ringer coil a combination of three pieces of apparatus in one, for the purpose of discarding the magneto generator, but when put to trial it was not found to be efficient enough to be of any practical value. This was on account of the induced wave length in the secondary being too short to give the pivoted polarized armature the necessary vibration, when sending a slow alternating battery current through the primary winding by a simple fiber disk wheel, arranged with alternate connections and sliding contacts. The increase of the induced electric wave length to twice the original length would ring the bells admirably, by arranging the primary winding and the disk wheel so there would be a longer sweeping of the lines of force across the secondary. This arrangement, however, is of no practical value for the present, as it brings to the telephone more complication and requires more cells.

Farmers Get Market Prices by Telephone.

A dispatch from Clarinda, Iowa, says: "The new rural telephone system, which was recently brought into this city from Villisca, 15 miles away, and which has 40 farmers as subscribers and owners of the line along the route, is being utilized by them as a market reporter each morning. They have an arrangement with persons in this city to call them up all along the line each morning and report to them the price of live stock, etc., at Chicago, South Omaha, and other large cities, on the day before, so that they can determine whether or not to take their stock to town to sell it immediately, or wait a day or two. When the farmers get their rural mail route through that route, they will have all the advantages of city life, without having to pay the town taxes or surrendering their freedom."

The South Carolina Telephone company will soon begin business at Columbia, S. C., with not less than 200 subscribers. The Bell Telephone company in the same city is making extensive improvements.

National Telephone and Telegraph Company.

A new $50,000,000 company has been added to the long and rather bewildering list of telephone companies. It is the National Telephone and Telegraph company, and it was incorporated at Trenton, N. J., on July 10th. The company is empowered to construct and operate telephone and telegraph lines in New Jersey and other states, as well as in foreign countries. The company is also empowered to conduct a system of telegraphing without wires, and to deal in telegraph and telephone materials. The incorporators are Joseph B. McCall, A. Lowden Snowden, Harry J. Verner and J. F. Sullivan of Philadelphia and Heulings Lippincott of Camden. The articles were filed by a lawyer who has filed all of the New Jersey incorporations of the companies organized by the Widener-Elkins-Whitney syndicate.

It is reported that this new company has been formed to take the place of the Telephone, Telegraph and Cable company of America, which was incorporated last fall with a capital of $30,000,000. It is asserted that one of the chief reasons for the new move is the desire of removing the assessment feature of the stock of the Telephone, Telegraph and Cable company of America. It is also said that the discovery was recently made that the latter company's charter gave it the right only to manufacture and use telephone apparatus, and did not empower the company to erect poles and string wires in the public highways. The new corporation will have the right of eminent domain in New Jersey and through subsidiary companies in other states also.

The Chicago Tribune prints a statement from its New York correspondent to this effect: "The creation of the National Telephone and Telegraph company is the initial step toward the consolidation under one management of the following great corporations: The Western Union Telegraph company, the Postal Telegraph company, the Commercial Cable company, the Bell Telephone companies throughout the world, the Telegraph, Telephone and Cable company of America, and the National Telephone and Telegraph company." It may be added, however, that this morsel of news will have a better relish if taken with a grain of salt.

James F. Sullivan, one of the incorporators of the new National company, is said to be vice-president of the Market Street National Bank of Philadelphia. He is thus reported: "The National company will buy up all the small companies in the United States that are not now controlled by the Bell or the Telegraph, Telephone and Cable company of America." When asked if the company had plans for a Pacific cable, Mr. Sullivan is alleged to have said: "In a general way lines to the Philippines, Hawaii and the Orient have been considered, but no determination has been reached."

Telephony in Railway Service.

In a recent communication to the St. Louis Railway Club E. A. Chenery, superintendent of telegraph of the Terminal Railroad Association of St. Louis, said:

The time is not yet ripe, and I question whether it ever will be, for railroads to dispense entirely with the telegraph in the handling of their business. That a great amount of matter now sent by telegraph might as well go by mail is as true as that a large amount of such business, in order to obtain quick results, could better be handled by telephone.

Great benefits are obtained at large terminals where adequate telephone facilities are provided. Delays in the placing of car orders, engine assignments, material orders, working directions and numberless other important matters which formerly resulted when the telegraph was used, seldom occur now since the advent of the up-to-date telephone system. The fault for the delays referred to is not necessarily always with the telegraph department, as seems to be the general impression. Messages often are dictated to a stenographer along with a bunch of letters, and in due course of time reach the hands of a messenger whose ultimate destination is the telegraph office, the messages finally landing on the operator's table, where they meet with delay again, the operator having a moment before "cleared" the office for which the same is destined, and the wire is now busy. All this time the sender of the message is waiting for a reply and blames the telegraph for the long wait. How much more satisfaction is there in the telephone method, when with one on your desk you call up your man, issue directions or get information desired in about the same time it takes to dictate a message after the manner first mentioned.

Several progressive railroads are recognizing the value of the telephone and are equipping their terminals with modern exchanges, they in turn connected with long-distance service, and each terminal brought in close touch with the general offices. When the value of such facilities becomes better known, the handling of the general business of a railroad will be greatly improved.

Bees in telephone terminal boxes in Brooklyn, N. Y., have been making it hot for linemen recently. The insects seem to take a great fancy to this new form of hive.

Telephone News from the Northwest.

The Norman County Telephone company is building a line from Ada, Minn., to Halstad, Hendrum and Perley.

The Southern Minnesota Telephone company is building a toll line from St. James, Minn., to Sherburn.

Lightning struck the telephone system at Crookston, Minn., and burned out a number of drops in the central office.

Beginning July 1st, Fargo, N. D., was made the exchange point for 30 long-distance wires of the Northwestern Telephone Exchange company.

The telephone company of Willmar, Minn., which canvassed Buffalo, Minn., with a view to establishing an exchange, was unable to secure enough subscribers to make it a success.

The office at West Bend, Wis., will have night service, as well as day, on and after July 1st.

The Little Wolf River Telephone company, which failed to furnish a bond in accordance with its franchise at Oshkosh, Wis., has now assigned the franchise to H. L. Sweet of Oshkosh. Mr. Sweet proposes to form a local company to establish an independent exchange, and will appeal to the council to give him an extension for that purpose.

The Iowa Telephone company (Bell) has started a telephone-rate war at Iowa City, Iowa. The Iowa company has an old-style exchange there. The Hawkeye Telephone company recently established a modern system and captured a good many of the Iowa company's subscribers. The latter has now cut rates to $1 for business telephones and 75 cents for residence connections. The Iowa company is also rebuilding its exchange.

The Hastings Telephone company has been granted a franchise in Prescott, Wis.

The Arcadia Telephone company is putting in a local exchange for Whitehall, Wis.

The Park Region Telephone company of Alexandria, Minn., has completed its toll line to Parker's Prairie, Minn.

A fire near the central office of the Northwestern Telephone Exchange company in Sioux Falls, S. D., burned off the wires and crippled the service for 12 hours. The repair men worked all night to straighten out the wires and had service again the middle of the next forenoon.

The Chamberlain Independent Telephone company has been formed at Webster City, Iowa, to absorb the Chamberlain exchange. Several toll lines will be constructed.

The Lamoni (Iowa) telephone exchange will run a farmers' party line southwest nine miles.

The Nebraska Telephone company has filed a statement with the State Board of Equalization in Lincoln, Neb., showing that it owns in real and personal property about $190,000, and has about 1,150 telephones in use in Lincoln.

The telephone exchange at Belmond, Iowa, has been sold to the Western Electric Telephone company.

The Johnson County Telephone company at Iowa City, Iowa, has completed toll lines to Lone Tree, River Junction, Hill's Siding and Riverside.

The Home Telephone company has nearly 150 telephones in operation at Ida Grove, Iowa.

The Hardin County Telephone company has been incorporated at Eldora, Iowa, with $50,000 capital stock. This is believed to be a move to acquire control of all the Independent telephone lines in the county, prior to a consolidation of the Independent companies of the state.

The Rolfe, Ia., telephone exchange has been completed and put in operation.

The Bishop Telephone company is constructing a new metallic circuit between Manchester and Dubuque, Iowa.

A deal has been completed at Nebraska City, Neb., whereby the Nebraska City Telephone Exchange company and the Telephone and Construction company, organized about 16 months ago, have passed into the hands of local capitalists.

The Inland Telephone company has completed toll-line connection with North Yakima, Wash.

O. G. Pratt, manager of the Hardin County Telephone company at Eldora, Iowa, was injured recently in a runaway.

The Bell Telephone company is rebuilding the exchange at Winnipeg, Man., and will substitute the central-energy system. A toll line is being extended to Portage la Prairie, Man.

The Sunset Telephone company is about to move its central office in Olympia, Wash., to new quarters, where new equipment will be put in.

There have been complaints of the service of the Mutual Telephone company of Des Moines, Iowa. There has been talk of changing the company to a stock company, but it is feared that it would be but a preliminary move to forming an alliance with the Bell interests. The company has announced that it is about to put in about $50,000 worth of new cables and other equipment for improving its service.

The East Valley Telephone company of Beechwood, Wis., plans several extensions of its system.

The Aitkin, Minn., council refused the Northwestern Telephone Exchange company a franchise for long-distance connections.

The Wisconsin Telephone company has been granted a franchise at Black River Falls, Wis.

Contracts are let for installing a telephone exchange for Beresford, S. D.

The Forman Telephone company has about completed extensive improvements to its system and the installation of a new switchboard at Wahpeton, N. D.

A number of improvements have been made to the local and long-distance service of the Northwestern Telephone Exchange company at Fargo, N. D.

The Northwestern Telephone Exchange company will put the wires in the business portion of town underground.

George A. Hughes has been granted a telephone franchise at Dickinson, N. D.

The Eastern Wisconsin Telephone company, which has recently consolidated with the Little Wolf River Telephone company, is about to build a toll line from Glenbeulah to Fond du Lac, Wis.

The Greene and Western Telephone company has begun work on a telephone system at Chaska, Minn.

The state Executive Council of Iowa is assessing the telephone companies of the state under the Blanchard law. The assessments are based on the mileage for the toll companies, the local exchanges being assessed separately. The assessment per mile ranges from about $10 per mile to as high as $226. The average is about $20 to $25 per mile.

There are 191 miles of telephone wires in Webster County, Iowa.

The state Board of Control of Iowa has contracted with the Stromberg-Carlson company for 132 telephones to be placed in the 12 state institutions under the board's management. These instruments will displace those now in use, which are generally of the Bell pattern. Negotiations have been going on since Christmas.

The city officials of Des Moines, Iowa, are waging a war against placing advertising cards on the telephone poles of the streets.

The Spokane and British Columbia Telephone company will extend a toll line from Molson to Loomis, Wash. There has been a race between this company and the Inland Telephone company to cover Northern Washington. The business men of that district are understood to have concluded to favor the Spokane and British Columbia company. The line will be continued to connect with the Okanogan country.

A local telephone company has been formed at Edgar, Neb., with S. W. Christy as president and W. L. Osborn as secretary.

The new telephone exchange at Red Lodge, Mont., has been completed and put in operation.

A force of workmen employed by the Wisconsin Telephone company at Green Bay, Wis., in rebuilding and extending the system, went on a strike. The foreman of the crew had some differences with the company and left. The crew then struck in sympathy, to force his reinstatement. The company arranged to fill the men's places with men from other cities.

The Mutual Telephone company of Creston, Iowa, has ordered materials for the new exchange.

The Central Telephone company has sold its lines in Pocahontas County, Iowa, to the Northern Telephone company.

The Rocky Mountain Bell Telephone company has begun work on an extension from Livingston to Big Timber, Mont.

Fifty telephone operators of the Sunset Telephone company at Seattle, Wash., went on a strike for higher wages recently. The girls are preparing to form a union.

The Iowa Telephone company has applied to the city of Lohrville, Iowa, for a franchise. R.

MANUFACTURERS AND DEALERS.

F. C. Brucknet, formerly of the Schmidt & Bruckner Electric company of New York, has organized the Bruckner Electric company to continue the manufacture of high-grade telephone equipments. The new company, of which Mr. Bruckner is president, has its general offices in the Electrical Exchange building, 136 Liberty street, and its factory and branch office in the Lexington building, 141-155 East One-hundred-and-twenty-fifth street, New York. Only first-class apparatus will be put upon the market by the new company, which starts out with excellent prospects. One new article to be introduced is a telephone transmitter especially adapted for central-energy systems.

The Texas Arm and Pin company, Beaumont, Texas, a well-known manufacturer of long-leaf yellow-pine cross-arms, pins and brackets, reports that it has built up an excellent trade among the telephone and telegraph companies of the United States. It may interest users of electrical woodwork to know that eight months ago this company began business with a second-hand machine in a broken-down factory, but now it has four factories equipped with the latest and best machinery, and is shipping more cross-arms, etc., than it expected. The company will be pleased to mail a neat pamphlet on the subject of cross-arms, pins and brackets to anyone on request, or it can be obtained by addressing the Buckner-Saunders Lumber company, Monadnock block, Chicago.

The Corning Telephone company has about completed a complete metallic-circuit exchange at Corning, Iowa, with 150 subscribers. It will have everything working in about two weeks. The local Bell company is offering service free or for whatever it can get.

Pittsburg and Vicinity.

The new West Penn Long-distance Telephone company is composed of the same people that control the Pittsburg and Allegheny Telephone company. As the charter of the latter company does not give it the right to operate outside of Allegheny County, the long-distance company was organized, to operate in 20 of the western and southern counties of the state.

The Pittsburg and Allegheny Telephone company is almost ready to give service in Pittsburg and suburbs. The new exchange on Seventh avenue is almost ready; a few minor details only remain to be completed. The great switchboard is installed, and the work of setting the instruments will require only a few weeks. In the East End and other sections of the city, work of laying subways is progressing rapidly. Contracts for several branch exchange buildings have already been let.

The Central District and Printing Telegraph company (Bell) of Pittsburg, at the last meeting of its directors, decided to erect a 10-story fireproof office building and telephone exchange at Fourth avenue and Cherry alley, which, when completed, will cost over $400,000. It is expected that the building will be ready for occupancy by April of next year. The purpose of erecting this additional building is to subdivide the downtown business district, in order to give better service and to accommodate the rapidly growing list of new subscribers to the system. One of the finest and largest switchboards ever made will be installed on the top floor, with a capacity for 8,000 lines.

The West Penn Telephone company of Washington County, Pa., has made some extensive improvements in its system recently. Small exchanges have been established at Middletown, Taylorstown, Independence, Cross Creek, Buffalo Village, Patterson's Mills and Burgettstown, with trunk lines connecting all the above-named towns. Connections have also been made with the Phœnix Telephone company of Steubenville, Ohio. Wellsburg Telephone company of Wellsburg, W. Va., and the Green County Telephone company, covering nearly all of Green County, Pa.

The Home Telephone and Electric company of Wilkinsburg, Pa., has strung a pair of wires on the poles of the Postal Telegraph company to the East End exchange of the Pittsburg and Allegheny Telephone company.

The capital stock of the Central District and Printing Telegraph company has been increased from $4,000,000 to $7,500,000. Over $2,000,000 of this is to be devoted to improvements in and around Pittsburg. The company has just completed a fine aerial cable system in Beaver Falls, Pa., and another is in the course of construction at Rochester, Pa.

Last week the Federal Telephone company completed exchanges in Charleroi, Esplen and Etna.

The Pittsburg and Allegheny Telephone company is applying for an ordinance in McKeesport, Pa.

The Federal Telephone company is applying for an underground ordinance in the city of McKeesport, Pa. The Central District and Printing Telegraph company has also applied for an underground ordinance in McKeesport, Pa.

Twin City Reorganization.

Details of the recent reorganization of the Mississippi Valley Telephone company are made public, as follows: Twenty-five persons will be asked to subscribe for $20,000 in stock, each subscriber to get $20,000 bonds as a bonus for the stock paid in. The sum of $200,000 to be used to pay off the debts of the company and to extend and equip the plant. The promoters of the plan are A. B. Jackson, attorney for J. C. Hubinger, and F. H. Moulton, cashier of the Farmers and Mechanics' Savings Bank, both of Minneapolis.

GENERAL TELEPHONE NEWS.

The Bell company is rebuilding its exchanges at Columbia and Charleston, S. C.

A dispatch from Houston, Texas, dated July 13th, states that practically all of the operating force of the Southwestern Telephone and Telegraph company's exchange at Houston was on a strike. The strikers' grievance is said to have been caused by the discharge of some of the girls for having joined the Electrical Workers' union.

The Mendon Center Telephone company for building a line from Mendon Center to Honeoye Falls, N. Y., has been formed with the following directorate: Edward H. White, Benjamin H. Cole, Albert A. Lord, George Finigan, Fred E. Lord, Louis B. Lord, R. Clive Harmon, Mardin Davis, William L. Terry and Vinton J. Townsend.

A Sioux City, Iowa, dispatch to the Chicago Record, dated July 13th, states that "E. A. Clark, manager of the Sioux City exchange of the Iowa Telephone company, is the inventor and patentee of an automatic switchboard which will do away with central offices, and the announcement was made in this city to-day that the Clark Automatic Switchboard company had been incorporated at Providence, R. I., with a capital stock of $1,500,000 for the manufacture of the switchboards."

Why Some Municipal Electric Plants Do Not Pay Better.

By Geo. D. Shepardson.

Part II.

Some Experiences in Municipal Plants.

From personal knowledge and the contributions of friends whose testimony is believed reliable, the following incidents are culled to show how the efficiency of municipal plants is less than called for by the theories of some political economists. (Private plants are far from perfect in their operation, and equally bad examples could be drawn from knowledge of their interior workings, were that subject under consideration at present.) The illustrations point the incompetence of those in charge of plants, the poor systems of records, the too-cheap economy in design and operation of plants, the low rates, the dishonesty of aldermen and the baneful effect of politics.

The state of the records kept in some of the municipal plants is almost incredible. In several towns there is no complete record of the service connections to the waterworks and electric plants. In one place a new superintendent found it necessary to shut off the water to enforce the payment of back water rents. There was no plat of the water mains or services. He therefore was compelled to open the streets and search for the cut-offs, for which purpose the services of a chain gang from the county jail, were secured. In another town, when the collector was getting a promise of payment from a merchant, he was requested to bring in the bill for the meter in the barn at the same time. The collector held his own council and discovered a meter with a number of lights, for which no record could be found. In that town, the only account books found were an electric-light book with monthly columns for accounts of customers and an individual account book for water consumers, there being no record of purchases, repairs or any other expenses. In another place, by a careful canvass of the town and examination of the lines, water and lights were added to the record of about $900 income a year, and no one knew how long they had been getting free service. In another place, where the rates are low and the waterpower leaks badly, so that it is necessary to spend several thousand dollars at once, the superintendent is confident that the plant is clearing about $800 net profits a month. In another town "there are no records and no system of accounts."

Closely allied to poor systems of bookkeeping is the incompetence of the city clerk or collector who has charge of records and collections. They do not understand the business, and naturally do not make it pay. "The collector knew practically nothing of the station working, was ignorant of the station output, amount of coal used for electric part of plant, etc." "Owing to inefficient and incompetent officers, all sorts of prices were charged for supplies and work furnished the city. For example, a plumber was paid $2.20 for a common valve costing 90 cents, and other items in proportion." In another place the innocent recorder was beguiled into paying a higher price for a new lot of incandescent lamps "because they had more watts than the kind formerly used."

The committees of the town councils are often green hands and of little value in administering municipal plants. In one place a former collector had been found short in his accounts, and a committee was appointed to check his work. After two days upon his books, they made a report on the shortage, which was made good, and the bondsmen were immediately discharged. Soon after, when the water rents came due, a number of people were found to have his receipts for dues which had not been credited on the books, but the man's bondsmen had been released, and the town had a considerable sum to charge to profit and loss. A committee went over a lot of old accounts and found that their predecessors had approved reports in which there were serious defects, but lest they should seem to reflect on the abilities of their friends, the superintendent was instructed to call it square and open a fresh account with each person whose accounts were found faulty in former reports.

A case recently occurred in a neighboring state to show how short-sighted some councils are in regard to franchises. A company applied for a franchise to furnish light and power from a waterpower not far away, intending to spend about $30,000 in the plant. After dallying along for some time the franchise was granted by the council, but vetoed by the mayor, who wanted a municipal plant. Although the town was already within $8,000 of its bond limit, it voted bonds in that amount to build a plant, hoping in some providential way they could put in a plant. In one town, where a committee of the council was supposed to keep track of matters, a superintendent managed to do away with over 1,000 lamp renewals in a single year, of which there is no account. Over $300 worth of fixtures sold without record were traced.

The superintendents of municipal plants are often incompetent. The superintendent of one plant where they still use 50-volt transformers, heard of the saving in using large transformers. So he bought one and tried to supply 50 lamps one block distant by a No. 6 wire. (Assuming one ampere per lamp and 400 feet to the block, would give a drop on the line of about 22 volts.) The superintendent was sure that No. 6 was large enough, for the insurance rules said it would carry it all right. The trouble was, therefore, in the transformer, and he compelled the agent to trade it for three small ones. The large one "did not regulate" as well as the small ones, and he is sure that the modern idea of large transformers with secondary networks is a mistake and a failure, for he tried it. In another town of about 4,000 inhabitants, a technically trained superintendent is saving about $5,000 annually above the records of his predecessors. In a smaller town a similar man is saving between $2,600 and $3,000 annually to the town on account of more skillful management. He increased the revenue by $100 in a single month by using better transformers and lamps, although the station output was 10 per cent. less. The station output was materially lessened by inspection of the circuits and tying up the lines where they had fallen upon the cross-arms. Incandescent lamps on flat rates, taking 58 to 70 watts, were replaced by 53-watt lamps, with marked economy. In another station the superintendent confided to an agent that he was bothered about learning the frequency of his alternator. The agent said it was too complicated a matter for him to figure offhand, but he would calculate it when he returned to his office. The agent found that the practice of his own company in similar cases was to use 125 cycles, and he reported that the superintendent had such frequency. As a matter of fact, it was 140, and the speed was marked on the machine. In one town the chief reason why one alderman voted in favor of one system against a lower bid was that his preference was the machine with "kilowatts," while the cheaper machine was a "multipolar" machine, and he preferred kilowatts to multipolars.

In the laudable endeavor to secure economy, the mayor and council frequently lose at the bung while saving at the spigot. This occurs both in the first purchase of the plant and in its later operation. After one town had voted to put in a lighting plant the mayor took a trip to learn what he could. After consulting with several agents and getting propositions from them, he called upon an engineer who was given to understand his services would be required. After spending some hours pumping him, the mayor left and went home, where he concluded that he was enough of an engineer himself to lay out the plant. So he bought some machines, hired a wireman, and the plant was put in. At another place a resident bought up some second-hand machinery, and after putting it into operation, sold it to the town for what it would cost when new. In a few weeks they had to spend about $100 for repairing the armature, and then had to buy a new machine.

At another place they decided to secure a cheap engineer to design their plant. He specified a 20-horsepower gasoline engine to operate a 600-light dynamo and in addition to drive the pumping machinery for the waterworks. The council made a contract for the gasoline engine as specified, including a proviso that if a steam plant was substituted, the gas-engine contractor was to receive a commission of 15 per cent. of the cost of steam plant. It is reported that this was actually done and paid. Two of the larger towns of the state were contemplating municipal ownership and each secured the services of an inexperienced young man to prepare plans and specifications for the plant, in one case because he was a friend or relative of one of the committee, in the other case probably because he was cheap. The country is full of "half-baked" electricians, who pose as engineers and as advisers to investors.

There is frequently an attempt to reduce operating expenses too far. At one place the council discharged a good engineer and hired another because he was cheap. Within three days he got his cylinder full of water and broke the girder of the Corliss engine. It is common, even with privately owned stations, to attempt economy by hiring cheap firemen, since anyone can shovel coal or throw wood. But owners fail to recognize that by paying $10 to $20 more for securing a capable fireman they are apt to save his wages several times over in reduced fuel bills.

In some cases there is great loss on account of downright dishonesty of the superintendent or the council committee. "A city employing an honest superintendent, with liberal pay and some backing in the council, will often prevent small and also large steals, which are almost invariably found in municipal departments, such as lamp renewals (on which it is difficult to keep accurate account or check), 'rake-offs' on purchases for the plant, for which in the end the city pays. One supply company offered a new superintendent as high as 20 per cent. on all purchases the year around, as it had always done so. This is substantiated by old bills. Lamps are checked up once a month while burning, and one is often asked to go easy in counting, being offered all sorts of bribes from cigars or drinks to considerable sums in cash. I know of officials receiving special concessions in this way amounting to several hundred dollars a year. All this could have been prevented by a proper system of checking, but at best comes down to one man being honest." "Carloads of wood have been sold 'by the car' by former superintendents. An investigation by an alderman indicated that a loss of over $1,000 a year had been sustained from that source alone." In another place the city recorder is said to collect the accounts, and sometimes sub-lets the job to his friends, who "knock down" about half and turn the balance over to the recorder, who in turn transmits to the treasurer so much of it as suits his convenience, there being no records and no other system.

The political conditions prevent best results in many plants. Where the employes are appointed by aldermanic influence it is not uncommon for an underling to retort to his superior officer when corrected for some shortcoming, "Oh, well, I have more pull than you have, and what are you going to do about it?" In one town until recently the plant was operated by two men—an engineer, who took care of the station, and a lineman, in charge of outside work. These men were not on speaking terms, and, of course, each attributed all troubles with the lights to the other man's part of the plant. This state of affairs continued for several years, during which time the arc system was in bad condition, the lineman attributing it to the dynamo, and the engineer laying it to the lamps. When a change was made, there were two applicants for lineman, one a good man who would have attended to business, the other a young son of one of the aldermen, with little experience or ability. There were also two applicants for fireman, one a good man and the other a lazy, good-for-nothing fellow, who claimed to have considerable influence in the country, so that he could turn considerable trade to some of the stores in which the aldermen were interested. By combining forces the poorer man was appointed in each case.

There is a continual struggle between the temperance and the saloon element in most of the towns, and when a new election puts the opposition into power, the superintendent is almost sure to lose his place in favor of some friend of the new management. In one town the superintendent had found the station accounts in very bad shape, and was getting them into fair condition, when the election went "wet." The next day the new mayor informed the superintendent that he would give him any kind of a recommendation he might ask for.

Conclusion.

The incidents noted above show that the question of the desirability of municipal ownership is one complicated by many elements that are often lost sight of by the advocates of municipal ownership. After all is said, the arguments must be modified by the "personal equation." It is largely a question of circumstances. A community, whether a hamlet or a metropolis, is a co-operative institution, and should be run on business principles. Some manufacturing concerns find the best economy and the most satisfactory results in making all of their product from the raw material. Others, differently situated with respect to plant and market, or with respect to character and constitution of the officers, find it more satisfactory to sub-let the contracts for the manufacture of parts, confining their attention principally to assembling and marketing. Each may be doing the best thing under the circumstances. In the same way, some communities may find municipal ownership to be more economical and satisfactory than private ownership. A much larger number than is generally supposed find it really better to purchase their lights from other sources.

[*The end.*]

Boston to Newport on One Charge of a Battery.

Everyone acknowledges that the storage-battery automobile is the ideal self-propelled vehicle for city service, or for any service where the mileage required does not exceed the capacity of one charge of its battery. People know that it is simple to run, makes no appreciable noise and no odor, and is, generally speaking, offensive to none except an occasional very green horse. In view of its acknowledged advantages for the service to which it has been considered that it is limited, it is interesting to note that during the last year some progress has been made toward the development of a storage battery capable of furnishing mileages on single charges two or three times greater than obtained previously. There seems reason to hope that the electric automobile will become as reliable and convenient a conveyance for ordinary runs between cities and towns and throughout the country as it now is for service usually confined to the limits of cities.

Recently one of the Electric Vehicle company's carriages was run on one charge of the battery from Boston to Newport over roads which made the distance 72½ miles. The total time consumed, including stops, was five hours and 18 minutes, and the average speed was over 14 miles an hour. The vehicle used was not designed for speed, and it was not attempted to make it. This run, however, with the other long runs recently made by electric vehicles, certainly indicates that the storage-battery carriage is not only the ideal automobile from the point of view of simplicity and convenience, but that it is also being developed into a vehicle which may be used for runs of under 80 or perhaps 100 miles on a single charge of the batteries.

Electric Power in Cement Works.

A comparatively recent application of the electrical transmission of power is in cement-manufacturing plants. Lathbury & Spackman, the Philadelphia consulting engineers, seem to be the pioneers in this particular branch of work. They designed what is believed to be the first electrical equipment of this character for the plant of the Alma Portland Cement company at Wellston, Ohio, and the installation was briefly described in the Western Electrician of February 24th last. The success attending the operation of this electrically-driven plant warranted the erection of plants with larger capacities to be operated exclusively by electricity. In consequence Lathbury & Spackman have now been retained to design works for the Detroit Portland Cement company at Fenton, Mich., on the Grand Trunk railroad, to have a capacity of 1,000 barrels of Portland cement a day and to be operated entirely by electricity. The various machines will be direct-connected to motors obtaining current from a central power house. Direct current at 220 volts will be used.

Another large cement establishment to be electrically equipped is Alsen's American Portland Cement Works at West Camp, N. Y., on the Hudson River, which is now building to have a capacity of 1,500 barrels a day. In this plant, also, electric power will be relied upon exclusively.

In efficiency and economy electric-power transmission has already demonstrated its superiority, and it appears to be the coming equipment for the cement industry. No doubt many new plants will be designed entirely for electric power, and it is probable that in the older plants electricity will be gradually substituted for other forms of power transmission.

Important Car-truck Patent Suit.

In 1897 John A. Brill instituted a suit against the Third Avenue Railroad company of New York for infringement of patent on car trucks employing elliptical springs between the body of the car and extension of the frames, in combination with spiral springs, as exemplified in 180 trucks purchased by the defendant company from the Bemis Car Box company of Springfield, Mass. The patent upon which the suit hinged was issued on July 5, 1892, to George M. Brill of the J. G. Brill company, Philadelphia. The trucks in question were the "Standard" trucks of the Bemis company. A decision has finally been reached in the case by Judge Shipman of the United States Court for the Southern District of New York in favor of the Brill company. It was held that the truck in question infringed all the claims of the patent and a decree with costs was ordered, with an accounting for damages and profits and an injunction issued against further infringement of the claims of the patent. The decision seems to affect a large number of trucks in use all over the country to-day and for years past. The lawyers for the complainant were Francis Rawle of Philadelphia, Frederick P. Fish of Boston and Joseph L. Levy of New York.

Chicago Inter Ocean Automobile Tests and Races.

The Inter Ocean of this city is organizing and promoting a series of automobile tests, exhibits and races to be held in Chicago, September 18th, 19th, 20th, 21st and 22d. The programme laid out is a most comprehensive one, and is intended to bring out, not only speed, but all the practical points of value possessed by different makes and types. The show will be held at the grounds and racetrack of the Washington Park Club, a place well fitted for it—both as regards accessibility, convenience in handling crowds of spectators and available space for the exhibits, tests and races. The complete programme has not been announced, but will be ready in a few days. A general outline of tests, races, etc., has been submitted to various manufacturers for suggestions, and the provisional programme will be modified in accordance with the suggestions received. The show, if as complete as indicated by the proposed programme, will be far ahead of anything of the kind yet held in this country, and if manufacturers co-operate, as there is every reason to expect they will, the expectations regarding the show will be realized. Prizes amounting to $10,000 will be awarded.

British Pacific Cable Project.

In the House of Commons on July 12th the secretary of state for the colonies, Mr. Chamberlain, announced that tenders for laying the Pacific cable will be invited immediately, the government of Canada and the various colonial governments interested having accepted the recommendations of the committee.

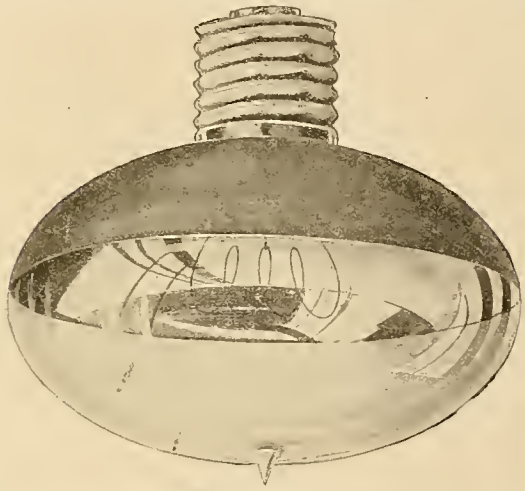
New Edison Reflector Lamp.

Much interest is taken in the possibility of a high-efficiency incandescent lamp consuming 2½ watts per candle or less. While the production of such a lamp is at present thought to be impossible in the regular type, the General Electric company has been able, by specializing the form of filament and lamp, and by the use of a reflector concentrating the light in one given direction, to increase the practical efficiency of the incandescent lamp to less than 1½ watts per candle per unit of light in useful direction.

This lamp is known as the reflector lamp, and is shown by the illustration. The filament is made in a four-coil spiral, so as to give the maximum amount of light from the tip end of the lamp. The umbrella type of bulb, with a reflecting surface behind, secures a threefold concentration of light in the given direction.

The reflector lamps are backed with a special reflecting composition, giving a highly polished mirror-reflecting effect. The composition is durable, and is not affected by the heat of the lamp. This backing can be furnished with an outside coating of India-red enamel, green enamel, copper bronze, gold bronze or aluminum bronze, to suit any style of decoration desired. The lower half of the lamp can be furnished either plain or frosted. The plain silvered lamp is best adapted to decorative lighting in show windows, and in ceiling and frieze lighting. For desk lighting, however, and for reading purpose, the frosted lamp is to be preferred.

These reflector lamps are very economical for conditions where a maximum amount of light is



NEW EDISON REFLECTOR LAMP.

wanted in one direction. With the brilliant and beautiful lighting effects possible with this type of lamp, there should be a wide field of use for it in theater, hotel, frieze, window and other forms of decorative lighting. A decided improvement has been effected in the case of the arc light by the use of a reflecting shade, concentrating the light in a useful downward direction. In the same way the reflector lamp secures great improvement in economy, by saving the light, which would otherwise be wasted in an upward and useless direction, concentrating it downward.

The lamps are made in two sizes—28-candlepower, consuming 38 watts, and 36-candlepower, consuming 50 watts, and can be furnished of any voltage or base desired.

Double-voltage System at Urbana.

The contract awarded to J. Holt Gates & Co. of Chicago for the new Urbana, Ill., electric-light plant provides for an installation with some unique features. There will be one 120-kilowatt and one 60-kilowatt Warren alternator, direct-connected to Ideal engines, each running at 250 revolutions per minute. This plant will be especially interesting, not only on account of direct connection for such small units, but also because each dynamo will have an output at 220 volts' alternating current (7,200 alternations) on one side of the machine and 2,200 volts at the same frequency on the other, thus running without transformers to supply nearby lights and also providing a high-pressure transformer system for lights at a distance from the station. The Warren Electric Manufacturing company will supply the transformers as well as the dynamos.

A new telephone-exchange building is to be erected by the Pittsburg and Allegheny Telephone company in Allegheny, Pa., where the company is rushing the work on its pole lines and conduit system. The site for the new building has been secured by the purchase of property at East Diamond street and Park way, the price paid being $25,000. The new telephone company has also about completed its East End exchange building on Spahr street, near Ellsworth avenue.

Gas Engines and the Economy of Gasoline Engines for Small Power.[1]

By John Wilkes.

The slight expense at which small-sized gasoline engines may be operated is so marked that it is somewhat surprising that they are not more widely used even than they are. This may be due to counterbalancing disadvantages or defects in the gasoline engine as a motor, or it may be due to the fact that the gasoline engine, being a comparatively new thing, has not yet been thoroughly introduced, so that its advantages are not as widely known as they might be.

Defects and disadvantages the gasoline engine certainly has, but in spite of them there are situations where it is decidedly the best kind of power to use. It is to bring up for discussion before the members of this association the subject of the advantages and disadvantages of this motive power that the present paper is written.

The title has been written "The Economy of Gasoline Engines for Small Power," because, in the writer's opinion, a very large gasoline engine is not economical, compared with other kinds of power, except under unusual conditions. However, the gasoline engine's half-brother—viz., the gas engine—is, for cases requiring large power, a very promising applicant for future requirements, and later on in this paper a few words will be said as to that.

Gas and gasoline engines are of an entirely different type from steam engines. In this end-of-the-century day we have wireless telegraphy, horseless carriages, smokeless powder, and the gas engine might be called a "boilerless engine." There is no boiler about it. The pressure furnishing the power is generated by an explosion of gas in the cylinder of the engine.

Historical Sketch.

The gasoline engine is an offshoot from the gas engine, or, rather, more properly speaking, it is a gas engine, the gas being merely a particular kind, namely, the vapor of gasoline; so that in what follows of a general nature, wherever a "gas engine" is spoken of, it is to be understood that it is the same thing as a gasoline engine.

The idea of deriving power from the energy of an explosion by means of a motor is at least as old as Watt's invention of a means of turning the expansive force of steam to account.

Huyghens proposed in 1680 to make an engine in which the explosion of gunpowder in the cylinder of an engine would force the piston forward and so produce power. Something like this is what is done in a gas engine, so that in this sense; the idea of the gas engine may be said to have antedated Watt's steam engine. However, it is hardly necessary to say that no practical working motor was made on this plan nor at this time. Passing over several interesting and more or less successful attempts at the problem, the first commercially successful internal-combustion motor or gas engine was the Lenoir gas engine of 1860.

In this engine a mixture of gas and air was drawn into the cylinder for about half-stroke, the valves closed, and the mixture ignited or exploded, producing thus for the last half of the stroke considerable pressure. This engine was double-acting, like the ordinary steam engine—that is, it had the force applied on opposite sides of the pistons alternately. These engines were introduced commercially to some extent. They ran smoothly, quietly and satisfactorily, but consumed rather a large amount of gas. As this was the first commercially successful gas engine, it will be seen that the steam engine had rather a long start of the gas engine, as Watt introduced the steam engine in 1769.

The next great step in advance was the introduction in 1876, of the famous Otto gas engine; and as practically all engines built since operate on the same plan, a brief description of the "Otto cycle," as it is usually termed—though, strictly speaking, Beau de Rochas first proposed it—will be given. The engine is usually single-acting, or, in other words, receives the pressure of the explosion only on the back side of the piston, the front of the cylinder being open. The series of operations is as follows: The piston being at the back end of the cylinder and just ready to start forward, the inlet valve opens and a mixture of gas and air is drawn in as the piston moves forward. When the piston has reached the limit of its forward movement, the cylinder is full of the mixture of gas and air. All of the valves then close, and the piston on its return stroke compresses the mixture of gas and air. As the piston again starts forward the compressed gas and air are exploded or ignited by a spark, and the pressure thus produced is the source of the power of the engine. On the next stroke the products of combustion are expelled from the cylinder through the exhaust valve. The same cycle of operations is then repeated indefinitely. It thus appears that only one stroke in four is effective, and during the rest of the time the motion of the flywheel is all that keeps the engine going. Very heavy flywheels are thus a necessity. The Otto patent ex-

1. Paper read before the Engineering Association of the South, at Nashville, Tenn., March 8, 1900. Mr. Wilkes is the engineer for the Tennessee Coal, Iron and Railroad company at Whitwell, Tenn.

pired in this country in 1890, since which time numerous factories for the manufacture of gas and gasoline engines have sprung up all over the country.

Design and Form of Construction.

With this brief sketch of the gas and gasoline engine, we will now consider the design, construction and operation of the engines commercially before the public in this country. The above-described Otto cycle, which has been found by experience to be the most economical and best of any so far proposed, is used in nearly all engines made, and the differences in the engines are differences in the organs provided to carry out these functions, so to speak. In common, they all have large, heavy flywheels, trunk pistons, single-acting cylinders, water jackets and poppet valves. The points of difference are the method of making the mixture of the air and gas, or the measuring of the gasoline, mechanism for operating the various valves, method of ignition, style of cylinder (vertical or horizontal), etc.

As between vertical and horizontal cylinders, it may be said that the arguments for one or the other are pretty much the same as in the case of the steam engine. Vertical cylinders require less floor space, have less drag and wear by the piston on the bottom side of the cylinder, and apparently adapt themselves more readily to multicylinder construction. There seems to be a tendency toward this as a type of advanced American construction. However, many good makes of American engines—in fact, probably the majority—employ the horizontal cylinder.

The valves of gasoline engines are now nearly always made of the poppet type. The mechanism for operating them is of the most varied kind—spiral gears, bevel gears, eccentrics, push rods, spur gears, bell-crank levers, etc. The writer's preference is for a side shaft driven by spiral gears and operating everything—governor, inlet valve, exhaust valve, sparker, etc. This seems to be the simplest and neatest construction.

Mixing chamber and inlet valve are sometimes cast integral with the cylinder, sometimes bolted on. They often present a cumbersome, awkward appearance, are in the way if the engine is to be moved about, and are so placed that they offer great temptation to the men moving the engine to take hold of them in lifting the engine, with the result that they are broken off. The same is true as to many of the other parts of the engine, which are often made too small and delicate, stand out too far from the body of the engine, and are admirably adapted to take the weight of the whole engine—until they break off.

Feed for Gasoline.—Gasoline may be fed by a pump feed or gravity feed. For very small engines the latter is preferable, as being simpler. On large engines the pump feed is safer as regards fire, as the gasoline tank may then be outside the building, and there is no danger of the gasoline flooding.

Ignition is produced usually either by a hot tube or an electric spark. The former is the favorite method in England, and the latter usually in this country. If an electric spark is used, it may be produced by a battery, such as the Edison-Lalande, and a spark coil, or by a small dynamo made for the purpose and driven by the engine itself. The difficulty about the latter is that when the engine is not running the dynamo is "dead," so there is the difficulty of starting; and if a battery must be used then, it is less bother to have a battery that can be used all the time. Besides this, if the engine has work to do in which the load is thrown on and off suddenly, and the load is nearly or quite up to the capacity of the engine, there is a momentary slowing up of the speed of the engine when the load is thrown on, and this causes a diminution of the speed of the dynamo, so that it will not furnish current enough to make a spark; the result is that the engine misses an explosion, causing further loss of speed, which decreases the current from the dynamo, and so on until the engine stops. If electric ignition is used, it is best to have the sparking points or electrodes of platinum, or rather an alloy of platinum and iridium. The arrangement of the means for bringing the points together and separating them is important. The points should come squarely together, without chance of missing, and the adjustment of them so that they will do so should not be long, tedious and difficult. The electrodes should be simple and the platinum points easily applied, and also (as the scrap is very valuable) easily removed. If the design is such that platinum wire can be used to make the points, it would seem to be an advantage, as a short piece of the wire could be kept on hand and enough to make a point cut off as needed from time to time

Batteries for portable engines are apt to be troublesome. There is a style of Edison-Lalande now made which has liquid-tight steel enameled jars, with rubber rings to seal them; these may be better for portable batteries than the ordinary style with porcelain jars. In general, simplicity, compactness, neatness of design, durability and fewness of parts should be aimed at by the designer of an engine that is to be handled by the class of mechanics that the gasoline engine usually falls into the hands of.

That for the practical needs of some people, whatever may be the case as to the general market, the gasoline engine might be simplified is shown by the experience of the mines where the writer is employed. A small gasoline engine used for running a pump for pumping in the mines having had some of the small, delicate parts constituting the gasoline injector broken, the whole injector, with governor, mixing valve, etc., was taken off and sent to the machine shop for repairs. The exigencies of the case requiring it, as the water was about to get beyond control, the engine was run all the same; and since then, the injector proving difficult to keep in proper adjustment, on account of wear, etc., it has been cast aside, and we have the spectacle of the engine running—and running satisfactorily, too—with all these parts gone. The "governor" to the engine, as it now runs, is the work it has to do, and, in case of accident, the boy who runs the engine.

Operation.

In the operation of gasoline engines there are several points at which they differ from steam engines. In the first place, they are are not like steam engines, in which all that has to be done to start is to open the valve. Gasoline engines have to be started. The wheels have to be turned by hand until the engine makes the first explosion, which, if everything is all right and perfect, will be the first time it is turned over. Generally, though, everything will not be all right and perfect, and sometimes a good many turns are required, which soon gets to be very tiresome. "Self-starters" are usually furnished with the larger size engines (above 15 or 20 horsepower); but with our 30-horsepower engine we have never used it, starting always by hand. Gasoline engines run better after they get warmed up.

Gasoline engines, owing to the intense heat generated in the cylinder by the explosion, require a higher grade of cylinder oil than do steam engines. Batteries require renewing every two to seven months.

Repairs on gasoline engines used inside mines and where the grade of meshanical skill of those in charge of them is that of ordinary laborers are likely to be disappointing to one who reads the testimonial books sent out by various makers and expects similar results in his own case.

One advantage of gasoline engines is that they require so small an amount of water—only a small amount for cooling the cylinder, which may be used over and over again. So that they may be said to require practically no water supply. Our 30-horsepower engine uses about 300 gallons a day, whereas a steam engine of the same power would require 3,000 gallons. This has led to their use, even in pretty large units, in the arid regions of the West—Arizona, New Mexico, Colorado, etc. One 40-horsepower engine there uses less than 40 gallons of water a day, according to a published report.

It may as well be acknowledged, in closing this division of the subject, that in operation gasoline engines are "balky." Sometimes they will run; sometimes they won't. That's all there is to be said about it. The best thing to be done when the engine gets perverse is to continue to work with it. What you do doesn't matter. When it gets in the humor to run, it will run; but neither you nor anyone else can tell what you did to make it go.

Testing.

In testing small gasoline engines to ascertain what brake horsepower they were developing, I have used the rope brake and spring balances. This is a cheap, simple, easily applied kind of brake, from which there is no danger of overheating the rim of the wheel to which it is applied and requiring no lubrication. The outfit for testing an engine up to, say, 10 horsepower, does not cost over two or three dollars. Indicating gas engines is said to be rather unsatisfactory and difficult. I have never tried to indicate one.

Cost of Operating

Small gasoline engines, once they are started, require practically no attention. It is to this principally that the economy referred to in the title is due. The cost of the gasoline at present market prices for any size below 10 or 15 horsepower is less than the cost of attendance alone for a steam engine and boiler; so that, even with coal absolutely free, one could not afford to use a steam engine and boiler of small size in an isolated location. There are many such places where less than 15 horsepower is needed at a location isolated from any large boiler plant. Of course, if the power is needed at some point closely adjacent to a large boiler plant, where the only thing necessary is to put in the steam engine and connect to a steam pipe, the steam engine would probably be the cheapest; but if a fireman has to be employed to fire the boiler to make steam for a small, isolated steam engine, even though the fireman can be engineer as well as fireman, then the gasoline engine is cheaper for the total than the steam engine is for attendance only, to say nothing of fuel.

To show how cheap a gasoline engine may sometimes be, I may mention an engine of 7½ horsepower which works under a varying load, the expense of running which is: For gasoline, 65 cents a day; attendance, 10 cents; total, 75 cents a day. A steam engine for the same work would cost: Attendance, $1.75; water supply, 10 cents; fuel (half a ton of coal, say), $1.50; total, $3.35 a day.

At Whitwell there are in use one two-horsepower engine, one three-horsepower, one 30-horsepower, and there has just been installed an eight-horsepower engine to drive a ventilating fan.

Large Gas Engines.

Recently considerable interesting work has been done in the line of large gas engines, using either natural gas or producer gas. A number of large engines are run on natural gas in Pennsylvania, Ohio, Indiana and other states in the natural-gas belt. With a good gas engine and cheap natural gas to use in it, the power consumer has something almost as good as a free waterpower and something cheaper than the electrical energy as sold by the waterpower development companies, such as those at Niagara Falls.

Natural gas, however, is not at everybody's door, and the more general question of gas engines run by special gas made for the purpose is therefore of interest to a larger number of people. There are three different lines in this direction along which workers are experimenting, viz., gas engines run on producer gas, gas engines run on blast-furnace gas, gas engines run on the gas from by-product coke ovens.

The first (producer gas) has been successfully exploited in England by Dowson, and in France by Lencanchez, and also in this country, the plant at Danbury, Conn., and the recently installed plant of the Erie Railway, at Jersey City, N. J., being examples.

So far, however, it has only been from anthracite coal that this producer gas for gas-engine purposes has been successfully made, in this country at least.

There is no apparent reason why gas from the Semet-Solvay and other by-product coke ovens should not be suitable for use in gas engines and furnish very cheap power. The blast furnace being incidentally a huge gas producer, the idea of using the surplus gas from it in gas engines has occurred to several people.

The most described plant of this kind is the one at Seraing, Belgium, though there are several others in England and elsewhere. There is now in operation at Seraing a 200-horsepower gas engine run on blast-furnace gas, and the results are said to be satisfactory and very economical. Very large engines are now being built in Germany and France for this purpose, some as large as 500, and even 1,000, horsepower.

The thermal efficiency of gas engines is much higher than that of steam engines, and the efficiency as measured in pounds of coal used, which is what a practical man is interested in, is also better, being for gas engines equal to about one pound of coal per horsepower per hour; while it is a very good steam engine that comes under two pounds per horsepower per hour, and ordinary engines run from four to eight or 10, even sometimes higher.

Now, if gas engines are so much superior to steam engines in economy, why are they not rapidly taking the place of steam engines? The answer is that it is principally because the gas engine is hard to start, "balky," of large dimensions in comparison with the power developed, and a new thing. Until very recently they were not made in large sizes, rarely over a 100-horsepower. This is, as stated above, not now the case. I think we may look to see the gas engine assume a very prominent place in the future, and perhaps it will not be a very distant future either.

Chicago Drainage Canal Waterpower.

At a meeting of the Chicago City Council, on July 16th, the mayor and comptroller were authorized to sign a contract with the sanitary board for the waterpower of the Chicago drainage canal. The contract is to run for 75 years, and may be terminated by either party by giving a year's notice. If the sanitary trustees desire to terminate the contract they agree to pay the city the amount expended for a power plant. The city agrees to pay $4 a horsepower for two years, and after that the contract provides for a reappraisement each two years, the cost not to exceed $4. It is estimated that the canal will produce 30,000 horsepower. The city agrees to build a power plant at Lockport, to cost $2,500,000. The city will attempt to issue bonds for the construction of the works, and the city's right to do so will be tested by this issue.

Andrae & Sons' Affairs.

The Julius Andrae & Sons company of Milwaukee has been in financial difficulties, and recently called a meeting of its creditors to consider its affairs. It is said that the liabilities of the concern amount to $106,000 and that the nominal value of the assets is about $126,000. The company dealt in bicycle goods and electrical supplies, and it is believed that it was the bicycle end of the business that brought about the trouble. The house has been engaged in the electrical business in Milwaukee for a number of years, and it is hoped that an arrangement may be made whereby the business will be continued.

The Northside Consolidated Street Railroad company of Chattanooga, Tenn., has been incorporated, with $100,000 capital, by S. W. Devine, W. B. Royster and E. D. Lilley.

CORRESPONDENCE.

London Letter.

London, July 2.—Early on Friday morning one of the elevators, or lifts, as they call them here, gave way at the new London Bridge station of the city, and South London Electric railway, and fell with a loud crash to the bottom of the shaft, a distance of 120 feet. There were four persons descending, all of whom were injured.

The quarrels of the Irish leaders have invaded the sacred region of private bills in the House of Commons, and there was once more evidence of it in the long fight on Thursday afternoon over the Dublin electric-lighting bill. The Dublin members went one way and Mr. Tim Healey and others went the other way. Tim was raspish over the matter, and gave his version of certain local affairs, much to the amusement of the House.

Ten years hence, in an odd corner of the new South Kensington Museum, there will be exhibited among the curiosities of bygone ages a specimen of the present London tram car. Teachers will take their classes and point to the relic as a proof of the little value placed on time by men of the nineteenth century. People in 1900, they will say, were content to sit in such cars for an hour to go a distance of three miles. The boys of 1910, who will do the distance in a few minutes, will pity the slow old fossils of a former decade. The tram car is doomed, and before long the tram horse will have disappeared from the streets. London is on the eve of the greatest revolution in local transit since the introduction of railways. Within the next few weeks, in the western part of London, will be inaugurated the most magnificent system of electric cars in Europe. These magnificent palace cars, I am told, will cost over $6,000 each. They will carry 69 passengers at the rate of a cent a mile and are 85 feet long. The power house will have a chimney 250 feet high, which will be the only one in the country built entirely of steel. The reconstruction of the lines has cost $60,000 a mile.

Wireless telephony experiments are being made from the Isle of Anglesey to the Skerries. The site of the experiment has been chosen because no submarine wire ever known would stand the force of the sea there, and so the Skerries need more urgently than most places to have a means of communicating with the shore.

People interested in the decision of the House of Commons committee on the question whether big companies shall supply large districts with electrical energy, or whether the business shall be undertaken by smaller companies or by local authorities, assembled in force on Thursday. I need hardly say that the large central companies, that propose to supply extensive districts, were successful.

The exhibition at the Agricultural Hall of tramways and electrical accessories will close on Wednesday, the glorious Fourth. It has been largely attended and all the exhibits were attractive, but the most noticeable was that of the Westinghouse company. The Electric Tramways and Traction company and the Brush company's exhibits came in for a good deal of attention, but perhaps the one most admired was a car built by J. G. Brill of Philadelphia and especially designed for summer and winter use. W. H. B.

New York Notes.

New York, July 14.—Judge Lacombe of the United States Circuit Court yesterday authorized Colonel William Jay, the receiver of the Manhattanville and Nicholas avenue and the Forty-second street railways, to enter into contracts for the equipment electrically of the roads. This will call for an expenditure of over $200,000. Naughton & Co., contractors, will do the work.

President H. H. Vreeland of the Metropolitan Street Railway company has given it out that the horse cars on the Thirty-fourth street cross-town line are to be replaced by storage-battery cars.

An experiment on portrait photography by incandescent light was made here recently by Falk, a photographer, whose gallery is at the Waldorf-Astoria. A cluster of 21 incandescent lamps was employed, enclosed in a hood. The requisite whiteness of light was obtained by running the lamps far above the regular voltage. The results are said to be fully equal to sunlight photography. Of course, the lamps have but short life under such treatment, but they need be turned on only a short period for each photograph taken.

The Board of Rapid Transit Commissioners has decided to lengthen the station platforms for the new rapid-transit system north of One-hundred-and-fourth street and the express stations south of that point, making them 450 feet in length, or long enough to accommodate eight-car trains.

The Ricker-Hine syndicate, operating the street railways at Plainfield, Rahway, Westfield and Elizabeth, N. J., has purchased the company in which United States Senator John Kean is largely interested operating between Elizabethport and Elmore. This puts an end to a bitter franchise war.

The change of the Kings County Elevated, Brooklyn, to electrical operation will probably take place inside of a few weeks. M. L. G.

From the Buckeye State.

Columbus, Ohio, July 14.—There have been a number of plans suggested for the operation of the municipal lighting plant in this city, and Director Kauffman has been urged to adopt some of them. He is firm in his determination to have nothing more to do with it, under the circumstances, however, and the City Council has taken hold of it. The director of law decided that it could be placed in the hands of trustees, and this plan was adopted. Professor B. F. Thomas of the Ohio State University, was one of the men chosen for this place, but he set about an investigation, and is still at work on it. If he finds that the action of the City Council is legal and everything is all right, he will accept the place, and if not he will make it known. This matter has been the subject of more comment than any one thing that has occurred in the city for some time.

Two cars collided on the new Springfield, Dayton and Urbana electric line near Springfield a few day ago, and 10 persons were seriously injured. It is now said that the motorman of one of the cars was to blame for the accident.

The first rail on the Columbus, London and Springfield electric road was laid last Wednesday. The contractors are now pushing the work along the national pike west of the city.

Frank Bourne, an expert engineer of New York, is now going over the various routes proposed by the Chillicothe, Mount Sterling and Columbus electric railway, with a view to selecting the most practical one.

The City Council of Kenton, Ohio, will advertise for bids for lighting the streets. It wants a plant of 110 arc lights of 2,000 candlepower each for a term of five years.

There seems to be a great demand for the banks of the canals in this state for traction purposes. Over a month ago a party of capitalists filed an application with the canal commission for the use of the Miami and Erie Canal, from Cincinnati to Toledo. On Friday another application was received for the same privilege from the Cincinnati, Hamilton and Dayton Traction company, which is made up of the stockholders of the Cincinnati, Hamilton and Dayton Railroad company. There will be a fight for the possession of this franchise, from the fact that any line built along this canal will parallel the Cincinnati, Hamilton and Dayton road, and would, to a great extent, injure the business. If the company operated by the stockholders of the road gets the franchise it will turn the money back to the road. There may be some plan to delay matters also if this company gets it. The capitalists who first asked for it will put a good road in operation if they get it, as there is plenty of money at hand to build it, and the gentlemen are all trained business men. It is claimed that Thomas N. Fordyce holds the exclusive franchise of these banks for the purpose of operating canal boats by electric power, but the Cincinnati, Hamilton and Dayton company intimates that there will be no poles put up to interfere with his plans if the franchise is granted to it. There is still a question as to whether the commission will grant the use of the canal banks for electric-road purposes, although the Supreme Court has decided that this can be done.

The Miami Valley Electric Railway company is planning to build a branch from Dayton to St. Marys. The business men of Sidney are urging the management to run the line by way of their town, as it would result in the loss of much business to them if the road would go within a few miles, only to carry the people to some other place.

The council of the village of Oberlin, Ohio, is debating the advisability of municipal ownership of the gas and electric-light plant there. The owner, C. T. Beckwith, may sell if the city means business.

Work commenced on the extension of the Grove City electric line from Grove City to Morgan Station Friday. This will give a better service to persons wishing to come to Columbus from the southwest.

The employes of the Columbus Railway company will receive their fourth quarterly dividend on August 1st. This will be in the same ratio as that received by the stockholders.

C. M. Lott of Paulding is negotiating for the purchase of the electric-light works at Hicksville. He asks the city for a 10-year franchise, and if he does not get this he expects to put in a new plant and furnish the street lights at $65 each.

The Portage Lake Traction company has been granted a franchise to build a road from Ravenna to Kent.

It is reported that the plan to build an electric line from Findlay to Toledo by way of Fostoria has been given up, because the farmers along the line had begun a vigorous opposition to granting the right-of-way. Theodore Wentz, a Canal Dover banker, was at the head of the project.

The Youngstown and Sharon Street Railway company has secured the right-of-way between Sharon and Hubbard, which, for a while, promised to give the managers much trouble.

The Columbus, Buckeye Lake and Newark Traction company and the Newark and Lancaster Traction company have made application for the use of the berm-bank of the canal, between Newark and Hebron.

Work is now progressing rapidly on the new road being built from Sandusky to Norwalk. The grading has been begun in several different places in order to hasten its completion.

The Portage Lake Traction company has in contemplation a line from Ravenna to Cleveland, but the officials say they are not yet ready to begin on the work, and have not taken the preliminary steps to secure the franchise, although they have secured the right-of-way on all the other branches.

People of Mansfield are agitating the question of the city combining a pumping station and lighting plant on the municipal-ownership plan.

The Alliance Gas and Electric company has made a proposition to the Alliance council to either sell or lease the plant to the town on terms to be made by arbitrators, if necessary. The proposition is believed to be a favorable one, if the town wishes to enter the municipal-ownership experiment. It seems that the negotiations with New York parties who had proposed to build an electric line from Alliance to Salem are off.

The injunction against the Dayton Street Railway company has been dissolved, and the company may now move its tracks in certain places, as had been planned some time ago.

D. K. Bird has been chosen as superintendent of the Mount Vernon Electric Light company, to succeed William Wilkinson, who resigned to go into the coal business.

The Village Council at Athens has passed an ordinance requiring the lighting company there to furnish incandescent lights for the streets. The company will be given an additional term of three years to its franchise, in consideration of the expense involved in changing the system. O. M. C.

Northwestern Notations.

Minneapolis, July 14.—The council of Duluth, Minn., has amended a proposition of the Commercial Light and Power company for street lighting and tendered an acceptance of the changed offer.

Work will soon be started on improvements to the dam of the Gas and Electric company of St. Cloud, Minn.

The street-railway company of Ottumwa, Iowa, is testing fenders on its cars.

The Southern Electric Supply company and the General Electric company have contracts to install an electric-lighting system at Hastings, Neb.

The Hutchinson Electric Railway company has been formed at Weyauwega, Wis., to build an electric line from New London to Berlin.

The Gas and Electric company of Grand Forks, N. D., is installing a public heating system. Mains are being laid through the streets.

A survey has been begun for the electric line to be built from Geneva, Minn., to Albert Lea by the Albert Lea and Geneva railway.

The village of Willmar, Minn., has contracted for a new boiler for the light and water station.

The electric-supply men of Minneapolis and St. Paul claim they are discriminated against in the matter of freight charges. A concerted action will be brought to bring about a revision of classification. If this proves unsuccessful, it is hinted that suit may be brought to enforce the interstate-commerce law against classification.

The Edison Electric Light company has paid the city of Des Moines, Iowa, $852.15, being one per cent. of the gross earnings of the company, to be paid in semi-annual installments.

The Postal Telegraph company has won a suit in Idaho courts to condemn a right-of-way along the lines of the Oregon Short Line.

The Highland Canal and Power company of Duluth, Minn., has changed its plans for storage-reservoir capacity. The company proposes to develop waterpowers around Duluth and transmit the power to the cities. It was the original intention to have a capacity of the storage reservoir of 30,000 horsepower. The company has concluded to be prepared for the future, and will make it about 100,000 horsepower. This will not all be developed at once, of course, but will be in readiness to be developed as needed.

The Tri-city Railway company of Davenport, Iowa, has put in new rolling stock and is improving its tracks.

Laurence Stenger, a student of electricity in Parker, S. D., has perfected a dynamo of his own invention. It is probable a system will be installed to furnish light for Parker.

The Railway and Light company of Winona, Minn., has accepted the new franchise tendered by the city, and will extend its lines.

W. I. Gray of Minneapolis will superintend the installation of the new electric-light work for the Austin, Minn., plant.

Work will be begun at once on the new electric-light plant of A. P. Hoyt at Omro, Wis.

Dayton, Iowa, will install an electric-light plant.

The street-railway company of La Crosse, Wis., has begun work on an extension.

The Black River Falls Electric company expects to be able to furnish Duluth and Superior electric power in about one year. The company expects to develop 5,000 horsepower, which will allow 3,500

after deducting 30 per cent. waste and loss in transmission.

The council of Keokuk, Iowa, has granted an extension to the electric-light company's franchise.

The city of Appleton, Wis., has served papers on the Appleton Electric Light and Power company, to compel the company to operate the cars of the local street-car lines according to the conditions of its franchise. Since the burning of the company's power house, the power used by the local system has been transferred to the interurban line. During this time the company has operated but one car a day, fulfilling its contract with the Chicago and Northwestern railway. As the street-car service has been unsatisfactory for several years, the city officials intend to make the company comply with the terms of its franchise or forfeit its rights.

The Gas and Electric company of Creston, Iowa, has submitted a new proposition for furnishing street lighting, based on a five-year franchise. The proposition was voted down.

The Carroll (Iowa) Electric Light and Power company has amended its articles of incorporation to include a heating plant.

The Des Moines (Iowa) Street Railway company wants a settlement of its taxes. It offers to resume the sale of six tickets for 25 cents, if its assessment is reduced from $500,000, as it now stands, to $200,000.

The electric street-railway company of Chippewa Falls and Eau Claire, Wis., has awarded a contract for the erection of a new power station.

The Seattle and Tacoma Electric Railway company has received $100,000 toward the construction of the line from the bondholders, and further installments will follow as needed. The line is expected to be in operation in less than a year.

The local union of the International Brotherhood of Electrical Workers at Butte, Mont., has petitioned the council of that city to create a new department, to be known as the "Bureau of Electricity." This department shall have complete supervision over all electrical appliances in use in the city. It shall be empowered to cut down or remove all wires of any trolley company, when such endanger life or property, and the city is to be held blameless.

C. H. Storms, electrician for the Rapid Transit company of Waterloo, Iowa, has invented a block-alarm system, which is now in use by the company. When a car passes a switch it lights an electric light at the next switch, which remains lighted until the line is clear. It prevents delays by overdue cars, as it is always a guide as to whether the track is clear. The company uses it on the line between Waterloo and Cedar Falls.

It has been rumored that the municipal electric-light plant of Moorhead, Minn., would be sold. The story is denied, and it is claimed that it would take a vote of the citizens before a sale could be made.

The United States Court has authorized the receivers of the Commercial Light and Power company of Duluth, Minn., to issue receivers' certificates for $25,000 to liquidate taxes, interest on bonds and meet other liabilities.

Elias Clifton of Cherokee, Iowa, succeeded A. R. Jackson as superintendent of the Electric Light and Power company of Centerville, Iowa, July 1st.

C. M. Hertig of St. Cloud, Minn., who had a scheme to establish a system of street railway, to cover Fargo, N. D., and Moorhead, Minn., has not given it up yet, it is understood.

The Board of Trade of Mankato, Minn., is discussing the matter of rapid transit.

A new electric-railway line is suggested from Spokane, Wash., through the Spokane and Colville Indian reservations, to connect with the Spokane Falls and Northern railroad. There are a number of waterfalls along the line, which could be utilized to furnish power.

The Street Railway company of Fond du Lac, Wis., has awarded contracts for the erection of a pavilion at Lakeside Park. R.

Canadian Intelligence.

Ottawa, July 13.—The Ontario Power company will begin development work at Niagara Falls this summer, developing first 30,000 to 50,000 horsepower. The company has applications for 30,000 horsepower.

The City Council of Kingston, Ont., will invite the Electrical association of Canada to hold its annual convention there in August next. The convention was to have been held at Ottawa, but the fire in that city prevented. The Kingston City Council will vote a sum of money for entertainment of the association. There will likely be 400 members in attendance.

The town of Orillia, Ont., after the greatest difficulty, has reached an agreement whereby R. H. Patriarche, of the Electrical Maintenance and Construction company of Toronto, and Peter Ryan undertake to complete the town's power scheme, by which electric power is to be transmitted from the Severn River, 19 miles distant, to Orillia by the first of October next.

The Canada Atlantic Railway company has commenced installing electric lights and electric fans on its passenger cars. M. R. Shedd, of the Gould Electric Car Lighting company of Depew, N. Y., is in Ottawa placing the necessary plants on the cars. The governor-general's car, "Victoria," has been equipped with the lights and fans.

The Dominion government has received an application from Hon. Fred. Peters and E. O. Fader of Victoria, B. C., for certain shore rights in the harbor of Vancouver, B. C. They propose to utilize the rise and fall of the tides there to generate electric power, which will serve Vancouver, New Westminster, etc., and, at the same time, provide electric power upon a cheap scale.

J. P. Graves has made an offer to purchase from the city of Grand Forks, B. C., the waterworks and electric-light plants at the sum of $70,000, and to expend a further sum of $30,000 in improving the systems. He also seeks to acquire an exclusive street-railway franchise. In return for a bonus of $30,000, Mr. Graves offers to provide waterworks, electric-light and trolley systems for the city of Columbia.

A company composed of Winnipeg capitalists and business men has been organized, under the name of the Lac du Bonnet company, to transmit electricity for light and power, from a waterpower at Lac du Bonnet to the city of Winnipeg, a distance of 62 miles, using a voltage of 40,000 volts. Plans have been prepared for the power house and plant. The building will be 317 feet long by 56 feet wide and will be thoroughly fireproof. On the main floor will be placed 20 direct-connected generators, each of 1,000 kilowatts' capacity. Step-up transformers will be employed to raise the voltage to 40,000 volts.

Alderman Urquhart, in moving a resolution in the Toronto City Council having an important bearing upon any contracts which the city may be about to enter into for electric heat, light and power, referred to a new company, now being organized, for development of electric power on the Canadian side of Niagara Falls and for transmission of the same to Toronto, Hamilton and St. Catherines. He asked that the city engineer be instructed to report estimates for distributing electric heat, light and power to private concerns and consumers throughout the city. The alderman stated that this new company held a patent upon a method of transmitting electricity by wire, so that between Niagara Falls and Toronto only 20 per cent. of the current would be lost. He was not now in a position to give the exact terms upon which this company proposed to supply electricity, but would promise that it would be a surprising reduction upon the present cost of electric energy which obtains in Toronto, and it probably would be found that electricity will be offered to the city, in bulk, at a figure not greater than $30 per horsepower yearly.

The annual report of the directors of the Canadian Electric company, at the meeting of the shareholders held at the city of Quebec, showed that the development works of the company were well advanced and would probably be completed by the end of next September. Contracts have already been made for 3,000 lights, and it is expected that operations will be commenced with a lighting load of about 6,000 lights. Negotiations were in progress for lighting the streets of Levis, Que., and applications have been received from several manufacturing concerns for power. Tenders have been received for the laying of a submarine cable to carry the electric current across the St. Lawrence, from Levis to the city of Quebec. The company is also making great preparations for supplying many villages with light and power. It is installing the electric light all the way from the Chaudiere Falls, Que., where the power is generated, to St. Joseph de Levis, a distance of about 12 miles. It is said that the company also proposes running a scenic electric railway between these two points. The probable revenue of the company for the first year is estimated at $25,000 and the operating expenses at $1,000 per month.

At a meeting of the shareholders of the Montreal Electric Street Railway company, held on the 10th inst., the agreement between the street-railway company and the Chambly Power company was ratified. The agreement requires the delivery by the latter company of 5,000 horsepower continuously for a period of 23 years, with the privilege of renewal for a further term of five years, at $25 per horsepower per annum. Should the Chambly company at any time sell power at a lower rate to any other railway on the island of Montreal, the Montreal street railway will have the benefit of the reduction. Mr. Wanklyn, manager of the street-railway company, stated at the meeting that he had studied the question in all its phases for a period of 18 months, and the contract submitted was the very best procurable. At present the company was greatly in need of additional power. The Chambly current would be available night and day, and it was proposed to secure the very best machinery to transmit it.

Apropos of the price of electric power, it may be pointed out that probably the lowest figures have been obtained at Ottawa. The E. B. Eddy company, shortly before the fire catastrophe in Hull and Ottawa, had contracted with the Deschenes Electric company for several thousand electrical horsepower at $15 per horsepower per annum. Also some of the Ottawa electric men, who control the Little Chaudiere waterpower, offered recently to furnish a proposed cotton-mill enterprise in Ottawa with 3,000 electrical horsepower at $10 per unit yearly. It will be seen, therefore, that electric power can apparently be delivered in Ottawa, with profit, at something like one-half the best figure that the Montreal Electric Street Railway company can now get or expects to obtain for the next quarter of a century, although Montreal is a city well situated to secure electric advantages. Ottawa people naturally have great expectations regarding the industrial future of the Canadian capital, owing to the unrivaled facilities it possesses in respect to the development of electric energy. W.

North Carolina.

Charlotte, N. C., July 13.—The Charlotte Consolidated Construction company is completing the laying of three miles of double track at Charlotte, N. C. The plant will soon be one of the best equipped in the state.

The plant of the Carolina Manufacturing company at High Point, N. C., will be operated by power from the plant of O. M. Richardson.

The Wilmington (N. C.) Gas Light company will issue bonds for the improvement of its gas and electric service, work having already been begun. The sum of $25,000 will cover the amount of improvements.

After spending in the neighborhood of $100,000 on its great dam at Ivy Creek, the North Carolina Electric Power company has stopped the work. The proposed line runs from the dam to Asheville, N. C., 12 miles distant. It is stated that the suspension of work is only temporary.

The interests of E. R. Bliss of Chicago and others in the Intermontane Railroad company (electric) at Asheville, N. C., have been purchased in the interest of the Asheville (N. C.) Electric company. The new owner contemplates overhauling and improving the newly purchased line. L.

PERSONAL.

Elias Clifton of Cherokee, Iowa, has succeeded A. R. Jackson as superintendent of the Albia Electric Light and Power company.

Robert K. Gray, of the Telegraph and Maintenance and Construction company of London, arrived in New York early in the month. "He comes here," says the New York Tribune, "in connection with the laying of a new commercial cable."

James H. Hoffman, president of the Hebrew Technical Institute of New York City, died at the home of his son in that city on July 8th. Mr. Hoffman, who was in his 67th year and a native of Germany, was president of the Manhattan Electric Storage Battery company and interested in other manufacturing and commercial enterprises.

Since July 12th J. S. Beach, chief clerk to C. M. Baker, the general superintendent of construction of the Postal Telegraph company, has been missing. He lived in Melrose Park and the last known of him was that he intended to take a trip to Milwaukee. Mr. Beach had been in the employ of the company for five years and had always been a faithful and trusted employe. Mr. Baker fears that he has been drowned.

D. H. Louderback has resigned as president and director of the Lake Street and Northwestern Elevated Railway companies of Chicago. Howard Abel moves up from the secretary and treasurership of the Lake Street to take its presidency and L. S. Owsley is the new president of the Northwestern. William V. Griffin becomes secretary and treasurer of the Lake Street road. Harvey T. Weeks takes Mr. Louderback's place as director on both roads.

W. J. Johnston, formerly publisher of the Electrical World, has returned to New York, after a trip around the world. He was promptly interviewed in relation to the situation in China. Mr. Johnston thinks the present troubles in China may be the best thing that ever happened to that country, if the powers will only administer affairs there with an unselfish impartiality. Japan, in Mr. Johnston's opinion, is best fitted of all the nations of the earth to give China civilized rule, and if the other nations would allow the mikado to govern China upon lines laid down by a convention of the powers, the great Chinese market would be opened to the trade of all the world, under the most favorable conditions possible.

ELECTRIC LIGHTING.

Beaver, Pa., intends to install a municipal electric-light plant.

The Mazomanie, Wis., electric-light plant has been destroyed by fire.

The council of Osgood, Ind., has decided to put in an electric-light plant.

The Alliance (Ohio) City Council has decided to build an electric-light plant.

The Norfolk (Va.) Heat, Light and Power company will issue $500,000 bonds.

Lyons, Mich., will receive bids for the improvement of its electric-light plant.

The council of North Amherst, Ohio, wishes estimates on a city electric-light plant.

Spencerville, Ohio, will issue $8,000 in bonds for the erection of an electric-light plant.

The Leesville (La.) Waterworks company has obtained a franchise for electric lighting.

The Sea Side Electric Light, Heat and Power company of Rockaway Beach, Long Island, has

been organized with W. G. Wainwright president and J. W. Wainwright treasurer.

At Colborne, Ont., the entire electric-light station owned by J. A. Spence was burned last week.

Recovery, Ohio, will issue $10,000 in bonds to build an electric-light plant. F. Tegler is clerk.

W. P. Pitman of Lufkin, Texas, will ask for telephone and electric-light franchises at Alvin, Texas.

The Memphis (Tenn.) Light and Power company has increased its capital stock from $300,000 to $500,000.

The municipal electric-light system at Tarentum, Pa., is one of the most successful of the kind in the state.

The Indiana Cotton Mills company at Cannelton, Ind., is considering plans for a large electric-light plant.

At Howell, Mich., the town recently voted in favor of bonding for $15,000 to put in an electric-light plant.

I. Kelly and C. Heron, committee, will receive bids for a street-lighting plant for Galena, Ill., until July 24th.

J. H. Brown, K. A. Tracey and M. J. Cook of Chicago have incorporated the City Light and Power company of Dunkirk, Ind.

The Needham (Mass.) Electric company has been incorporated by W. W. Carter, C. H. Carter and F. B. Carter. Capital, $15,000.

The Chicago and Alton Railroad company will rebuild its shops at Bloomington, Ill., and put in a central power and heating plant.

New Castle (Pa.) local capitalists have applied for a franchise to build an electric-light plant and steam-heating system in the town.

The Standard Electric Light company of Kansas City, Kan., has been incorporated, with $25,000 capital, by L. E. James, W. J. Buchan and J. Fennel.

The electric-light plant at Morrice, Mich., recently purchased by Sutton & Makey, has been destroyed by fire. The plant was purchased for $10,000.

The ordinance granting the Atlanta (Ga.) Railway and Power company the right to operate an electric-light plant in Atlanta has been passed by the council.

The Baltimore (Md.) Board of Street Commissioners has awarded the contract for building a municipal electric-light plant to the George A. Williams company of Jersey City, N. J., for $52,590.

The city of West Hammond, Ill., has awarded the contract for its complete new electric-light plant, comprising two 30-kilowatt Warren alternators and one 40-light arc machine, to J. Holt Gates & Co., Monadnock building, Chicago. A new building will be erected, boilers added and the old plant completely overhauled.

The Concord (N. H.) Land and Water Power company is putting in five new 200-kilowatt generators and one new 300-horsepower water wheel. Part of this activity is due to a contract for lighting and furnishing power to the extensive shops of the Boston and Maine railroad, which road has heretofore furnished its own power and light.

The Washtenaw Electric company has filed articles of incorporation in Michigan, with $50,000 capital. The purpose of the corporation is the producing of electricity and electric light. The offices are to be at Ann Arbor and Ypsilanti and the power plant at Geddes. Two thousand shares, at $25 each, are held by Bernard Rorison, A. C. Rorison, W. J. Clarke, P. M. Miller, W. H. Sweet, C. L. Stevens, Robert Hemphill, Jr., A. Beyer, R. W. Hemphill, Clark Cornwell, H. P. Glover and R. W. Hemphill, Jr., trustee.

ELECTRIC RAILWAYS.

E. A. and F. E. Wilson have secured the franchise in Niles for an electric road from Niles, Ohio, to Salt Springs.

The Waynesburg and Ten Mile Valley Street Railway company has been granted a franchise in Waynesburg, Pa.

W. A. Bisbee has applied for a franchise to build an electric street railway in the city and suburbs at Jacksonville, Fla.

The Southside Railway and Development company of Petersburg, Va., is said to be spending $25,000 on improvements.

At Columbus, Ohio, the Columbus and Buckeye Lake Electric Railroad company has filed articles of construction, with $5,000 bond.

James D. Bashford and Calvin Hotchkiss of Lyons, N. Y., have the right-of-way for an electric road between Lyons and Sodus Point.

The Florence Electric Street Railway company has been incorporated, to operate in Fremont, Teller, El Paso, Pueblo and Custer counties, Colorado.

The street-railway strike at St. Louis has been renewed. The strikers say that the company has not lived up to its agreement. The renewal of the strike, however, does not seem to have caused any great disturbance and the cars are operating regularly.

A trolley car got beyond control of the motorman on the hill at Amsterdam avenue and One hundred-and-twenty-seventh street, New York, last week, and smashed into two other cars that were waiting at the bottom of the hill. Most of the passengers escaped before the collision took place, but a few were bruised.

A new power brake for electric street cars has been invented by Auditor James H. Neal of the Boston Elevated Railway company, for whom it will be manufactured under his patents on royalty by the United States Steel company. It is expected to be to the electric-car service what the Westinghouse air brake is to the steam-railroad service.

Under the title of Ulua Commercial company a syndicate of New York city and Philadelphia capitalists has been formed to open the interior of Honduras, Central America, to commerce by the construction of an electric railway and a wagon road to the parts of the country which are at present only accessible by pack mules. The Ulua River is to be dredged where necessary for 100 miles from the coast line, and from there the wagon and trolley roads are to be extended over the mountains of the interior. The capital stock of the new company is $500,000, fully subscribed.

The Moodus and East Hampton Electric Railway company has been organized at Bridgeport, Conn., with a capital of $150,000. The officers elected were the following: President, F. C. Fowler of Moodus; treasurer, Clifton J. Harvey of Woodbury; secretary, E. C. Crocker of Bridgeport; directors, F. C. Fowler, C. C. Chafee, William Markham, E. S. Boyd of Moodus; Clifton J. Harvey, A. D. Warner of Woodbury; William A. Reddon of East Hampton, and E. C. Crocker of Bridgeport. The Mutual Construction company has also been organized by the same capitalists to build electric railways throughout the state.

By the terms of an agreement reached between the Milford, Attleboro and Woonsocket, the Milford, Holliston and Framingham and the Marlboro, Westboro and Grafton Street Railway companies of Massachusetts the three managements have virtually pooled their interests, and later they may form an actual combination, if the plan to be tried works successfully. Their projects contemplate the construction of connecting links to make a continuous line from Milford to Westboro, in addition to their present lines. Through cars will be run over the three roads interchangeably. This gives opportunity for almost continuous travel from Fitchburg, Mass., to Providence, R. I.

PUBLICATIONS.

The Diehl Manufacturing company, Elizabethport, N. J., calls attention in a bulletin to its small motors for sewing machines and special purposes.

The Dean Brothers' Steam Pump Works, Indianapolis, Ind., has just issued a catalogue containing numbered lists of parts for pumps, directions for operating and valuable tables.

The American Electric Fuse company of Chicago is distributing circulars illustrating its McIntire and American joints, lightning arresters, paper insulators, fuses, McIntire specialties, etc.

The Ferracute Machine company, Bridgeton, N. J., is distributing a catalogue of presses and dies, numbered 13, with the announcement that a larger and more complete catalogue will be issued in a few months. It is difficult to conceive of a more complete catalogue of machine tools of the class described.

Interesting examples of men who have fitted themselves for good positions in engineering work by study in spare time are furnished in a little book entitled "Support Yourself While Learning a Profession," which is being sent free to all applicants by the International Correspondence Schools, Scranton, Pa.

A recent circular issued in a series on "The Application of Storage Batteries to Isolated Plants," by the Electric Storage Battery company of Philadelphia, describes the installation of chloride accumulators for the Arnold Print Works, North Adams, Mass. Illustrations are given of the works, the switchboard and booster, and battery room.

Lundell generators, direct-connected and belted, are described in catalogue No. 100, issued by the Sprague Electric company, New York. That portion of this handsome pamphlet devoted to multipolar machines is of especial interest, as the new Lundell split-pole machine for overcoming sparking is described fully, and the technical and engineering points in its design are set forth in a very complete manner.

POWER TRANSMISSION.

The Coast Range Electric Power and Mining Corporation, Newman, Stanislaus County, Cal., is incorporated. The directors are J. F. McSwain and H. B. Ellis, Merced; J. H. Custer, I. Sturgeon, J. A. St. Clair, C. F. Eddleman, F. A. Jeffres, J. Morris and A. Levy, Newman. The capital stock is $500,000, of which $54,925 has been subscribed.

SPACE TELEGRAPHY.

Wireless telegraphy is being tried at Honolulu with the idea of extending the service to give an island-to-island communication. The first experiments have been satisfactory.

MISCELLANEOUS.

The New York Shipbuilding company, which is now completing very large works at South Camden, N. J., will use electricity for nearly all its power around the yards.

Solomon Larsen, a track walker on the Kings County elevated, Brooklyn, recently fell from the structure on to electric feed wires under the structure, and was killed by the current.

It has been found by experiment, says the Scientific American, that a thick coating of nickel can be obtained by using the ordinary plating solution and passing both alternating and direct currents through the bath.

The Electric Tire Inflator company has been incorporated at Denver, to deal in appliances for the automatic inflation of rubber tires. W. H. Smith, George W. Skinner and Charles H. Toll are interested. The capitalization is $10,000.

The United States government is about to establish three new magnetic observatories, one at Cheltenham, Md., 16 miles southeast of Washington, one at Sitka, Alaska, and one at Honolulu. The observatory building in each case will be without windows and will have a wall filled with sawdust three feet thick. The temperature is to be kept at between 40 and 50 degrees the year around.

TRADE NEWS.

The Non-Polarizing Dry Battery company of New York, originators of the popular O. K. and Mustavit dry batteries, has recently appointed John W. Brooks, 303 Dearborn street, Chicago, as its western agent.

The electrical instrument firm of Michado & Roller, 203 Broadway, New York, has turned its business as a whole over to an incorporated concern of the same name. The business will be carried on in the same manner and at the same address as before.

The Scientific Manufacturing company of Chicago has been incorporated, with a capital stock of $50,000, to manufacture electrical and scientific instruments and devices. The incorporators of the company are Murray F. Thayer, Ernest C. Thayer and F. H. Green.

It is announced that the business heretofore carried on by the Baines Improved Primary Battery company will be continued by the Improved Primary Battery company, 594 Broadway, New York, which latter company will fill all orders for Baines' improved batteries and grids.

The Ben Franklin Electrical company has been organized at Zanesville, Ohio, with $10,000 capital, to manufacture a combined burglar alarm and home call clock, invented by G. C. Fergus and R. B. Reed. The incorporators are Joseph Shaw, W. W. Harper, S. A. Weller, Willis Bailey, Guy C. Fergus and Robert B. Reed.

The Waukegan (Ill.) Electric Light company has contracted for the installation of a central-station heating system. The Evans exhaust hot-water heating system will be installed. This system is controlled by Evans, Almirall & Co., whose western representative, F. N. Jewett, has an office in the Monadnock block, Chicago, Ill.

The interests of Mr. Leschen in the Leschen-Macomber-Whyte company have been purchased by a new company, to be known as the Macomber & Whyte Rope company. The new company will continue doing business at the old location, 19 and 21 South Canal street, Chicago, where it will be prepared to give all orders better attention than ever. It has, it is believed, the largest stock of wire rope in Chicago. A complete stock of supplies will be carried, as heretofore, and a specialty will be made of mine, quarry and contractors' supplies.

BUSINESS.

The Electric Appliance company, Chicago, reports that, regardless of the fact that this is the most successful fan season it has ever had, it is able to ship Dayton fans promptly upon receipt of order.

The Gregory Electric company, 54 to 62 South Clinton street, Chicago, announces a special sale on weatherproof wire in sizes from 8 to 16, and also a large lot of well-known makes of transformers guaranteed as good as new.

W. H. Wissing of the St. Louis office of the Crocker-Wheeler company has closed contracts for the equipment of the St. Louis Refrigerating and Cold Storage company, with 400 kilowatts in generators and 52 motors. The Brown Shoe company's plant also takes 45 motors, with a second order for two 80-kilowatt generators, and the St. Louis Republic 40 motors.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 10, 1900.

653,218. Motor Controller. David H. Darrin, Cranford, N. J. Application filed September 2, 1899.

The combination of a motor, a main circuit, a controlling rheostat and a switch in the main circuit, electrical means for holding the switch in one of its positions, and means for de-energizing the last-named means, whereby the switch is permitted to be moved to the opposite direction independently of the operation of the rheostat.

653,221. Electric-traction Balloon. Marie J. A. Deydier, Lyons, France. Application filed August 11, 1898.

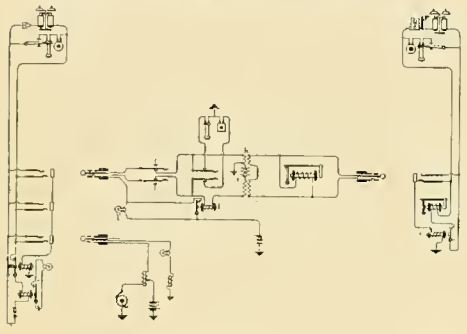
The combination with a balloon having a car attached, and a framework of bamboo canes secured to and extending around the balloon, of a motor car, a trackway upon which the motor car is adapted to travel, guide cables extending longitudinally of the trackway, a guiding device carried by the car, and engaging the guide cables, a cable connecting the motor car with the car of the balloon, a second cable extending from the latter car, and a guiding device carried by the latter cable and engaging the guide cables.

653,316. Trolley. William H. Russell, Watertown, Mass. Application filed November 23, 1899.

A sectional trolley wheel comprising groove-forming flanges of wear-resisting metal extending into the tread portion of the wheel to run against the trolley wire, and a relatively thin disk of softer metal interposed in the tread for carrying the current into the wheel.

653,319. Supervisory and Busy-test Appliance for Telephone Lines. Charles E. Scribner, Chicago, Ill., assigner to the Western Electric company, Chicago, Ill. Application filed October 3, 1898.

The combination with a telephone line and multiple spring jacks in different sections of a switchboard, and a test circuit for the multiple spring jacks, of a source of specialized test current and means for connecting the source of test current with the test circuit of the line at one of the sections, a signal at the same section and means for connecting it with the line simultaneously with the connection of the test current, means for closing the test circuit at another section of the switchboard to obtain a test signal, and other means at the second-mentioned section made operative in establishing connection with the line to display the signal, as described. (See cut.)



NO. 653 319.

653,342. Diamagnetic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed September 26, 1899.

The method of separating diamagnetic particles from a mixture containing them which consists in feeding the mixture into a relatively intense part of a magnetic field, continuing it in and subjecting it to the action of the magnetic field until the diamagnetic particles to be separated have gradually moved out from the mixture into a relatively weak part of the field, and then collecting the particles separately.

653,343. Electrostatic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed December 2, 1899.

The method of separating from a mixture particles of relatively greater electrostatic capacity than the remainder, which consists in passing the mixture through a field of convective discharge of static electricity, thereby charging the mixture electrostatically, and diverting the particles of greater electrostatic capacity by causing the electrified mixture to pass through another field of convective discharge of static electricity, the direction of whose lines of force intersects that of the first.

653,344. Diamagnetic Separation. Elmer Gates Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed December 2, 1899.

The method of separating diamagnetic particles from a mixture containing them and magnetic particles, which consists in feeding the mixture into a relatively intense part of a magnetic field simultaneously charging the mixture electrostatically and subjecting the electrostatically charged mixture to the action of the magnetic field until the diamagnetic particles to be separated have gradually moved out from the mixture into a relatively weak part of the field and collecting the diamagnetic particles.

653,345. Diamagnetic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed December 2, 1899.

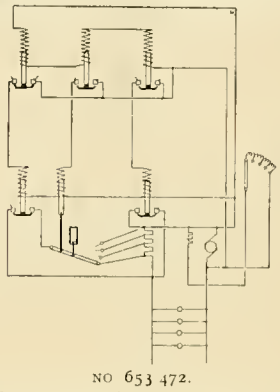
The method of diamagnetic separation which consists in introducing the mixture into a zone of median magnetic intensity, agitating the mixture while detained in the zone until the particles of varying susceptibility move in opposite directions, collecting the separated particles and conducting them away separately.

653,346. Magnetic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed December 2, 1899.

The method of separating from a mixture particles of conductive material which consists in passing an electric current through a moving body of the mixture and diverting the conducting particles by causing the moving mixture to pass through an auxiliary field of force.

653,422. Telephone-test Set. Albert C. Ludington, Marquette, Mich., assignor of one-half to Nathan M. Kaufman, Marquette, Mich. Application filed January 18, 1900.

In a lineman's test set, the combination of the following instrumentalities: A vibrator responsive to alternating current, a magneto-generator included in circuit with the vibrator, a commutator for the generator constantly connected to deliver intermittent direct current; a terminal spring connected to take off alternating current from the generator, included in a normally close branch around the commutator, and means operated at will, by the working shaft of the generator, to open and close the branch.



NO 653 472.

653,424. Speed-equalizing Device. Alexander D. Lunt, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed April 30, 1900.

The combination of a shaft, a fly-wheel loose thereon and an electromagnetic connection between the fly-wheel and shaft.

653,448. Reel or Spool for Electric Thermostatic Cables. John D. Gould, New York, N. Y. Application filed July 10, 1899.

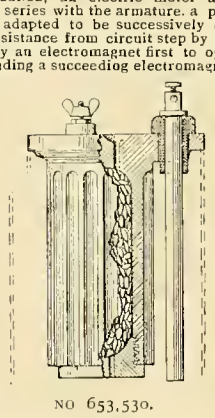
In an electric fire-alarm apparatus, a reel or spool comprising a wooden barrel having metal flanges forming heads at the opposite ends of the barrel, journal pins located in the barrel and projecting from the ends, metal brackets in which the free ends of the pins are journaled, a wire connected at one end to one of the metal heads, extending longitudinally through the body of the barrel and terminating at a point adjacent to the opposite metal head, a second wire connected to the last-named metal head and terminating at a point adjacent to the end of the first-named wire but insulated therefrom, combined with an electric cable arranged to be wound on the spool or reel, the cable being composed of two wires insulated from each other, one of which wires is composed of fusible material, the wires being electrically connected at one end, respectively, to the two separate wires carried by the spool, an electric battery having the poles connected respectively to the two metal brackets in which the spool or reel is journaled, and a bell in the battery circuit.

653,469. Electric Signaling Apparatus. Henry G. Carleton, New York, N. Y., assignor to the Carleton Electric company, New York, N. Y. Application filed March 16, 1900.

The combination with a plurality of sets of connected circuit terminals, of a circuit-closer, means for producing a relative movement between the circuit-closer and the sets of terminals whereby each of the terminals of each set and the circuit-closer may be brought into operative position and means whereby the closer may be caused to co-operate with a predetermined number of the terminals of each set during the continuation of the relative movement.

653,470. Self-starter for Electric Motors. Henry H. Cutler, Chicago, Ill. Application filed June 8, 1899.

In combination, an electric motor and a resistance therefor, in series with the armature, a plurality of electromagnets adapted to be successively energized to remove the resistance from circuit step by step, and means controlled by an electromagnet first to operate for operatively including a succeeding electromagnet in circuit.



NO 653,530.

653,471. Controller for Dynamo-electric Machines. Henry H. Cutler, Chicago, Ill. Application filed August 24, 1899.

The combination with an electrical circuit, of a regulator for controlling its electrical condition within prearranged limits, circuit-controlling devices for checking the variation in either direction beyond the prearranged limits, an electromagnet responding to a definite current for controlling the regulator, and electromagnets responding respectively to currents above and below the actuating current of the first-mentioned electromagnet for controlling the circuit-controlling devices.

653,472. Controller for Dynamos or Generators. Henry H. Cutler, Milwaukee, Wis. Original application filed August 24, 1899. Divided and this application filed January 29, 1900.

The combination with an electric generator and a working circuit containing translating devices, of a solenoid for regulating the voltage within prearranged limits, a solenoid for checking the rise of voltage above the limit, and a solenoid for checking the fall of voltage below the limit. (See cut.)

653,530. Voltaic Cell. Charles T. Richmond, Cleveland, Ohio, assignor to the National Carbon company, Cleveland, Ohio. Application filed October 9, 1897.

In a voltaic cell, a porous cup having an open lower end, a closed top and an external annular flange at its upper end, all of the parts being integral, and a removable plug which screws into the lower end of the cup and thereby closes it, and vent holes in the closed top and the plug. (See cut.)

653,531. Machine for Grinding Carbon Diaphragms. Charles T. Richmond and Mahlon M. Zellers, Cleveland, Ohio, assignors to the National Carbon company, Trenton, N. J. Application filed July 10, 1899.

The combination of a rotating grinding wheel, a pneumatic holder having a head tube and a mouth tube telescoping therewith, and adapted to be moved longitudinally toward and from the grinding wheel.

653,538. Electrolytic Apparatus. Nathaniel L. Turner, Salmon City, Idaho. Application filed June 7, 1899.

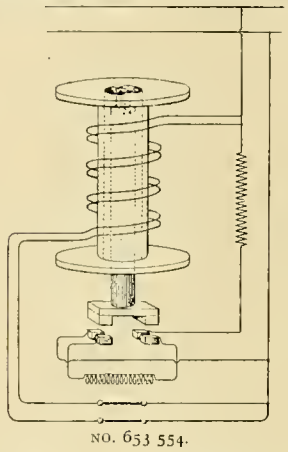
An electrolytical apparatus, comprising a tank, a carrier provided with depending arms, an electrode supported by the arms, turn buttons secured to the arms and adapted to hold the electrode thereon, and an electrode of opposite polarity to the one first mentioned.

653,549. Electric Trolley. Thomas Derrick, Lansingburg, N. Y., assignor of three-fourths to Adam Derrick, George Vandercook and George A. Dicker, Lansingburg, N. Y. Application filed January 27, 1900.

In an electric trolley a rim having a peripheral groove for the trolley wire; a circular raceway secured to the rim; a tubular support surrounded by and concentric with the rim; a circular raceway secured to the support; a plurality of bearing balls or rows interposed between the rim and support raceways respectively, and means for detachably securing the support to the trolley pole.

653,554. Circuit Controller for Incandescent Lamps and Magnetic Guide therefor. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 22, 1899. Renewed May 25, 1900.

In an electric-lighting system, a glower which is normally a non-conductor but is adapted to become a comparatively good conductor under the influence of heat, an electric heater in proximity to the glower, and a solenoid in circuit with the glower, the solenoid controlling both sides of the heater circuit. (See cut.)



NO. 653 554.

653,572. Electric Arc Lamp. John A. Fleming, London, England. Application filed December 23, 1899.

An electric-arc lamp employing two carbons, one of which is provided with two longitudinal bores separated from each other to leave an intermediate carbon wall, and a core or rod of refractory material freely arranged in each of the bores and presenting themselves to the opposite carbon in such manner that the electric arc will be formed between the cores or rods and thus heat them to incandescence.

653,577. Thermo-electric-light Cup. Clarence R. La Bier, Terre Haute, Ind., assignor of one-half to Charles H. Hilton, Terre Haute, Ind. Application filed February 5, 1900.

A device for superheating air consisting of a cup or jacket having a number of incandescent electric-light bulbs inclosed therein, the cup or jacket having a curved flaring mouth and a flexible binding of non-conducting material surrounding the mouth.

653,585. Contact Brush. Samuel L. Neely, Pierron, Ill., assignor of one-half to Henry F. Knebel, Pierron, Ill. Application filed October 23, 1899.

A contact brush comprising a head including two elements, a plurality of wires clamped between the elements, connections between the wires, and elastic plates lying between the elements and the wires.

653,590. Primary Battery. Edward R. Post, Newburg, N. Y. Application filed February 5, 1900.

In a battery, the combination with the battery elements, one of which is of corrugated form, of a spring attached at one end to the corrugated element on the exterior thereof and having its free portion fitting and conforming to the shape of the element and normally sprung toward the same.

REISSUE.

11,840. Contact System for Electric Railways. William Grunow, Jr., Bridgeport, Conn., assignor, by direct and mesne assignments, to the McElroy-Grunow electric-railway system, Jersey City, N. J. Application filed May 29, 1900. Original No. 631,073, dated August 15, 1899.

A free or independent contacting electromagnet operatively connected with the circuit connections of which it constitutes a terminal; in combination with means carried thereby for effecting the preliminary excitation or magnetization thereof; sectional working conductors, an armature electrically connected with one member of the latter and additional means for aiding the first-named means in maintaining the electromagnet in contact with the armature.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, JULY 28, 1900. No. 4

Power Plant of the Advance Thresher Company.

One of the latest concerns to be added to the rapidly increasing list of companies using electricity as a motive power in their factories, is the Advance Thresher company of Battle Creek, Mich. Confronted with an old power plant long since outgrown its usefulness, a factory spread over several acres of ground, necessitating long lines of shafting, quarter-turn belts and bevel gears and an increasing business, it was decided to build an entirely new plant, and by means of electric motors drive the machinery in various rooms of the different departments independently of one another.

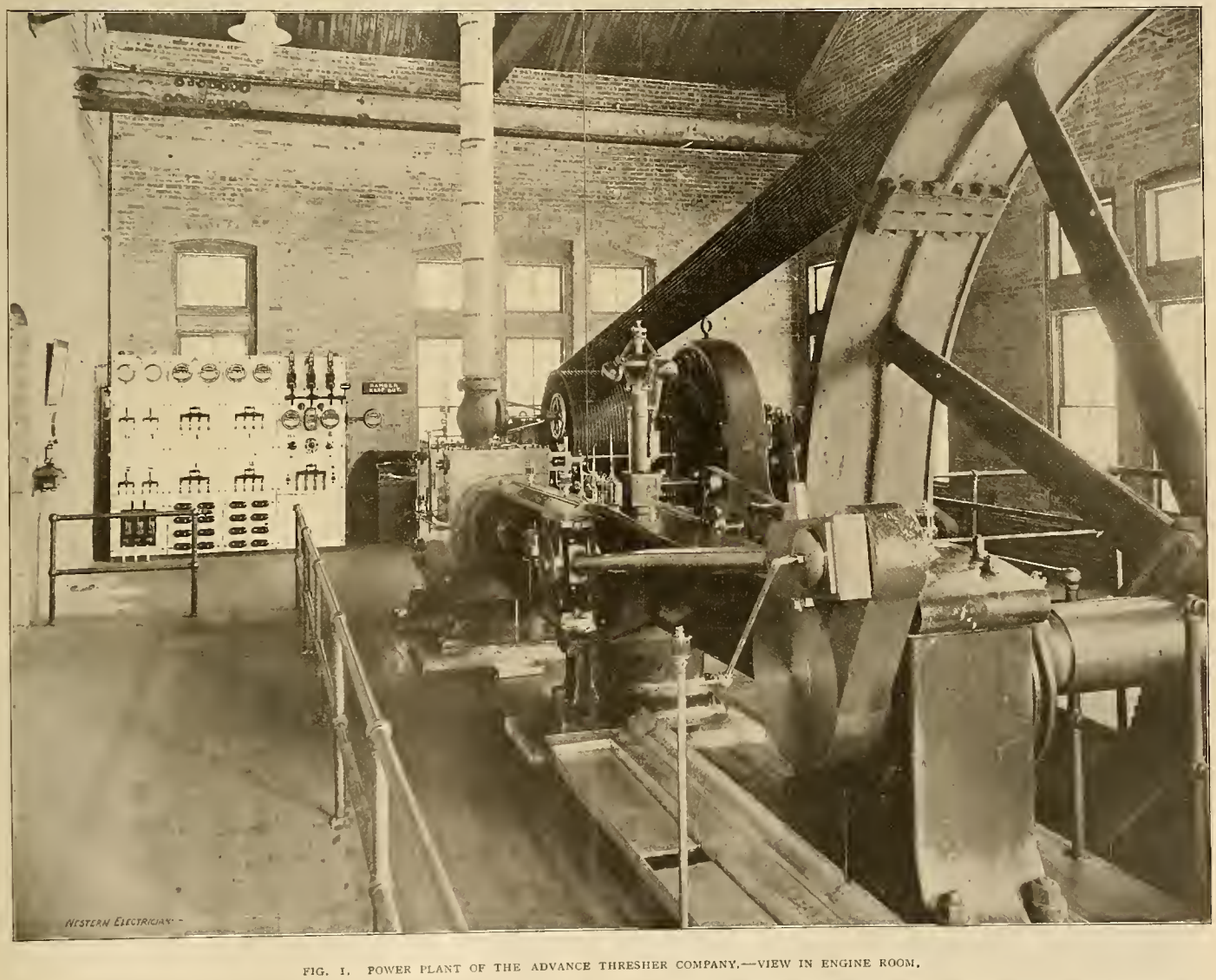


FIG. 1. POWER PLANT OF THE ADVANCE THRESHER COMPANY.—VIEW IN ENGINE ROOM.

After visiting several manufacturing plants that were electrically operated, the officers of the company decided upon the induction motor as being the easiest to install and operate. The variable-speed factor and the lower cost of the direct-current motor were regarded as offset by the fact that the induction motor requires so little attention and operates practically the same under so many different conditions.

A short description of the plant is herewith given. The boilers are of the fire-tube variety, four in number, and are 66 inches in diameter, 18 feet long and rated at 110 horsepower each. In the setting of the boilers, the plan of suspending them from I beams was adopted. Each boiler is suspended by four iron hooks from two 10-inch I beam , which extend over all the boilers and are supported on iron columns. This plan of setting the boilers makes them entirely independent of the brickwork, thus making it possible to locate them permanently before any of the brickwork is commenced.

A brick chimney, 125 feet high, with an internal flue 54 inches in diameter, furnishes an exceptionally fine draft to the boilers. Two of these boilers are now doing the work that in the old plant during the winter required six boilers, aggregating twice the rated capacity of those now in use. The feed water for the boilers is pumped through a 500-horsepower Cooksen heater, which raises the temperature to about 210 degrees Fahrenheit.

The engine is a Bates-Corliss, with a 22-inch cylinder and 48-inch stroke. The frame of the engine is of the box-girder type. The engine is rated at 400 horsepower with 140 pounds initial steam pressure, and running at 75 revolutions per minute. The flywheel is 20 feet in diameter with a 38-inch face and grooved for 22 1⅛-inch ropes. The rope and rope-tightening device were furnished by the Dodge Manufacturing company. The engine is at present operating at about two-thirds its normal load.

The electrical machinery is of the Westinghouse manufacture. The generator is a two-phase, 300-kilowatt alternator of the three-bearing type. It is a separately excited machine, and, running at 300 revolutions a minute, will generate 682 amperes at 440 volts.

It might be interesting in this connection to give what was to the assistant mechanical superintendent, who installed the plant, a "new theory" as to the operation of this machine. There was a great deal of interest and curiosity manifested on the part of the employes around the factory during the installation of the new plant, and one day, during the dinner hour, several men were gathered around the generator wondering why it took such a large engine to drive the comparatively small armature. They could not see where the "pull" came from. While discussing the question, a new arrival spoke up very confidently saying: "Why, when that drum (armature) begins to revolve it expands and rubs against them pieces (field poles) and the friction is what makes the electricity, same as on a belt." It is stated, however, that this friction theory didn't gain much credence among the men.

The switchboard is a four-panel board of the Westinghouse standard design. It carries four power circuits and four lighting circuits, and in addition to the regular equipment of the board there are circuit breakers on the main line and also a polyphase recording wattmeter.

The current for the lights is taken off one phase of the machine and transformed down to 110 volts, by means of two transformers, with their primaries connected in parallel and their secondaries in series. Three-wire feeders and mains with the two-wire distribution system was the plan followed in wiring the factory for light.

In the accompanying illustrations, Fig. 3, on the next page, gives a general view of the front of the Advance Thresher company's works. The office is the large building near the center and the power

house is shown on the right. At the extreme left will be seen a line of high poles. This is the power line of the Kalamazoo Valley Electric company, which has just recently started its large power plant at Allegan, nearly 40 miles distant, where a three-phase current at 30,000 volts is generated, and which is used to operate the street cars at both Kalamazoo and Battle Creek, and also the 23-mile interurban line between these two cities.

Figs. 1 and 2 show different views of the engine room of the power house, and give a general idea of the size and arrangement of the machinery. In Fig. 2 are shown an electrostatic toy engine and an electrostatic toy motor devised by the company's electrician. The latter was described in the Western Electrician June 2d.

Fig. 4 shows a 30-horsepower motor belted direct to a 66-inch exhaust fan, which carries the shavings and sawdust away from the woodworking machinery. This is a typical method of supporting the motors, and in addition to getting them up out of the way also affords a place upon which to

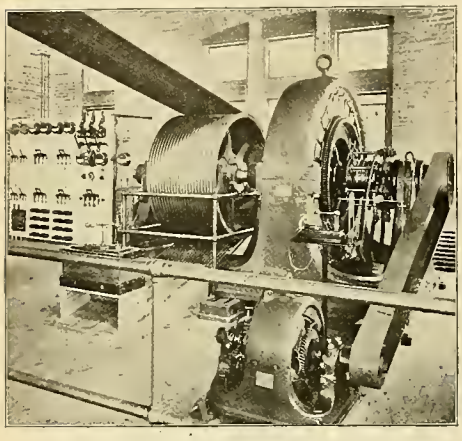


FIG. 2. POWER PLANT OF THE ADVANCE THRESHER COMPANY.—GENERATOR AND EXCITER.

stand in case any work has to be done upon the motor.

In Fig. 6 is given a good view of a 20-horsepower motor, direct-connected to a 30-inch wood planer. The two posts, which may be seen near the motor, and which are boarded together, serve the double purpose of supporting the starting box and of providing a support for the wires which lead to the motor. Fig. 5 shows a 20-horsepower motor with a pulley on each end of the shaft and belted to two parallel line shafts in the separator machine shop. The line-shaft pulleys are both on friction clutches, so that either shaft may be stopped or started without interfering with the other.

In the operation of the loading crane it was the original intention to connect the motor direct to the driving shaft of the crane. The crane is of 12 tons' capacity, designed and made at the Advance company's factory, and takes about seven horsepower to operate at full load. It was found that the induction type of motor will not start with anything like a full load, and as a derrick has to be stopped and started in any position with any load within its capacity, it was necessary so to arrange it that the motor could be started without a load, the load being thrown on after it had attained its full speed. A glance at Fig. 7 will show how this was accomplished. The motor is coupled to a short length of shaft, one end of which is free to slide on a feather in the motor coupling; the other end carries two paper, cone friction wheels, 16 inches largest diameter. These wheels can be made to engage with a similar iron wheel, mounted on the driving shaft of the crane, by means of the lever seen in the center of the picture (the flooring has been removed to show the apparatus). To operate the crane, the motor is first started, and then, by means of the lever mentioned above, either paper wheel may be held against the iron one and the motion of the crane reversed or stopped at will, the motor running all the time. This makes a very convenient and quite simple arrangement and is said to give excellent satisfaction and service.

FIG. 3. POWER PLANT OF THE ADVANCE THRESHER COMPANY.—FRONT OF WORKS.

Plans for the American Institute in London.

For the benefit of the members of the American Institute of Electrical Engineers who are about to start for Europe, the secretary of the British Institution of Electrical Engineers has sent out the following information concerning the plans for their entertainment: The members of the American Institute will be offered a trip up the Thames in electric launches on Sunday, August 12th, the visitors and their hosts leaving by a morning train for a starting point at a convenient part of the river, and returning the same way after lunch at a waterside hotel. On the evening of Monday, the 13th of August, they will be entertained by the president (Professor Perry) and members of the Institution at a dinner in London. On Monday and Tuesday special visits will be arranged to works and places of interest in the neighborhood of London. Particulars of these visits will be found awaiting American guests on their arrival in England. Members of the American Institute who will be in London at the time of the visit are requested to place themselves in communication with the secretary of the Institution of Electrical Engineers, 28 Victoria street, London, S. W., to which address they are also invited, if they care to do so, to have their mail forwarded.

For the joint meeting of the American Institute and the British Institution of Electrical Engineers to be held in Paris on August 16th, the following is announced as the title of the subject selected for discussion: "The Relative Advantages of Alternate and Continuous Currents for a General Supply of Electricity, Especially with Regard to Interference With Other Interests."

Felling a Large Tree by Electricity.

By Sterling Shaw.

One of the chief attractions of Jacksonville, Ill., is the large trees which overarch many of the principal streets, shielding them from the sun. The grounds of the state insane hospital located there are also shaded with many trees, and recently a limb of one of the largest of the trees was broken off by the wind. As it fell it blocked the carriage drive, and it was decided to cut away the whole tree. As the workmen found the tree too large for a crosscut saw, they were about to chop it down when it was suggested that the electrician "electrocute" it. Following out the suggestions, connection was made with an arc-lamp circuit passing near. The electrician changed the circuit at the power house, so it could be thrown on to a dynamo that was operating a power circuit and then dropped a couple of short wires from the nearest arc-lamp pole, connecting 20 feet of No. 14 iron wire between them. Putting the wire around the tree and having a couple of men hold it taut, the current was turned on, but it was found that only a 35-ampere circuit could be obtained. This was not sufficient to make any appreciable effect on the trunk of the tree. After another unsuccessful attempt with a smaller iron wire, the arc-light circuit had to be put in service for the night.

The following morning a pair of No. 2 weatherproof lines were run to the nearest underground feeder, and a 20-foot piece of seven-strand No. 16 galvanized-iron wire inserted in the circuit, three of the strands being taken out to give air space and room for the products of combustion to pass. The feeder was cut out of regular duty and put on a small dynamo, which was also specially arranged for wide regulation of voltage. The dynamo tender was given a code of signals and told to keep his eye on a man who was placed on top of the administration-building tower to transmit the signals from the electrician.

Soon after a signal was passed the wire became uncomfortable to the touch, another signal and it soon began to smoke, and the bark to blacken, another, and the zinc whitened, while those holding the cautery began sliding it slowly back and forth. The bark sparked and smoked. The cautery took

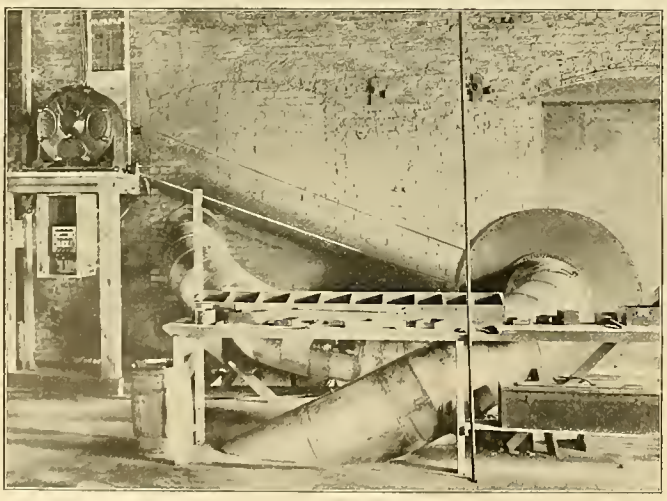


Fig. 4. Motor-Driven Exhaust Fan.

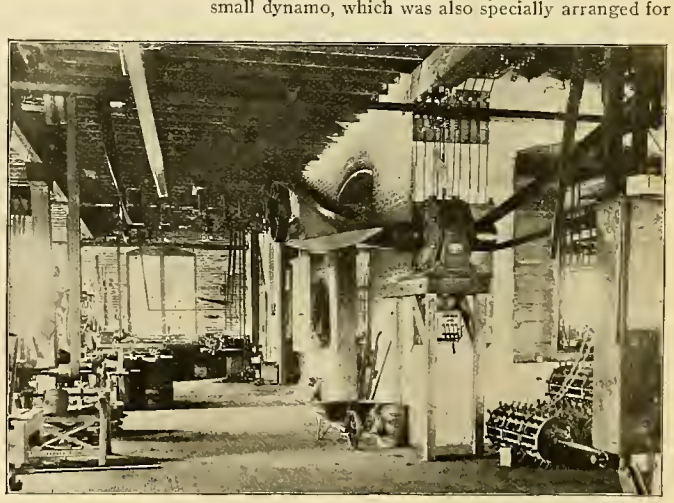


Fig. 5. Motor Belted to Two Parallel Line Shafts.

POWER PLANT OF THE ADVANCE THRESHER COMPANY.

a dull-red color in the sunlight and a cherry hue in the crevice. Its motion was adjusted so as to give sufficient air to reduce the wood to soft charcoal, after the water was evaporated, and to remove the charcoal as fast as formed. In an hour the crevice was 18 inches deep, and at this point the cautery, having been considerably reduced in size by oxidization, gave way, and was replaced by another. The operation was kept up until the trunk was almost cut through, when the little bit of unburnt wood in the center of the trunk parted, and the tree fell.

The tree was an elm, with a large per cent. of water, and was 11 feet in circumference. The current in the cautery was from 120 to 135 amperes direct, the voltage at the machine being varied from 80 to 115. The time consumed in the operation was two hours and 10 minutes.

Suggestions to Union Traction Company's Employes.

Mr. J. M. Roach, president and general manager of the Chicago Union Traction company, issued, on July 10th, a letter to the conductors, gripmen, motormen and other employes of the company, in which he called their attention to criticisms that had been made about their actions and suggested a

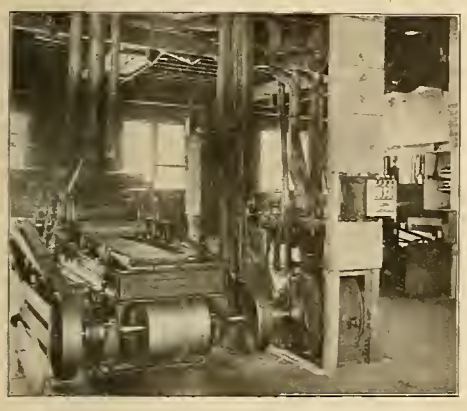


FIG. 6. POWER PLANT OF THE ADVANCE THRESHER COMPANY.—MOTOR DIRECT-CONNECTED TO WOOD PLANER.

number of ways in which a more cordial relation might be brought about between the public and the company's employes. The letter also contained notice of an increase in the men's wages on August 1st, and that this announcement was fully appreciated is shown by a testimonial of thanks which a delegation of the employes presented to Mr. Roach on July 18th. The document was signed by 2,000 of the employes of the company. In response Mr. Roach said that if his suggestions concerning politeness to passengers were carried out the men might expect additional increases.

As Mr. Roach's letter will undoubtedly interest other traction managers, it is herewith printed in full.

To the employes of the Chicago Union Traction company: Gentlemen: In the management of great interests like the Chicago Union Traction company, and in order to successfully meet all the requirements of the public, it is necessary that the management and the employes thoroughly understand each other. With this object in view, it is my desire in this communication to call your attention to the many criticisms which are being passed upon your actions, principal among which are the alleged ungentlemanly treatment of passengers and general carelessness which results in accidents.

Before taking unnecessarily harsh measures, it is the desire of the management to better present conditions and also retain the employes who are now in its service; therefore, I especially and most earnestly request that conductors, gripmen, motormen and all other employes so conduct themselves in every act that their conduct toward the public may be such that it will commend both the employes and the management to the entire community. In other words, an employe of this company must be a gentleman under any and all circumstances.

An impression seems to be prevalent that the employes are aggressive toward the public instead of conciliatory, as they should be. It is my sincere desire that this feeling be changed, and in order to bring it about I appeal to you to consider your own welfare as well as that of the company. A close observance will be kept upon the conduct of employes and strict compliance to the above expected.

In reference to accidents, I wish to say that there are conductors, gripmen and motormen who have been in the service of this company for a number of years and have never had a serious accident, at the same time running upon streets where others meet constantly with annoying and expensive accidents, caused by lack of attention and forethought to see impending danger.

I wish to state most emphatically that avoidable accidents must be stopped. I am of the opinion that this can be brought about without the dismissal of men, and call upon you to demonstrate by your actions, commencing this day, that accidents may be materially reduced. If this cannot be accomplished by mild measures, the management will be forced to act more severely.

I am positive that if each employe should devote himself to the faithful performance of the duties assigned him and avoid the unnecessary things, there will be a great improvement. There are a few things to which I wish to again call your attention.

Be gentlemanly at all times. Remember that deportment is considered in the general standing of an employe, and neatness of person and attire is as much necessary to success in the railroad business as elsewhere.

Elderly persons and women with children should have assistance when getting on or off your car.

Don't start your car before your passengers are safely on or off.

Don't follow wagons too closely. Many accidents happen through anticipating their getting out of the way when they do not do so.

Don't run by passengers without good reason for doing so. The use of a little judgment in this will save much unfavorable criticism. Remember that you are on the street to accommodate the public and not simply to run a car from one end of the line to the other.

Don't be in too much of a hurry at transfer points. Wait for passengers wishing to catch your car. Many complaints are being made of conductors purposely failing to see passengers hurrying to catch their car from the side or rear. Wait for them.

Conductors should look out for passengers alighting from their car when another train is approaching from the opposite direction. Be particularly careful at transfer points.

Look out for your passengers and your car on rough tracks, when passing vehicles, crossing bridges and viaducts and places where there are obstructions.

When a passenger asks for a transfer and is entitled to one, he should receive it without question or display of temper on the part of the conductor, even though he had been offered one before and had refused it. Transfer rules differ in different cities, and strangers to the regulations here should be cared for properly.

Chewing tobacco is offensive to many persons, and numerous complaints have been made of careless expectorating by employes while on the cars. This lowers you in the estimation of the general public.

Don't approach street crossings at a high rate of speed. Stop for boulevard crossings and intersecting lines.

Don't sit carelessly on the dash-board or seat of your car. Stay in your proper place when not otherwise engaged. Watch your trolley at crossings and overhead-switching points.

Don't hold unnecessary conversation with fellow employes, passengers or others while on duty. When questioned, give the desired information, if you know.

Look to the comfort of your passengers; keep the seats and floors of your cars clean and adjust the curtains or windows so as to offer protection from sun, rain, or cold winds.

Handle your controller so as to get the greatest efficiency from the least amount of current.

Remember that in the railroad business, as well as elsewhere, gentlemanly deportment, neatness of person and good common sense will, sooner or later, meet with their proper reward. Each day you are on trial before the public. Your work will become easier and your life more pleasant if you so conduct yourself as to gain the good will of those with whom you come in contact. Next month you will meet with thousands of strangers from all parts of America, here to attend the annual encampment of the Grand Army of the Republic. I wish particularly to request that each of you take pains to act in so gentlemanly a manner that any visitor who patronize our lines will carry away with him a pleasant memory of courteous treatment at your hands. Give them any assistance in your power so as to make their visit to Chicago a pleasant one.

As further evidence of the close relations existing between employer and employe, the management has concluded (at a time when no demands are being made) to pay all trainmen in the service of the Union Traction company a uniform rate by the hour. On and after the first day of August, 1900, the employes of that part of the system known as the old North Chicago Street railroad, will, if they prefer this system of payment, receive the same rate of wages as now paid to those of the West Side lines of this company, as follows: Gripmen, 23 cents per hour; motormen, 21 cents per hour; cable grip-car conductors, 23 cents per hour; cable trailers and electric-car conductors, 21 cents per hour.

OBITUARY.

Walter Tenney Carleton.

The death of Walter Tenney Carleton, for the past three years the Western Electric company's representative in Japan, occurred at Haverhill, Mass., on July 6, 1900.

His health for the last year had not been good, but on his return to this country in June he had expected that he would be able, after a brief vacation, to take up the work that had been assigned to him at the Chicago house. His death occurred after three days' illness, from peritonitis, following an unusually difficult operation for appendicitis.

Mr. Carleton was 32 years of age, and had been in the company's service over eight years. He was graduated from Dartmouth College in 1891, and began work with the company at New York in the following spring. Most of his work there had been in connection with the telephone sales, and he had a large acquaintance among telephone men in the East. In 1897 he went to Japan to look after the company's interests there, and he took a leading part in the organization of the Nippon Electric company, of Tokyo, being its first secretary. He was devoted to the company's interests and his work was always efficient and successful. A widow and infant son survive him.

Alexander R. Pike.

Alexander R. Pike, manager of the San Francisco office of the Columbia Incandescent Lamp company and the Wagner Electric Manufacturing company, died suddenly at San Francisco, on July 14th, at the age of 29 years. He was born at Brookline, Mass., and attended the Massachusetts Institute of Technology and entered the electrical field in 1890. He was superintendent of the testing department of the Missouri Edison company until the fall of 1896, when he resigned to enter the commercial side of the electrical business. He was very widely known among the electrical fraternity, and was a man of sterling quality and ability. A host of friends will mourn his demise.

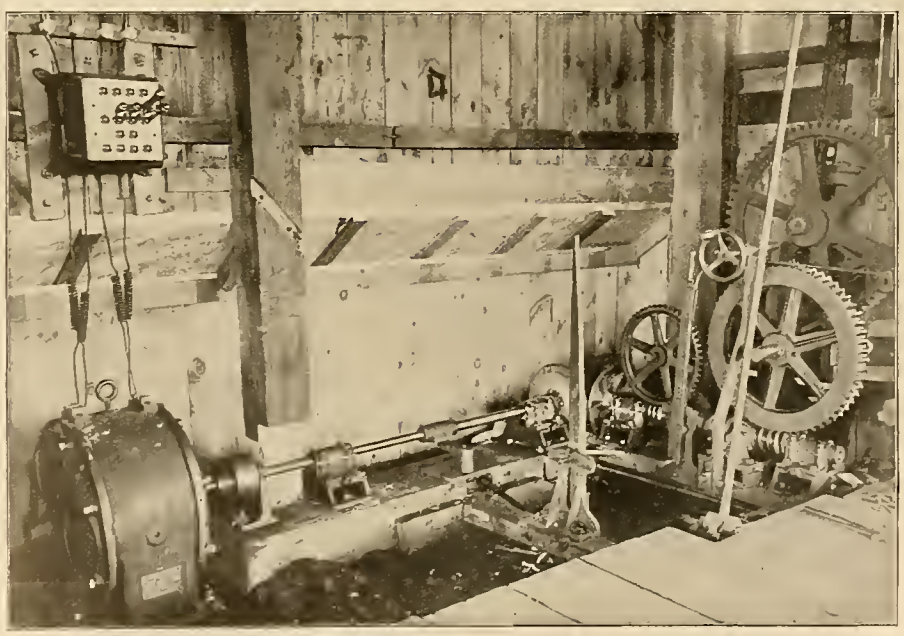


FIG. 7. POWER PLANT OF THE ADVANCE THRESHER COMPANY.—MECHANISM OPERATING LOADING CRANE.

The Central London Underground Railway.

Most prominent among recent electric-railway enterprises in Great Britain is the Central London railway, recently opened. While there are a number of elevated-railway systems in the United States, either equipped or undergoing electrical equipment, which surpass it in size and represent a more advanced practice in rapid-transit work, the Central London Underground may safely be regarded as representing the highest type of electric-locomotive service developed, and is probably equipped for the heaviest rapid-transit service yet operated by electric locomotives. At the time the Central London was planned the multiple-unit system, now the accepted practice in this country for this kind of rapid-transit work, was in an experimental stage. The engineering world was, however, just coming to a realization of the factors that go to make the best results in rapid-transit service and that the Central London profited by this fact is seen from the excellent provisions which are made for handling heavy trains with quick acceleration and an economy and safety due to low maximum speeds.

The road is 5¾ miles long and cost something like $15,000,000. The Greathead system of tunneling was used, the 11½-foot tunnels being lined with cast-iron. The depth of the road below the surface is about 100 feet, and the distance between stations averages about 2,550 feet. The service for the present

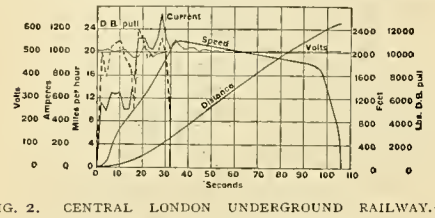


FIG. 2. CENTRAL LONDON UNDERGROUND RAILWAY.—PERFORMANCE OF LOCOMOTIVE.

is to consist of trains of seven coaches, run on a 2½-minute headway, although it is expected to run trains every two minutes later on. To maintain a two-minute service 28 trains are required. The trains consist of seven coaches and a locomotive, the weight, without locomotive, being 105 tons, or 17 tons per car. Each car seats 48 passengers. The locomotive weighs 43 tons. A locomotive, with train, is shown at one of the surface terminals in Fig. 1.

In Fig. 2 is shown the electrical performance of one of these trains on a half-mile run in the open air. In practice in the tunnel, however, the air resistance will be more perhaps and the acceleration will be much more rapid, in proportion to the current used, because the road has been laid out so that the trains have a down grade to assist them in starting and an up grade to assist in stopping. The result will be a great economy in the size of motors necessary to operate on a given schedule and an economy in the power used. Gradients of this kind are the most efficient and practical means known of storing up and utilizing the energy usually wasted in the brake shoes in rapid-transit service. The descending grades on leaving stations are 3.3 per cent., sometimes been the practice. The armatures are built up on brass sleeves, which are afterward forced on to the car axle. The weight of the armatures and commutators, without the axles, is 3,000 pounds, and the complete motor weighs 12,000 pounds. They are four-pole machines, and their rating is 117 horsepower. The controllers connect the motors two in series, two in parallel to start and then throw all four in parallel for full speed. Westinghouse air brakes are used.

The track and third rails are of the section shown

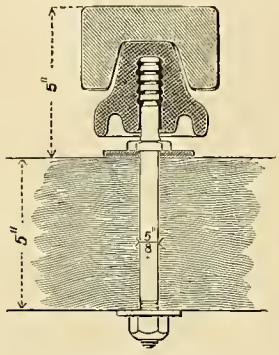
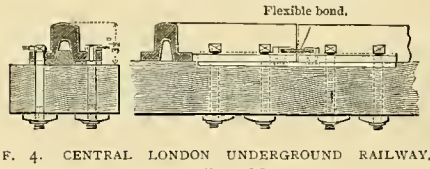


FIG 3. CENTRAL LONDON UNDERGROUND RAILWAY.—THIRD RAIL.

in Figs. 3 and 4, and look rather peculiar to American eyes. The track rails weigh 100 pounds per yard and the third rails 85 pounds. The third rail is midway between the track rails.

The power station corresponds closely with the latest and best American practice. Hunt conveyors, driven by electric motors, supply coal to Vicars mechanical stokers under 16 Babcock & Wilcox water-tube boilers, each capable of evaporating 12,000 pounds of water per hour at 160 pounds per square inch. The engines are run condensing with the aid of a Barnard-Wheeler water-cooling tower, similar to that used on the South Side elevated railroad of Chicago. Six compound condensing Allis-Corliss engines are direct-connected to 800-kilowatt, three-phase, revolving-field alternators, giving current at 25 cycles, 5,000 volts. The electrical apparatus was



FIF. 4. CENTRAL LONDON UNDERGROUND RAILWAY.—TRACK RAILS.

all furnished by the General Electric company, through the British Thomson-Houston company. The exciters are four, of 50-kilowatt capacity and direct-connected to vertical engines. The 5,000-volt supply from the alternators is sent out to three sub-stations, where it is transformed down and delivered to rotary converters, which give direct current to the third rails. Fig. 5 shows the main

FIG. 1. CENTRAL LONDON UNDERGROUND RAILWAY.—ELECTRIC LOCOMOTIVE WITH TRAIN.

and approaching stations an up grade of 1.66 per cent. is usual. The power derived from the grade during acceleration amounts to 400 horsepower. The maximum speed being about 25 miles an hour and the stops about 20 seconds in length, the average schedule speed will be 14 miles per hour.

The locomotives are eight-wheeled, consisting of two four-wheeled trucks joined together and surmounted with a cab. The distance between the wheel centers of each truck is five feet eight inches. The motors are gearless and mounted directly on the axle, without the cushioning support which has switchboard, which is provided with high-tension Parshall switches, which make a long break, both on the front and back of the board, and are separated by marble partitions, as seen. The method of running the high-tension buses along the top of the board can also be seen. All the alternating-current ammeters and voltmeters are Hartmann & Braun hot-wire instruments. All the electrical and steam-engineering features are the design of H. F. Parshall, consulting engineer of the Central London railway, who has been identified with the most important electric-railway engineering in England the last few years, as he was in this country in former years.

For the illustrations and information in the foregoing credit is due the London Electrical Review.

Barcelona Electric Railway Affairs.

Consul-General Tay of Barcelona says in a recent consular report that the chief contractor for the four-mile Barcelona and San Andres Railway is F. H. Bagge, 14 Ronda Universidad, Barcelona, who imports his trucks, tubing for posts, and motors from the United States. The wire is to be supplied by Hulheim of Rhine, Germany; rails, from Belgium; car motors, by General Electric company, Paris; gas engines, Crossley of Manchester; cars, from Saragossa, Spain; accumulators, Tudor;

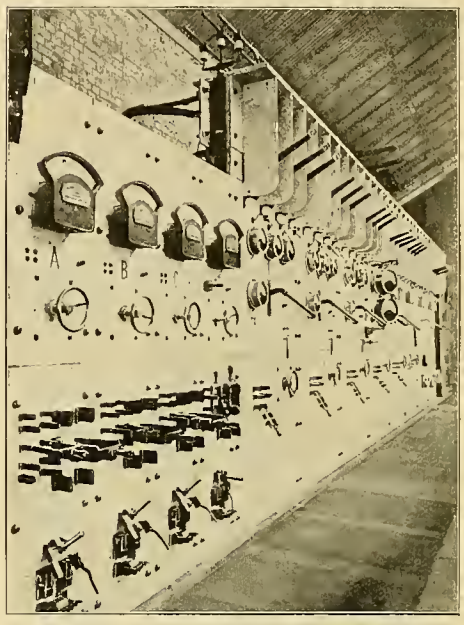


FIG. 5. CENTRAL UNDERGROUND LONDON RAILWAY.—MAIN SWITCHBOARD.

dynamos, Industrial Electrico, Barcelona. He says further:

"I find it very difficult to get any reliable information about projected roads, especially about those for which the equipment is being bought, as the directors, chief engineers and other officials of new tramways are foreigners and have their headquarters in other cities. I would suggest, therefore, that our manufacturers write the Société Anonyme de'Entreprise Générale de Trauvaux Liége, Belgium, in good time before the contracts are let at Brussels. The society is a very large one and has built many miles of tramways in Europe, and is constructing lines in Russia, I understand, at the present time.

"In connection with the sale of electrical supplies and equipment in Barcelona, I would advise manufacturers of motors not used in connection with tramways and other small electrical appliances, that their agents here must keep a certain stock of such articles on hand, as I am informed by several electrical importers of Barcelona that frequently English or German goods are sold because the purchaser cannot wait for better American-made articles, which take so long to come from the United States."

Overcome by Heat While on a Pole.

Samuel E. Cotter of Ansonia, general electrician of the Derby (Conn.) Gas and Electric Light company, was killed on July 4th, while at work on a pole in Derby, by contact with live wires. Mr. Cotter had been repairing the wires of the company during the day, according to the account in the New York Tribune, and at the time of the accident he was sitting on the cross-arm of a pole at the corner of North Main and Liberty streets. In seeking a firmer position for his work the electrician chanced to sit on a wire the insulation of which had been burned away. For a reason which has not been satisfactorily explained, he grasped another live wire with his left hand. By doing so he completed a circuit of 2,000 volts. Passers-by in the street below heard a cry of pain, and looking upward saw a body dangling at the top of a pole 50 feet from the pavement. When taken from his fearful seat, a half hour later, the dead man was burned almost beyond recognition. According to Medical Examiner Conklin, the electrician had been overcome by the heat and grasped the live wire in a faint to save himself from falling. Mr. Cotter was 52 years old and leaves a wife, a son and daughter. He had been connected with the Derby Gas and Electric Light company for 30 years. He was also superintendent of the local fire-alarm system.

J. L. Hisey of Sparta, Mich., contemplates building an electric-light plant in Bellaire, Mich.

Project for Rebuilding Austin Dam.

The municipal authorities of Austin, Texas, have taken steps looking to the rebuilding of the great dam across the Colorado River, at that place, and the waterworks and electric-light and power plant, all of which were destroyed in the great flood that swept down the valley of the Colorado River on April 6th, an account of which was given, at the time of its occurrence, in the Western Electrician. The value of the destroyed property was about $1,600,000, but it is estimated that it can be replaced at a sum much less than the original cost. An expert investigation is now being made, and as soon as it is completed plans and specifications for the improvement will be prepared and a call issued for bids on the work. H. B. Patterson, superintendent of the electric-light and power plant, who is said to stand high in engineering circles throughout the country, has prepared a report to the municipal water and light commission on the subject of the present condition of the ruins of the dam and the probable cause of its destruction. His report is of unusual interest to engineers who have considered the subject. He says:

"A great many articles have appeared since the breaking of the dam relative to the cause, but none of them treated the subject correctly. Six hundred feet of the western portion of the dam is comparatively in as good condition as ever and could be used without being disturbed to any extent should the dam be reconstructed. The eastern portion of the dam, including headgates, is almost a total wreck, and even that which is now standing would have to be taken down. The foundation in all instances should go to good rock foundation."

Treating of the cause of the destruction of the dam, Superintendent Patterson says: "This subject has been previously treated by engineers as though 11 feet of water was passing over the dam, with tail water at zero, which was not the case. At the time the dam gave way we had about 11 feet of water passing over the dam, and about 25 feet of tail water, which was unable to get away. This 25 feet of water below would have the effect of balancing a certain amount of water above, which would place the foundation of the dam on a safer basis than at any time in its history. The greatest tendency to move the dam from its foundation was when the water was at its crest, and the tail water at zero. We find that by striking the 25-foot line of tail water directly through cross-section of the dam, it passes through that portion of the dam which was only 31 feet in thickness, and on very close examination we find the cement work very poor. This, in my estimation, was the cause of its failure."

As to the probable cost of reconstructing the improvements, he says: "The cost of construction would be very much less than the original cost, there being 600 feet of the dam which could be utilized in its reconstruction, and so much of the early foundation work is intact. The approximate expense of the reconstruction of the dam proper, on lines as advised above, would be in the neighborhood of $300,000. Adding to this complete rebuilding of power house and its equipment with up-to-date electrical apparatus, on supposition that the waterwheels now in the old plant should be used, present foundations and old material of power house also as far as advisable, the expenditure would be increased to about $500,000. This would not only give Austin the best equipped plant in the United States, but the difference in operating expenses over the best-equipped steam plant would warrant the expenditure of $600,000 in its construction."

Large Direct-connected Unit at the Paris Exposition.

By Frank C. Perkins.

An important exhibit at the Paris Exposition this year is that of the Siemens & Halske company of Berlin, and the engine manufacturer, A. Borsig of Tegel, Germany. The unit, comprising a direct-connected, triple-expansion vertical engine and a Drehstrom dynamo, shown in Fig. 1, is one of the largest on exhibition. The high-pressure cylinder of the triple-expansion engine measures 760 millimeters (30 inches), the second cylinder measures 1,180 millimeters (46.5 inches), while the low-pressure cylinder is 1,340 millimeters (52.75 inches) in diameter. The speed of the engine is 90 revolutions a minute, while the capacity at a pressure of 14 atmospheres is about 2,500 horsepower.

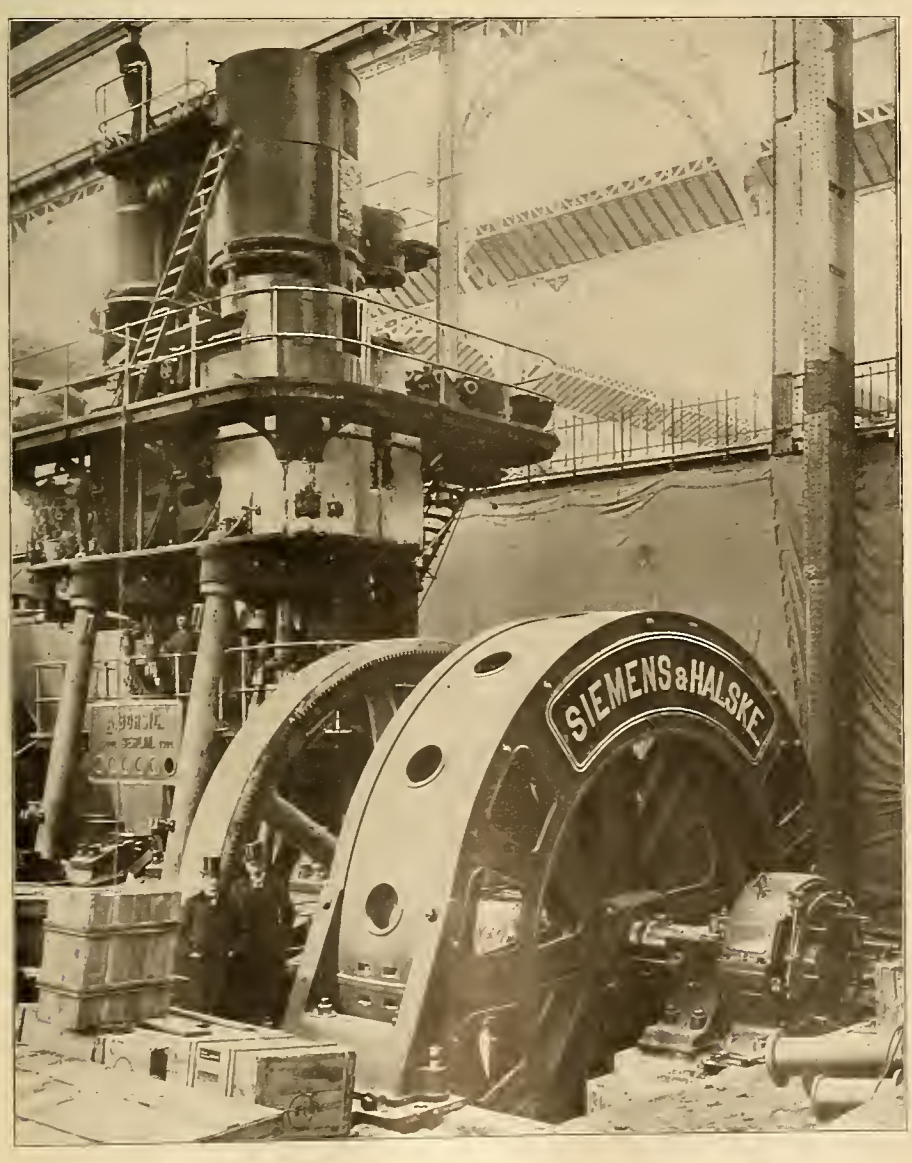


FIG. 1. LARGE DIRECT-CONNECTED UNIT AT THE PARIS EXPOSITION.—BORSIG ENGINE AND SIEMENS & HALSKE GENERATOR.

FIG. 2. LARGE DIRECT-CONNECTED UNIT AT THE PARIS EXPOSITION.—FERRARIS INSTRUMENT STANDARD.

The Siemens & Halske Drehstrom dynamo operated by this engine has a capacity of 1,200 kilowatts. The current generated by the machine is 340 amperes at 2,200 volts' potential. The field poles are mounted upon the flywheel. On the exterior of this flywheel frame there are 80 coils, making up the field magnet of the alternator. The armature winding consists of a series of copper bars placed in slots in the interior of the crown. The armature is stationary and consists of an external ring of laminated iron, with a series of slots upon the inner periphery, in which is used a copper-box winding, the bars being joined on the outside by bending.

The measuring instruments used in connection with this installation are of the Ferraris design, and were built by the Siemens & Halske company. These three instruments are mounted upon a standard, as shown in Fig. 2, and are each about 600 millimeters (24 inches) in diameter. They are so arranged that the reading may be readily observed from either side, two sets of scales being supplied on each instrument. The central and top instrument indicates the number of kilowatts, while the instruments on the right and left indicate respectively the current and voltage.

St. Louis River Power Project.

The St. Louis River Water Power company at Duluth, Minn., has recently elected officers, and talk has been revived regarding the long delayed project of developing the water power of the St. Louis River for transmission to Duluth and Superior, 16 miles distant. Since 1881 about 4,500 acres of land along the falls has been owned by the company, which is capitalized at $1,000,000. The newly-elected officers of the company are: President, J. M. Butler of Philadelphia; vice-president, J. H. Harney of Philadelphia; secretary and treasurer, C. B. Cox of Carleton; general manager, James Bardon; directors, J. M. Butler, J. H. Harney and H. E. Butler of Philadelphia; James McIntyre of Eau Claire; C. B. Cox of Carleton; M. S. Bright, H. S. Butler and James Bardon of Superior.

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CONVENTIONS AND EXPOSITIONS.

Ohio Electric Light association, Toledo, O., August 14th to 16th.

Inter Ocean Automobile Meet, Chicago, Ill., September 18th to 22d.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

There is some prospect that the ill-starred Austin dam may be rebuilt. The superintendent of the power plant formerly operated by its aid estimates that, by using portions of the old dam and some of the old hydraulic and electrical machinery, the equipment can be re-established in better shape than ever at a cost of $500,000, while an equivalent steam plant would cost $600,000. However, to do this it is proposed to use about 600 feet of the western portion of the dam, now standing. Inasmuch as defective cement work in the portion of the old dam that was carried away is given as the cause of the failure, it would seem to be doubtful whether the masonry of the standing portion could be accepted as strong and safe. The experience of Austin with its municipal dam has been peculiarly unfortunate, and it may well be doubted whether the attempt to rehabilitate it is wise, as the former work was neither an economic or engineering success.

The interesting question of artificial profiles in railroad construction is again brought up by the completion of the Central London underground railway, described in this issue, where the tracks are so constructed that there is a down-grade for trains starting out of stations and an up-grade for trains approaching stations. By this means a very considerable saving of power is effected. A tunnel road, like the Central London, affords ideal conditions for the adoption of artificial profiles. In a paper read before the American Institute of Electrical Engineers two years ago Mr. A. H. Armstrong considered this subject at some length and concluded that, with a perfectly symmetrical artificial profile, the energy consumption for a given run might be reduced as much as 40 to 50 per cent. from that required on a level track. Of course, as Mr. Armstrong has pointed out, the ideal profile would provide for a down-grade at starting sufficient to do the work of acceleration and with an up-grade to do the entire braking required, thus leaving only the friction energy to be supplied by the motive power. Obviously, however, this grading is impracticable on surface roads; and on elevated lines, too, it has been found in at least one instance where the proposition was considered that the added cost of labor and material on the structure would more than offset the increased economy of operation.

The death of a man in Baltimore last week by shock from an electric fan emphasizes the importance of protective devices for low-tension interior circuits. The possible danger to customers from contact with low-tension incandescent lighting circuits which may be accidentally crossed with high-tension circuits is realized by central-station men, but, owing to the extremely infrequent occurrence of accidents from this source, the danger is apt to be forgotten. However, there is no class of accident that can be more damaging to the business of a central station, to say nothing of the humanitarian aspect of the case. Let the public once become suspicious of incandescent interior circuits in a small city, due to a severe shock or a death from contact with such circuits, and the damage to the business will pay for a good many outfits of protective devices. The danger, when it exists, is usually on the secondaries of alternating circuits where the primary and secondary coils are crossed in the transformers. A number of plans have been proposed which insure safety to life and protection from fire. Several of them are practical and available. One of the simplest of these—the permanent grounding of the secondary—is, perhaps unfortunately, not available at the present time on account of the underwriters' rules; but in view of the strong feeling on the part of many eminent engineers that it is the best practice, it is not unlikely that this ruling will eventually be modified. If no protective devices are employed to insure against high-voltage shocks on the secondaries through defective transformers, it should at least be made a practice to test transformers for such defects frequently, especially during the thunderstorm season, as lightning is a noted enemy to transformer insulation, and leaks caused by a lightning puncture may go unnoticed for some time. The very fact that an incandescent secondary is normally such a harmless thing and is so regarded by the public makes the duty of keeping it harmless more obligatory with electric-light companies than if it were something always to be handled with care.

Advocates of municipal ownership, if honest, view with apprehension the political mess. Even if the idea is theoretically sound—which it is not, except within a limited application—there is much to be done in American municipal politics before it can be economically carried out. Mr. E. S. Lacey, president of the Bankers' National Bank of Chicago, expresses this fear in a recent interview. He says: "I would not favor municipal ownership of anything more under the existing conditions. With an ideal civil-service system the plan might be all right. But under the present system, as it operates, municipal ownership would degenerate into another political pudding into which politicians and politicians only would have their thumbs. Municipal ownership of street railways, water systems and other enterprises are entertaining subjects for theoretical reform, but I do not believe that such changes will work till we have a better system of government, a more perfect enforcement of the civil-service idea and the utter effacement of the political-plunder idea which now obtains in all parties."

Many illustrations of the sad results of the political operation of industrial works have been given in this journal. A recent and instructive instance is furnished by the city of Boston. About two years ago Mayor Quincy established a municipal printing plant, a municipal carpenter and repair department, a municipal ice plant, and various other departments for doing work previously done by private concerns under contracts. "The city," says Mr. Guild A. Copeland, writing in Harper's Weekly, "was to save the money heretofore paid in middlemen's or corporations' profits, and was not to allow greedy contractors to wring dishonest profits from the municipal treasury. The painful announcement that the whole scheme is now discredited and is a subject for popular ridicule may cause some sorrow among those municipal statesmen elsewhere who have been so strongly on the side of municipal ownership as a theory which might save American cities from present evils." Mr. Hart, the present mayor, began an investigation which resulted in the abolition of the municipal bureaus named, as hopelessly extravagant. Mr. Copeland gives a skilled workman who held high place in one of these bureaus, as authority for the figures that follow. Reckoning up the cost of material at the current quotations, and the probable cost of labor necessary to do the work under the supervision of any reliable contractor or business house in Boston, it was found that a job of electrical equipment on the ferry-boats operated by the city should have cost $6,800. As a matter of record, it actually cost $10,200. The electrical work on a city building for hospital nurses should have cost $1,528. It really cost $4,754. The work on a city armory should have cost less than $2,600, but the city had to pay nearly $6,700 for the job. Some work on a public school, estimated as likely to cost $1,471 if done under contract, cost the city about $3,600. The city's ice plant also furnished an inviting field for investigation. After the statisticians had finished figuring on that public-spirited enterprise, it was found that the ice used by the Water Department in the drinking-fountains cost about $60 a ton, when it might have been bought from the local ice companies for $2 or $3 a ton. "Thus, in one bureau after another," writes Mr. Copeland, "practically the same situation was found. Instead of saving money by doing all kinds of city work directly by city employes, the city has been brought into debt tremendously; so that to-day the debt is over four times the limit fixed by the state Legislature, the excess having been borrowed under special legislative acts. The interest on this debt, with sinking-fund payments, now amounts to more than the entire amount annually raised by taxation for all city purposes, outside of the school expenditure."

Boston has been regarded as having at least as pure municipal politics as any other large American city, so that the lesson of its municipal-ownership experiment is particularly valuable. The conclusion is irresistible that a fundamental reformation of the politics of American cities must come before municipal ownership on any extended scale can be a success.

Direct-current Distribution at High Pressure.

By Alton D. Adams.

Direct-current distribution on series arc circuits has long been carried out at pressures from 3,000 to 4,000 volts, and in some cases at even higher figures. These arc circuits are, of course, designed for constant current at pressures that vary as the loads. It has long been the general opinion that the constant-current system is not destined to play any important part in electrical distribution outside of its use for arc lamps. Comparatively little has been done in high-pressure distribution with direct currents, aside from arc-lamp lines. The only other important application of direct currents at pressures higher than those of street-railway systems has been that to series incandescent lighting. The Edison municipal system, so-called, furnished an example of direct current, constant-pressure distribution at about 1,200 volts. In this system a sufficient number of low-pressure incandescent lamps are connected in series on a circuit to acquire the voltage of the dynamo to which the circuit is connected. Other similar circuits of lamps are also connected to the same dynamo, until its capacity is reached. The current in each series of incandescent lamps is desired to be constant, but this constant current is maintained, not by changes of the dynamo voltage, as in the case of series-arc circuits, but by automatic devices that cut resistance into any of the circuits where lamps go out, so as to keep the resistances of all circuits nearly constant.

Almost the only application of constant-pressure series systems is to street lighting. Nearly all high-pressure distribution for interior service is now accomplished by means of alternating-current generators and transformers. In many cases the alternating-current equipment is much superior, for areas beyond the limits of low-pressure distribution, to direct-current apparatus. There are conditions, however, to which direct-current distribution at constant and moderately high pressures might well be applied with advantage. One such case exists where an area of moderate extent, but still too great for direct low-pressure service from a single station, offers electrical loads that require the direct current, to a large extent. Another opportunity for direct-current distribution, at high and constant pressure, exists in connection with many low-pressure, direct-current stations, that now serve limited areas, beyond which are desirable loads that cannot be reached with the present voltage. In these circumstances the direct-current machines known as dynamotors or rotary transformers offer a ready and sometimes the best means by which to render the desired service.

The rotary transformer for direct currents performs a like office to that of the static transformer for alternating currents; that is, a high station pressure may be lowered to any desired amount at the consumer's premises, or a low station pressure may be raised to any desired point for the line distribution, and subsequently lowered at either sub-stations or the points of use. Compared with the static transformer, the rotary transformer has the advantage that it can be used with direct as well as with alternating current, and that it generates direct from alternating or alternating from direct current. The comparative disadvantages of the rotary transformer are that it has a moving part, that for direct currents it is practically limited to a few thousand volts in pressure, and that its efficiency is lower than that of the static transformer and its cost greater.

Two ruling factors thus tend to give the rotary transformer a place in some distribution systems. These are the fact that many low-pressure stations do not care to change their type of main generating equipment, and the still more important fact that direct current is necessary for many purposes. On the latter point may be noted the requirement for direct current in electro-chemical operations and storage batteries, and the general preference for it as a motive power. Direct current can, of course, be had from the high-pressure alternating system of supply, but this usually involves both static transformers and rotary converters at the sub-stations or the points of use. The distinction between rotary transformers and rotary converters, as the terms are here used, is that the transformers each have two separate armature windings and a commutator or collector rings for each, while the converter has but a single armature winding with both a commutator and collector rings connected to it. If, now, a supply area, with loads so scattered that a low-pressure service will not reach them economically, must be served with direct current, two courses are open: At the generating station, high pressure, alternating-current dynamos may be installed, so as to keep the investment in line conductors at a moderate amount, with static transformers and rotory converters used, either at sub-stations or at consumer's premises, to deliver low-pressure direct current. An alternative equipment, to do the same work, may include high-pressure, direct-current dynamos at the generating station and rotary transformers at either sub-stations or the points of use. Assuming that either class of equipment will give equally satisfactory service, the main points for comparison are first cost and efficiency of operation.

At the start, the limits of practical knowledge as to large, direct-current machines of high pressures should be held in mind. In large, direct-current dynamos there is but little known, from experience, as to the operation of commutators above 3,000 or 4,000 volts, though comparatively small constant current machines have been pushed somewhat beyond these figures. There is good reason to think, however, that as much as 5,000 volts at the commutator of a 1,000-kilowatt, direct-current generator would require the highest degree of engineering skill to insure satisfactory results. It seems, therefore, at the start, that the use of the direct-current equipment must be limited, in practice, to cases where several thousand volts are sufficient for the desired economy in conductors.

In sizes from 100 to 1,000 horsepower the prices of direct and alternating-current dynamos may be taken as approximately equal. The equipment at generating stations, therefore, costs about the same for equal capacities, whether of the direct or alternating-current type. For equal voltages the cost of line conductors will also be nearly constant for given per cent. of loss, distance and capacity. At the points where the high-pressure supply is reduced to meet the wants of consumers with low-pressure direct-current, the alternating system requires static transformers and rotary converters, while the direct-current system requires only rotary transformers. The static transformers and rotary converters are quite certain to cost more than the rotary transformers per unit capacity of delivery to consumers, and this difference of first cost gives the direct-current system a small advantage.

Apparatus for transformation from the high-line pressure may be located either at small sub-stations or on consumers' premises, but the latter plan has the advantage that the cost of a local-distribution system from a sub-station is avoided, and also that each consumer obtains current at any desired pressure with but one set of transforming apparatus between his secondary wires and the main dynamos. The method which locates the transformers at consumers' premises is best suited to fairly large users at considerable intervals, while sub-stations are adapted to a large number of small consumers closely grouped. Rotary converters are slightly more efficient than rotary transformers, but this difference should be fully compensated by the losses in the static transformers that are necessary with the former.

The above considerations indicate that the alternating and direct systems are very nearly equal as to their ability to supply both alternating and direct current at any desired voltage, under the limits named. This conclusion applies to those cases where the main dynamos can only be devoted to the supply of high-pressure energy to the distribution system.

Where dynamos at the generating station can be devoted to purposes aside from the high-voltage supply, another factor enters the question that may give the direct-current system a decided advantage. It is, of course, well understood that where several kinds of electric service are required from a central station, the ability to use any generating unit on any part of the load is an important advantage, contributing to low investment per unit of output and to efficiency and reliability of operation. Stations that operate traction systems or 500-volt circuits for stationary motors, also three-wire lighting stations that use 230-volt lamps, require 500-volt, direct-current generators for these classes of work. This is true for the three-wire stations, because only a part of the dynamos are required to be connected between the positive or the negative and the neutral wire for purposes of regulation, and it is better to connect the remaining dynamos between the positive and the negative wires. Such stations can greatly extend their service area for all kinds of consuming devices by the use of two 500-volt generators in series, so as to obtain a separate distribution system of 1,000 volts' pressure for the distant service.

So low a voltage as 1,000 is not now so frequently employed as that of 2,000 or more volts for new installations on the alternating system. It will be found, however, in many cases, that 1,000 volts will make it possible to reach all loads that are worth having, with only a moderate expenditure in conductors, and, in any case, the 1,000-volt system will have a distribution radius 16 times as great as the 250-volt, and four times as great as the 500-volt, three-wire system, at the same outlay for conductors, other factors remaining equal. Even this comparison takes no account of the third wire, which, if made equal in size to each of the others, adds 50 per cent. to their total weight. Such a use of 500-volt generators will, in some cases, enable valuable loads to be reached, without any additional investment at the generating station beyond that already made for lighting or traction service.

It is not necessary to operate all of the 500-volt circuits in multiple; the 1,000-volt service may be taken from a pair of the main dynamos at times when each is only partially loaded with 500-volt lines. In street-railway plants the use of two dynamos in series to serve distant parts of the system through rotary transformers at suitable points may effect a saving in conductors far greater in amount than the cost of the transformers.

For 250-volt, direct-current stations that are offered distant loads, in such amounts that high-pressure, main dynamos are not warranted, rotary transformers offer a ready solution of the transmission problem. In such cases one or more comparatively large transformers should be supplied with low-pressure current at the main station and high-pressure energy of the desired voltage generated for the line. Under this method several thousand volts may readily be had for the transmission. The main objection to this last plan lies in the fact that two transformations of energy must take place between the main dynamos and the low-pressure consuming devices. This arrangement is not, therefore, recommended where the loads to be reached by the high-pressure distribution represent a large per cent. of the total station output.

The Copper Situation.

[From the New York Sun.]

The magnitude of the demand for copper, especially from foreign sources, is of such unusual proportions as to call forth surprise even from those who some time ago were considered extremely pessimistic in their sentiments regarding this metal. The shipments this year of American copper to England and the continent are simply without precedent, and for the first half of 1900 are equivalent to the entire production during the same period of the following largest and best-known copper-producing companies of this country, viz.: Anaconda, Calumet and Hecla, Boston and Montana, United Verde, Copper Queen, and possibly several other small mines besides. The five great copper producers above named are estimated to have turned out for the first six months of this year about 195,000,000 to 200,000,000 pounds of fine copper, while the official returns of exports of copper to Europe during the same period are 202,220,480 pounds.

The following table is of interest in showing the United States copper production and exports for the first six months of this year, and the unexported metal left in the country from current output, in gross tons of fine copper:

1900.	Production. Tons.	Exported. Tons.	Unexported. Tons.
January	21,013	14,035	6,978
February	20,897	12,749	8,148
March	23,283	20,148	3,135
April	24,067	12,762	11,305
May	22,682	13,997	8,685
June	22,635	16,586	6,049
Total 6 months	134,577	90,277	44,300

It is thus seen that the exports of copper for the past six months were equivalent to 67 per cent. of the home production during that period and that this country only retained for domestic requirements about one-third of the copper output for the first six months of this year. The above figures prove another thing—that the surplus copper in this country must have dwindled to very small compass, indeed, and that domestic consumers are not in position to dictate market prices, owing to the comparatively small quantity of metal available to come on the home market.

It is also a remarkable fact that, notwithstanding the enormous size of the shipments of copper to Europe, the foreign visible supply on July 15th showed an actual reduction since July 1st of 1,420 tons. The stocks in France lost 600 tons and the quantities afloat from Chili and Australia were 500 and 300 tons smaller, respectively, than a fortnight ago. It is not strange, therefore, under these circumstances, that market values for copper not only hold steady, but exhibit a tendency to stiffen under the wholesome trade conditions governing the article.

BOOK TABLE.

Modern Electric Railway Motors. By George T. Hanchett. New York: Street Railway Publishing company. 1900. Pp., 200, with 184 illustrations. Price, $2.00.

The name of the author of this work is perhaps sufficient guarantee of its merit, and one finds, on examination, that it by no means falls short of what would be expected of it. A number of books have been written having a somewhat similar title, but this book differs materially from anything heretofore written, both in the ground covered and aim. The distinguishing feature of the present work is that it treats thoroughly the detail parts which go to make up the various railway motors in use today. Each part is taken up by itself and the reasons given which have led to the present form of construction. The author has not tried to cover a wide field, but has confined himself to the construction of railway motors. The result is gratifying and compelte, especially so in view of the many half-baked books on electrical subjects appearing recently. Field magnets are first taken up, then armature windings, field coils, armature construction, commutators and brush holders, motor casings, motor suspensions, bearings and gears, lubrication, general dimensions and data, management and repair, railway-motor design and a table of electric-railway motor dimensions. A whole chapter is devoted to each of the above-named subjects. On the whole, this is one of the most thorough works of the kind ever published, and, moreover, it is all practical.

The New York and Queens Electric Light and Power company, with a capital stock amounting to $2,500,000, to operate in the borough of Queens and Nassau County, was incorporated July 21st in New York. The directors are Henry R. Wilson of New York city, Thomas W. Stephens and H. L. Snyder of Montclair, N. J.

DEVELOPMENT OF THE TELEPHONE FIELD.

Notes from Ohio.

Frank L. Beam, general manager of the Citizens' Telephone company at Columbus, has filed a complaint with the chief of police that the company's wires in several buildings in the city had been cut and that other damage had been done to the company's property. He offers a reward of $100 for the conviction of the guilty parties. The company has had much trouble of this kind, but the officers do not attempt to place the blame upon anyone. It seems strange that this should be done, when they are just completing one of the finest plants in the state.

Judge Eason has dissolved the injunction in the case of the village of Millersburg, Ohio, against the Kilbuck Telephone company, and the company is therefore allowed to continue the construction of its lines in the town. The court said that the poles were all placed upon private property, and that the wires were stretched 35 feet above the surface of the earth and out of reach of an injunction. They did no damage to the public in general, and did not interfere with the use of the streets, hence he could not see where the village had any right to interfere with their work.

Work on the farmers' telephone lines at Massillon is progressing nicely. The United States Telephone company, which is doing the work, is now setting the poles by machinery.

The Village Council of Hamilton, Ohio, has had estimates of the cost of placing all electric wires in conduits. Thirteen ducts will be needed, and the estimated cost is $2 per lineal foot.

The Independent telephone company's exchange at Lorain, Ohio, has been connected with Cleveland by long-distance wires.

Attorneys for the Bell Telephone company met with Attorney-general Sheets and State Auditor Guilbert Friday, and an understanding was reached that the tax valuation of $10 per instrument, as suggested by the attorney-general, will stand. Judge Gilbert H. Stewart, attorney for the company, was inclined to believe that the valuation is too high, but, after a careful review of the matter, it was decided to make no change, the decision of the Supreme Court in the matter last winter seeming to form a basis for such valuation.

George Titus of Langsville, Ohio, is arranging to put in an Independent exchange at Vinton, in Gallia County. In case this is done, Gallipolis and a number of other towns in Gallia County will be connected up, giving a fairly good county service.

The stockholders of the National Electric Magneto Telegraph company held a meeting at Springfield a few days ago, and two new directors were chosen, Judge John C. Miller and Joseph F. Henderson. The following-named officers were elected: President and treasurer, Dr. Louis E. Niles, Springfield, Ohio; vice-president, W. S. Van Brocklin, Amsterdam, N. Y.; secretary, L. G. Wooley, Kenton, Ohio. Dr. Niles went to New York this week for the purpose of organizing a construction company to manufacture the fire-alarm telegraph system invented by Mr. Wooley. It has been tested in almost every way, and seems perfectly satisfactory.

It seems that the Columbus druggists have changed their minds in regard to the telephone systems they will use. At a meeting held a few days ago they notified the companies that unless the pay system was inaugurated, they would not change the present arrangements, as the service had been satisfactory to them, and they would not throw the old telephones out. In case the companies do not put in the pay system, it was agreed that only the subscriber and his family should be allowed to use the instrument. The druggists of that city are showing up an immense amount of generosity in this matter. No one has ever attempted to take advantage of either the telephone company or the subscribers in that city by using anyone else's telephone, except where it has been impossible to reach a person any other way.

There is much speculation in regard to the adoption of the telephone by the various railroads operating in the central states. It is said that the Pennsylvania Railroad company will, within a short time, put in a system over part of its lines, and that the Big Four will do the same. The officials believe that it will serve their purpose better than the telegraph in many instances, and they propose to give it a trial anyway.

On July 21st the Cedarville Telephone company of Cedarville, Ohio, was incorporated, with a capital stock of $15,000, divided into shares of $100 each. The purpose of the company is to construct and operate an exchange at Cedarville, and toll lines to London, Madison County; Wilmington, Clinton County; Washington C. H., Fayette County; Springfield, Clark County; Dayton, Montgomery County; Lebanon, Warren County, and to other towns and cities in the counties named. The incorporators are D. Bradfute, O. E. Bradfute, James H. Andrew, F. B. Turnbull and S. B. Rankin. The last-named gentleman is a banker and capitalist of South Charleston, Ohio, and the others are all prominent in business circles. The line or system will be one of the most important Independent undertakings in the state. O. M. C.

Opening of New Main Exchange in Chicago.

Between six and seven o'clock of Saturday evening, July 21st, all the telephone lines formerly operated from the old "main-office" switchboard of the Chicago Telephone company, at 203 Washington street, were transferred to the new Main exchange operating room in the same building. In addition about three hundred lines which had been designated under the name of "Express" were connected with the new board. The Express exchange, which has been temporarily situated with the Central exchange at 100 Washington street, has now been abolished, its lines being given numbers on the new Main board.

The new switchboard is on the eighth floor of the Chicago Telephone building and the transfer of connections from the old board on the floor below was made in two minutes. The work of transferring the lines was accomplished in a similar manner to that of the North exchange of the company, which was described in the Western Electrician, April 21st. The lines were bridged to the new board, the new branches being left open at the cut-off relays by putting small pieces of stiff paper between the contacts. Instead of cutting all the wires at the old office, as was done at the North exchange transfer, the cutting over was done by opening the contacts on the old board by inserting wooden plugs in the jacks and plugging into each jack on the new board, thus dropping out the papers and leaving the lines connected for service. A large number of employes assisted in the transfer, which was quickly and successfully performed, with scarcely any interruption to the service.

The new switchboard, which is of the relay-multiple type, has been under construction during the greater part of the last year. It has a capacity of 4,899 subscribers and there are about 4,300 lines connected.

The company distributed to all its subscribers on the Monday after the opening of the new exchange a new directory containin g all the changes in numbers made necessary by the transfer. The directory is a ponderous book of 920 pages and contains upward of 30,000 names. It weighs very nearly three pounds.

Strowger Automatic Exchange Sells Rights in Germany.

The German government has purchased the rights to use the Strowger automatic telephone-exchange system in Germany. The officers of the Strowger company, which is a Chicago concern, are authority for the statement that final payment of $350,000 has been made by the German government for the German patents on this system and that the first payment of $150,000 was made in January, at which time a trial exchange at Berlin was put in operation by the government under the direction of President Meyer of the Strowger company. A 200-instrument exchange was put into government service at the instance of the government department of postoffices and telegraphs. Strowger instruments from Chicago were put into the Kaiser's palace and all the offices of the postal department. They were to be given six months' trial, and if satisfactory the government was to pay $500,000 for the rights. After the 200-line exchange had been put in the government asked for 200 more instruments in private offices, factories and banks. These were installed, and the government has accepted the patents.

The French government has made an examination of the Berlin system and a payment has been made on a contract with the French government for the patent rights in France.

Citizens' Telephone Company at Grand Rapids.

A dispatch from Grand Rapids, Mich., states that the annual meeting of the Citizens' Telephone company was held in that city on July 18th. The report showed 3,387 telephones, a net gain of 453 for the year; also 19 state exchanges with a total of 2,112 instruments. During the year quarterly dividends of two per cent. have been paid, and the company has a surplus of $12,900. Charles Flowers of Detroit, and W. J. Berry, manager of the Grand Rapids branch of the Michigan (Bell) company, attended the meeting. It was apprehended that the Michigan company, which holds $44,000 Citizens' stock, would attempt to elect a member of the board of directors under the cumulative law. As a precaution against this the number of directors was reduced from 12 to 10. The Michigan company, however, did not attempt to interfere. The old board of directors was re-elected, with Charles F. Rood as president.

Bryan (Ohio) Company Sued for Creating Competition.

On July 19th the Bryan (Ohio) Telephone company was served, through its officers, with notice of a suit for damages brought against it by the Central Union Telephone company, in the United States Court, at Toledo. The damages asked in the amount of $10,000 are alleged to have resulted to the Central Union company by reason of the opposition against it in Bryan. It is claimed in the petition that the Bryan company has secured plaintiff's patrons, and by persuasion, misrepresentation, threats and intimidation has succeeded in inducing them to remove plaintiff's instruments and abandon its service. A temporary injunction was also asked to restrain the local company from further prosecuting its work, but no restraining order has been issued.

"The contest here," says the Bryan (Ohio) Press, "is attracting attention in many parts of the state, where similar conditions exist. Indeed, the struggle between the Bell and the Independent telephone companies in this section of the country has become a prime subject of discussion and public interest. Those who have studied such matters say that Bryan is the banner town of its size in the state for the use of telephones, there being between 400 and 500 in use here, with a population of less than 3,500 inhabitants."

Commenting further on the warfare between the two telephone companies, the same paper says: "There is no doubt but that the Central Union Telephone company has been seriously damaged in this town by reason of the discontinuing of service by so many of its important subscribers, but it is the same damage that results to any business by loss of patronage, and it seems foolish and puerile to try and blame a competitor for that loss. As long as business is carried on there will be competition and business men will solicit trade from their competitors' customers. This and this only has been done in Bryan, and the Bryan Telephone company feels very confident that the Central Union company will not be able to recover one cent of damages. In fact, it is claimed that the suit has been brought for the purpose of trying to intimidate those who may not be cognizant of the true situation of affairs, and not with the thought that there is a chance to recover damages.

"To give the public some idea of the condition of local service, it may be stated that Central Union subscribers are now unable to reach, by their own connections, any drug store, hardware, bank, the courthouse or jail, any icehouse, livery barn or meat market, while the Bryan Telephone company has over 300 subscribers, including almost every department of business, connected with its exchange."

Telephone Operator Wants Damages for a Shock.

Miss Maud Turnbull has brought suit in the Superior Court at Chicago against the Chicago Telephone company for $20,000 damages for injuries received while on duty at the company's exchange at 203 Washington street. The shock, which occurred four months ago, was received from a ringing circuit, and is said to have been caused by grasping the metallic contact part of a plug, instead of the handle, in making a connection. In speaking of the accident, the Western Electrician of April 21st stated that the voltage of the circuit could not have been over 50 volts and that the serious results of the shock had undoubtedly been caused by the nervous condition of the operator previous to the accident. It appears now that Miss Turnbull is partially paralyzed. She has power to talk and take nourishment, but otherwise is entirely helpless. The girl is 20 years old, and formerly supported her mother and a younger brother. The attorney who represents the plaintiff claims that the accident was due to crossed wires resulting from imperfect guard appliances and lack of inspection, which should make the company criminally negligent. Her condition, it is said, has not improved since the accident.

Long-distance Company in Virginia.

News comes from Newport News, Va., that active operations began on July 18th on the long-distance telephone system, which will spread almost over the entire state of Virginia. This system will be owned principally and controlled by the Virginia Long Distance Telephone company. The Peninsula line, from Newport News to Richmond, will be the most important branch. It will connect at Newport News with the Citizens' Telephone company, which already has a wire to Lee Hall, and there the work of setting poles and stretching wires was begun on the 18th. On this day work was commenced simultaneously at eight points in the state. The work is under the immediate charge of General Manager N. C. Watts of Staunton, Va.

Telephone News from the Northwest.

The state reformatory at St. Cloud, Minn., is about to install a telephone system, covering the various departments of the institution.

Commenting on the story recently sent out from Chicago that the incorporation of the National Telephone and Telegraph company was the first step in the consolidation of all the telephone and telegraph interests of the country, C. P. Wainman of Minneapolis expressed his doubt as to the reliability of the statement. He declared that the reported capitalization of $50,000,000 would be insufficient to wage a war against the Bell interests. The story said that the Bell interests would be forced to accept terms. Mr. Wainman thinks that nothing short of $100,000,000 would be sufficient to wage a successful fight against the Bell company. Mr. Wainman is the general manager of the Northwestern Telephone Exchange company of Minneapolis.

The Wisconsin Telephone company has made a reduction in toll rates to all southern, central and eastern points in Wisconsin. The new rates are on a minimum charge of one minute.

The State Executive Council of Iowa taxed the Iowa Telephone company on 6,109 miles of wire, at the assessed valuattion at $144 per mile. The Mutual Telephone company of Des Moines was taxed on 15 miles of line, at the rate of $4,000 per mile.

The City Council of Des Moines, Iowa, will investigate what right the Iowa Telephone company has in the city without a franchise.

Boyd McClellan is working hard to secure a list of subscribers for a telephone exchange at Pocahontas, Iowa.

The Iowa Telephone company at Davenport, Iowa, will hereafter telephone all fire alarms received by telephone, to every fire-engine house in the city. The houses will all be on one switch and will be called at once and given the location of the fire.

During a recent electrical storm the cable house of the Portage (Wis.) Telephone company was struck by lightning and burned. It rendered the city without telephones for a week.

The Nebraska Telephone company is expending $50,000 in extending its underground-conduit system.

The wiring is completed for the new exchange for Pomeroy, Iowa, but the completion of the work is delayed by the non-arrival of the instruments.

The National Automatic Telephone company has canvassed Manning, Iowa, with a view to establishing a local system.

The Northern Electric Telephone company of Willmar, Minn., has bought the exchanges of the Interstate Telephone company of Ortonville, Minn., located at Appleton, Ortonville, Graceville, Wheaton and Clinton, Minn., and Big Stone City, S. D.

The Lake Park and Ulen (Minn.) Telephone company plans extensions and improvements to its system.

The Bemidji (Minn.) Telephone Exchange company has been incorporated, with $10,000 capital stock.

The McCormick company of Albert Lea, Minn., is to have a separate long-distance wire connected with its warehouse, in order to leave the local wire open for local communication. The company has a great deal of long-distance work, which interferes with the local calls.

A telephone line is being built between Hollandale and Barneveld, Wis.

The Northern Minnesota Telephone company has its exchange at Long Prairie, Minn., completed, with the exception of the switchboard, which has been delayed.

A telephone line will be built from Wilmont to Lismore, Minn., at once.

W. C. Connor, Minneapolis lineman, while working in the interurban district on the Northwestern Telephone Exchange company's wires, got a severe shock and fell to the ground. He was badly cut, but was not seriously injured.

The new telephone system at Rolfe, Iowa, has 95 instruments connected.

The Central Telephone company of Rockwell City, Iowa, is about to move its central office to new quarters.

The Central Telephone company has sold its lines in Pocahontas County, Iowa, to the Northern Telephone company.

The Iowa Telephone company is an applicant for a franchise at Lohrville, Iowa, and proposes to extend its lines to Gowrie and Lake City, if successful.

There is considerable complaint at Des Moines, Iowa, over the inadequate telephone service given by the Mutual Telephone company, especially, although the Iowa company comes in for some blame. The former is in debt and would have to expend considerable to bring the system to a satisfactory condition. The exchange has been doing a reasonably profitable business, but is inadequate to the calls made upon it. Additional capital is needed.

The Central Telephone company has let the contract to build a line from Rockwell City, Iowa, to Knierim.

The parties interested in the Spokane and British Columbia Telephone company are arranging to form the Spokane and Okanogan Telephone and Telegraph company. The new company proposes a number of extensions of telephone line in the district along the international boundary line. Extensions will be made from Bolster, through to Brewster, Okanogan County, thence to Oro, to Golden and Loomis.

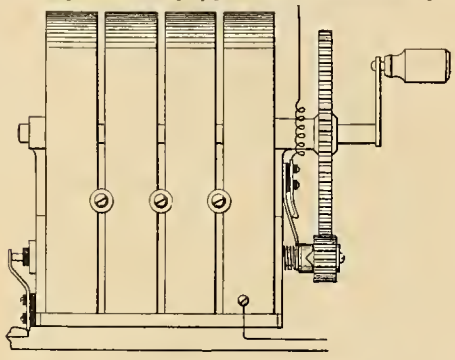
R.

Nolen Magneto Automatic Shunt.

The accompanying illustration shows a novel automatic magneto-generator shunt recently invented and patented by J. G. Nolen and now manufactured by B. F. Stewart & Co. of Chicago. The Nolen device really fills two offices, viz., that of a combined gear muffler and shunt.

The extreme simplicity of this device is said to be one of its most attractive features. The manufacturers claim it is also a radical departure from any device of the kind heretofore patented, as there were no references cited in the application for patent. Neither the main shaft of the magneto generator nor the large gear wheel is directly used for breaking the shunt, nor does the gear wheel recede into the box when the crank is turned.

The chief feature of the Nolen device is the pinion, shown in the illustration. This pinion would run loose on the armature shaft were it not for its two V-shaped lugs which engage similar V-shaped notches in another sleeve, as indicated. This latter sleeve is loosely keyed on the armature shaft, so that it may slide along the shaft laterally, but not revolve, unless it at the same time turns the armature shaft. The second sleeve (the one with the V-shaped notches) is held in place by a circuit-breaking spring which is in contact with another spring. The second spring short-circuits the generator when it is at rest, and this spring in turn is held in place by a spiral steel spring, which is mounted upon



NOLEN MAGNETO AUTOMATIC SHUNT.

the armature shaft, back of the circuit-breaking spring.

Owing to this construction, the generator crank can be turned in either direction, a point which no doubt will be appreciated by telephone-exchange managers, who experience the indifference of the general public in giving a fair signal or turn of the crank for disconnections. Again, this shunt is said to be very sensitive, for the circuit is broken immediately upon the crank being moved not more than an eighth of a turn. A generator equipped with this style of shunt is practically noiseless in operation. This type of shunt, also, the B. F. Stewart company states, can be mounted on any generator of standard manufacture.

Annoying Predicament of Winnipeg.

The Bell Telephone company has had charge of the city fire-alarm of Winnipeg, Man., for a number of years. Recently the city concluded to install a municipal system and notified the Bell company that the contract would cease on July 1st. But the new system was not ready for use on that date, and the city sought to have the telephone company extend the contract for a few months. The company replied that it had made other arrangements for the space taken up by the fire-alarm equipment, and unless the city would contract for three years, it could not extend the contract.

La Crosse Business Men Object to Putting Wires Underground.

Mayor Anderson of La Crosse, Wis., and the business men of that city are on the verge of war over the putting underground of housetop wires. The city recently paved a certain central district with brick, and required all wires to be put underground. The mayor is interpreting the ordinance to include telegraph call-box circuits and private telephone lines over the housetops, which it would be impractical to put underground, on account of the expense.

General Manager Henry A. Coit of the Citizens' Telephone company of Terre Haute, Ind., states that work on the company's new underground system has been progressing splendidly, and is now about completed. Mr Coit writes: "We have laid 45,000 feet of McRoy duct and have most of it run. Most of our material is on the ground and work is progressing rapidly. I have had a number of telephone men here to see our outfit, and they say that in point of construction it will be one of the most modern and up-to-date plants in the country. We have full metallic circuit." It is fair to say that the excellence and rapidity of construction of the Terre Haute plant is largely due to Mr. Coit's enterprise.

Strike of Rochester Linemen Settled.

An agreement has been reached between representatives of the Bell Telephone company of Rochester, N. Y., and the striking linemen, whereby the strike, which has been on for some weeks past, is practically settled. There have been mutual concessions and both parties are satisfied with the articles of agreement, which call for a flat rate of $2.50 a day, time and one-half for overtime and a ten-hour day. This is practically everything that the men asked for. The company also binds itself not to discriminate against any of its former employes. The local union met and ratified the articles of agreement. It is hoped that the strike of the Buffalo linemen will be settled within a short time.

GENERAL TELEPHONE NEWS.

The Guthrie (Okla.) Telephone company has been granted a franchise in that city.

The stockholders of the New York Telephone company will hold a special meeting in New York city on August 8th to vote on a proposition to increase the capital stock from $16,000,000 to $30,000,000.

The use of the telephone has at last done away with the ancient royal custom of mounted messengers between Windsor Castle and Cumberland Lodge, and the queen is now in easy communication with the Prince and Princess Christian.

Stockholders of the Pekin (Ill.) Telephone company have elected the following-named officers: President, James W. Barrett; vice-president, J. C. Mead; secretary and treasurer, W. B. Aydelott; directors, James W. Barrett, J. C. Mead, W. B. Aydelott, V. P. Turner and George B. Hornish.

The Citizens' Telephone company of Muskegon, Mich., recently elected the following-named officers at its annual meeting: President, Thomas Munroe; vice-president, Thomas Hume; secretary, Joseph B. Ware of Grand Rapids; treasurer, L. B. Smith. A semi-annual dividend of four per cent. was declared.

Trouble is said to be brewing again in the ranks of the telephone linemen at Cleveland, Ohio. It is claimed by the men that the Cleveland Telephone company has discriminated against its old men in the matter of discharges, and that some of them have been laid off because of their connection with the recent strike.

A telephone war is on in Logansport, Ind. A petition to the City Council is being circulated protesting against the county giving W. A. Vaile of the Central Union Telephone company, or any other company, a franchise without the rates being fixed. It is said that the Central Union company owns the Mutual plant and that Mr. Vaile of Indianapolis hopes to get enough votes in the council to fix things for his company.

The Erie Telephone system made a net gain of 19,891 subscribers for the six months ended June 30th, making a total number connected of 126,455. The net gain and total number connected are distributed as follows:

	Net Gain.	Total Connected.
Southwestern company	5,683	34,469
Cleveland company	1,335	15,011
Northwestern company	3,319	19,496
Michigan company	6,397	38,628
Wisconsin company	3,157	18,851
Total	19,891	126,455

MANUFACTURERS AND DEALERS.

The National Telephone Equipment company of Detroit, Mich., was recently incorporated, with $100,000 capital, $65,000 paid in. Hugh O'Connor, William C. Sterling, Jr., and Edward H. Parker were the incorporators.

The hanging telephones made by M. I. Vought, La Crosse, Wis., are receiving many interesting comments in foreign journals, many of which are very complimentary. The exhibit at the Paris Exposition has aroused considerable interest, demonstrating that they are going to be in great demand. A new and handsome catalogue is in press.

The Farr Telephone and Construction Supply company of Chicago reports a lively trade, much better than anticipated in midsummer. This company has now in the printers' hands a new 50-page catalogue and handbook of information, size, 6½ by 10 inches. This catalogue, the company says, contains the best photographic illustrations of its telephones, transmitters, magneto bells, receivers, switchboard drops, jacks and plugs that can be made and also illustrates all electrical supply material used in the telephone business. The book will be sent to any address, free upon request.

Telephone companies at Rome, N. Y., Fostoria, Massillon, Canal Dover and Portsmouth, Ohio, have recently placed orders with the American Electric Telephone company of Chicago for central-energy systems in conjunction with the popular American flash-light transfer system. Each of the above orders exceeded the 600-capacity mark. A new multiple switchboard is in course of construction in the American factory for St. Joseph, Mo., which will have an ultimate capacity of 3,000 subscribers, with 1,000 drops installed. Multiple boards made by the American company for York and Allentown, Pa., are said to be giving the most gratifying results.

New "Electrogravure" Process.

An interesting exhibit at the Paris Exposition is that of the new "electrogravure" process, which, as its name indicates, is a new method of applying the current in engraving work, doing away entirely with manual labor. It is applied to the formation of molds or matrices in hard metal, usually steel, made from a model in relief, the mold or die being then used to make reproductions of the design, medals, etc. In the usual process for making such matrices it has been necessary to use hand work entirely; the workman must be a skilled artist, and the cost is high. Different inventors have tried to find a mechanical process which would replace hand work in making the molds, the first attempts being the use of the galvanoplastic method, but it was soon found that a suitable matrix could not be made in this way. Mr. Joseph Rieder, a German inventor, has discovered a process by which a purely electrical method is used. The invention promises to be of great value in this class of work. The principle of the apparatus will be understood by referring to Fig. 1. A receptacle (styled "recipient" in the cut) is filled with a solution of ammonium chloride, which forms the electrolyte. Into the vessel is plunged a block of plaster (A) having upon its upper surface the relief to be reproduced. Below the plaster is a copper wire rolled into a spiral, which forms the cathode. On the upper part of the block rests the plate of steel (B) in which the mold is to be formed. This plate is connected with the terminal wire and forms the anode. The liquid, being absorbed by the plaster block, traverses the porous mass and comes finally into contact with the steel plate, but only at the highest points of the relief. When a current is passed through the apparatus thus disposed, a decomposition of the ammonium chloride takes place, and the chlorine is set free at the surface of the steel plate forming the anode; it combines with the iron, and the chloride of iron thus formed dissolves in the liquid. As the iron is carried off at the points touched by the plaster relief, the steel plate becomes hollowed out, little by little, at these points. Other portions of the model come successively into contact with the plate, so that at the end of the operation the whole of the model has penetrated into the steel plate, thus forming the mold desired.

The process thus appears extremely simple, but, in fact, the inventor has had great difficulty in reducing the idea to practice, and it seems scarcely credible that he has passed three years of experimental work before arriving at a practical result. It was found that the model and plate could not

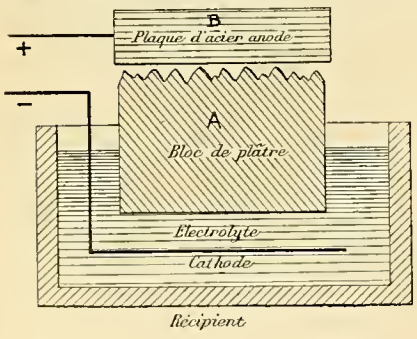


FIG. 1. NEW "ELECTROGRAVURE" PROCESS.

be allowed to remain together during the whole of the process without interruption, as it could not be ascertained when the work was finished, and again the particles of carbon which enter into the composition of the steel are separated by the action of the current and become interposed between the plate and the model, making it impossible to continue the work. Another difficulty is that the chlorine at the surface of the metal is rapidly consumed, and as this is necessary for the operation, and on the other hand, the diffusion through the plaster block is too slow a fresh solution must be applied to the surface of the relief at intervals. For these reasons the two pieces must be frequently separated; the time of contact depends upon the current density used and the percentage of carbon in the steel. Experiment has shown that not more than 20 seconds can be allowed for each period. Then an arrangement must be found to replace the plate exactly in the same position. The first machines made were not very satisfactory in this respect, and a number of different forms had to be constructed before reaching a conclusion. It was also found that the plaster models were somewhat fragile and a great depth of relief could not be obtained by the use of the same model. Thus a number of models had to be used, these being placed in the apparatus one after the other.

To carry out this idea the arrangement shown in Fig. 2 was devised. A glass vessel (g) is provided with a cover (d). In the middle of the cover is an opening, which is narrowed at the lower part, forming a ledge to support the rubber sleeve (c), holding the plaster model (E). Several of these rubber sleeves are provided, of exactly the same size and containing a plaster model of the same form; they are put in the same position by a mark on the side. By this arrangement, several models can be used to form the same steel matrix. (A) is the plate to be engraved, planed on all sides so as to fit exactly in the opening without lateral displacement. The plate is placed upon the model and left for 20 seconds under the action of the current, then lifted and cleaned. This is continued to the end of the operation, a small quantity of solution being put on from time to time with a brush. The result obtained by this form of apparatus has been quite satisfactory, but it was necessary to make a machine which should be entirely automatic; this has been carried out, and a machine of this type is now in operation in the gallery at the end of the foreign dynamo room of the exposition, in the German section. In this apparatus, the models, held by screws in a cast-iron frame, rest on a table which is movable in the ver-

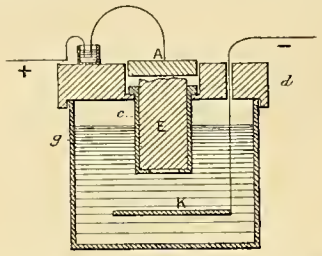


FIG. 2. NEW "ELECTROGRAVURE" PROCESS.

tical sense, taking its movement from an eccentric. Above the table supporting the models is fixed the frame for the steel plate to be engraved. This frame is arranged to take a position exactly parallel to the surface of the model; below the table is fixed the carriage, which, each time that it is acted upon by an eccentric, advances between the model and plate, which are already separated, and effects the cleaning of the plate by a rotary brush; at the same time a quantity of fresh solution is spread upon the plaster model. The steel plate and model remain in contact for periods of 15 seconds, at the end of which time the separation and cleaning take place automatically. The potential used is from 10 to 15 volts and the current density varies according to the size of the model; for a plate of 8 by 12 inches a current of 50 amperes may be used.

A. de C.

Affairs of the Chicago General Railway Company.

At the annual meeting of the directors of the Chicago General Railway company, held on July 20th, the general counsel of the company was authorized and directed to begin proceedings against the Chicago City Railway company to secure a determination of the rights of the latter corporation in Wabash avenue from Twenty-second to Madison street. It is contended that the 20-year extension ordinance of 1893 did not apply to the Wabash tracks and that there was no "time limit" named in the ordinance of 1874, and consequently the franchise under the horse and dummy act expired in 1894. The Chicago City Railway company, it is said, contends that its franchises entitle it to the use of Wabash avenue until 1948. It is stated that the petition, when filed, will ask that the rights of the city to the tracks be determined and the amount to be paid to the city for the use of the tracks be ascertained.

The action of the directors is said to have been taken with a view to securing a downtown terminal for the system, which now stops at Twenty-second street. The road is now in the hands of a receiver, but the directors contend the road would be free from financial difficulties if it could secure an opening into the business section of the city.

A resolution was also passed offering to provide a three-cent fare from the Illinois Central depot at Twelfth street to the Northwestern depot on Kinzie street if the city would provide the "legal requisites" for the operation of the company cars between those points.

The directors also went on record as favoring the proposition of the Street Railway Commission of the City Council to secure municipal ownership of the rails, with private ownership of the vehicles.

Glenn E. Plumb's resignation as president and director of the company was accepted, J. P. Black being elected to fill the vacancy as president, and W. A. Goodman as director. C. L. Bonney was elected general counsel.

The Stonewall (Miss.) Cotton Mills, of which T. L. Wainwright is secretary, want estimates on an 800-light incandescent plant.

Plans for Inter Ocean Automobile Meet.

As announced in the last issue of the Western Electrician, an important automobile meet will be held at Washington Park, Chicago, September 18th to 22d. A programme has been made out, which will be subject to change until August 15th, at which time the final programme will be arranged. The present programme, of which the following is an abstract, will be modified as may seem best from suggestions made by anyone interested in the meet, and especially those who will exhibit.

On the opening day there will be a general parade of all vehicles, and the public will be allowed to examine and ride in the vehicles. Prizes will be given to the manufacturer presenting the greatest number of practical designs and to the one having the greatest number of vehicles in line.

The second day will begin tests for practical utility. Different forms of power will be classed together, but vehicles of like size and power only will compete with each other. Vehicles must be of standard design, construction and equipment, as sold by the manufacturers. For this test each maker can enter three vehicles—one carrying two people, one carrying four or six people, one for merchandise delivery, carrying a load of 1,000 to 2,500 pounds with driver, the award to be in ratio of weight of vehicle and load. A test for manipulation will be made on a road crowded with standing and moving dummy figures, and over rough roads requiring quick stops and short turns. In these practical utility tests the following ratios of points will be established as winning values:

Speed to be determined on a 5 mile run. See 200 mile race	20 points
Elegance of carriage design and practicability	20 points
Best arrangement of brake and control of speed	20 points
Best climbing of grades	20 points
Best and surest safety devices for operating vehicles either on grades or level	10 points
Best, simplest and most easily accessible mechanical construction	10 points

There will be a hill-climbing contest, also a contest on an up-and-down grade, in which practicability and controllability of vehicles will be demonstrated.

There will be a heavy draft contest, open for all heavy draft motor trucks built for commercial hauling. In this contest the following ratios of points will be established as winning values:

Construction	20 points
Power	20 points
Carrying capacity	20 points
Design	20 points
Control	20 points

After decisions have been rendered on tests covered by above rulings, the prize winners of each class will be allowed open competition on:

Carriage design for general practical utility	30 points
Easiest manipulation	30 points
Safety and emergency devices	20 points
Cost of power per ton mile	20 points

(Per ton mile to include complete weight of vehicle and passengers as well as any additional load that may be carried.)

In these the cost of electricity is to be based at four cents per kilowatt hour; cost of gasoline or oil to be based on current market price per gallon. In entering machines for all tests of a practical nature manufacturers will be obliged to give the normal rated power of each vehicle, and a special prize will be awarded for the greatest range of useful power obtainable above and below the normal rating.

Without reference to power, one prize will be offered for the most original conception in an automobile as regards modifications and changes in carriage design that will still leave the vehicle acceptable and practical.

Four races will be given, in which speed alone will count for 100 points, each manufacturer to enter two vehicles in each class, of such design and equipment as he may select. One race of 20 miles will be run between electric vehicles and similar races between gasoline vehicles and also between steam vehicles. Any disabling of a vehicle during a race will disqualify it for further participation during that race. The prize winners of each race will then enter into a free-for-all race of 40 miles, standing start, without aid. The time for these races will all be kept by each mile, and a side prize given to the vehicle making the best single mile at any time during these races.

A two-hundred-mile, free-for-all, fast track race will be for owners of carriages carrying four grown people, as also a two-hundred-mile track race, for vehicles carrying two people.

Another interesting feature of the meet will be a mail-collection race. Four mail boxes will be placed at equidistant points around the race track and ten miles will be run, making forty stops in all to collect mail. Each driver will be obliged to stop at each mail box, unlock the box, take a card from it and lock it again.

An additional prize will also be given for the design of mail wagon which shall be the most practical and best adapted to the collection of mail from street boxes.

A ten-mile race will be run on rough track, constructed to represent an average country road, with a vehicle carrying four people, and another with a vehicle carrying two.

On the fourth day a 500-mile, free-for-all, smooth track race will be run, and exhibition performances given meanwhile on the inner circle. This will be followed by a five-mile automobile transfer express race, taking a swinging bag from suspended hooks at four points around the track without stopping. The man coming in first with twenty of these bags

will be awarded first prize. This test will be open to any and all classes of vehicles.

Ladies' day will be full of interest, as ladies will have the tracks exclusively in a series of races which shall be run in regular carriages and not racing vehicles, in addition to which the most dexterous lady operator in dodging dummy figures, climbing grades and general manipulation of the vehicle shall receive a special gold medal, with the name of the vehicle engraved thereon. Entries may be made either by manufacturers or private owners.

A special gold medal (engraved with the name of vehicle and operator) will be awarded the operator of vehicles (of the commercial and catalogue type) who performs the most difficult tests and practical movements. This will be immediately followed by an exhibition of vehicles owned exclusively by private parties, which shall be open and free for all in a four-mile race. In this the first prize will be for the winner of the race; second prize to the most dexterous operator; third prize to the best-appearing vehicle.

This race is to be followed by an open and free-for-all exhibition of fancy or trick driving, either by manufacturers, private owners, ladies or gentlemen.

There will also be a pulling contest, free for all, of any make, design or capacity of vehicle, the award to be in ratio to weight, power and performance.

To demonstrate the merchandise delivery wagon, a race of three miles will be run, having eight stations on alternate sides of the track, at each of which must be left a package weighing not less than 20 pounds. Each wagon will be allowed a driver and assistant, as is the usual practice on such wagons. In this test the wagon shall not be required to come to a full stop, the driver and assistant operating together as best they can, but the winning vehicle must arrive at the finishing point with all packages delivered and driver and assistant in their respective places.

After the races are over a prize of $1,000 will be offered to be most valuable invention in automobiles that shall have been practically demonstrated during the week of the exhibition.

A race will be given of automobiles running backward at full speed for one mile. This race is to be open to all kinds of vehicles.

The exhibits will be in the betting ring of the Washington Park track, which has a concrete floor and is sheltered. The space available is 75,000 square feet, divided into spaces containing 1,000 square feet each.

The Automobile Club of America and manufacturers are said to be co-operating heartily to make this meet a great success.

Telegraphic Board of Trade Quotations Discontinued.

On August 1st a radical change will go into effect regarding telegraphic stock quotations from the Chicago Board of Trade. The Western Union and Postal Telegraph companies will no longer furnish stock quotations on the old plan, but all quotations must go as private messages at regular rates. This is the result of the board making requirements as to rates and asking discrimination in the distribution of quotations which the telegraph companies could not accept. The board wished to shut off quotations to bucket shops, but the telegraph companies being common carriers cannot, according to the courts, discriminate as to whom they will furnish service. Meanwhile, a concern known as the Cleveland Telegraph company is preparing to supply a ticker service in Chicago, and an allied company, the Milwaukee Telegraph company, will furnish ticker service in Milwaukee and intermediate points. The officers of the Cleveland Telegraph company are: G. B. Solders, president; Allen A. Odell, secretary and treasurer, of Cleveland, and Fredrick E. Crawford, superintendent, Chicago. Its offices are in the Board of Trade building. Some members of the board think the discontinuance of the telegraph service will be a benefit to the board by discouraging bucket shops.

Susceptibility of Trees to Lightning.

Inquiry was recently made by the German government, says the Chicago Tribune, into the effect of lightning upon trees. Observations were made by overseers of foresting stations scattered over an area of 50,000 acres in the district of Lippe. The forests comprised 70 per cent. of beech trees, 13 per cent. of pines, 11 per cent. of oaks, and six per cent. of firs. Of 275 trees struck by lightning 58 per cent. were oak, 21 per cent. fir, eight per cent. beech, and seven per cent. pine. These figures show the extreme susceptibility of the oak to lightning stroke, and the large and disproportionate percentage of its attack upon the fir The beech appears to be almost immune from lightning stroke. While 70 per cent. of the forest trees were beeches, they received only eight per cent. of the strokes, or about one-ninth of their proportionate share. It has often been asserted in England that the beech was never struck by lightning. While the German observations disprove this broad assertion, they amply justify the common belief in the rarity of the occurrence.

Field Telegraphy at Mafeking.

The following account of some of the work done by the electrical engineers of Mafeking during its siege was written by the war correspondent of the Pall Mall Gazette and appeared in that journal on June 28th:

"Some departmental workers in the field are seldom heard of by the general public, and, therefore, do not come in for the share of praise for work done that should be theirs. Yet these departmental corps form the principal springs that work the war machine. Without a commissariat department an army could not take the field. It could not bring its necessaries with it, and would find itself in a corner for want of food. The Royal Engineers are seldom sung about, and few know how hard the scientific corps work to make everything possible for the conduct of operations. Is there a mountain to be removed? They do it. Does the general want to have a system of telegraphs constructed, or a railway built, on an engine driven, or a bridge thrown across a river, or a sea of timber cut down? The Royal Engineers are the men upon whom falls the work, and nobody can say that the corps does not perform it in the highest state of efficiency. Those corps that do the heaviest and most laborious duties are, as I have said, the bodies that are least heard of at home. They toil like galley slaves, but quietly; and when their toils are over little more is heard about them until they are required in some other part of the field.

"The public mind must be stimulated into interest by sound and dash. A blazing battery or mass of guns rattling and dashing over a plain to get into action comes first in public favor; the cavalry, with saber in hand, or lance-point dropped, scouring over the plain after a retreating enemy, comes next; and patient, swearing Tommy of the infantry of the line, with his bayonet fixed and his helmet on his ear, poking his way into an enemy's trench, is generally a good third. These are the fellows of noise, glitter and dash; but you cannot get much dash out of half a mile of transport wagons and mule teams or a system of useful telegraph wires. Therefore the men who work that part of the show must take a back seat, and be content to make up with the extra daily salary given them by a thoughtful war office.

"I want to say something about the telegraph and telephone service of Mafeking during the siege. To begin with, we had little wire and no Royal Engineers. The postmaster of the place, Mr. J. B. Howat, had the planning of the arrangements in his hands, and Mr. Arthur Campbell, of the Belfast Telegraph department, with Mr. J. B. Simpson, of the Northern relief, had the arranging and thinking and 'bossing up.' Miles of wire had to be laid to all the furthest forts and works, and the question was how to begin. As a start, all the telephones rented by the townspeople were taken down and the wires and instruments commandered. With these a humble beginning was made, and an efficient field system was completed across the veldt in all directions. The wire was carried on small pegs raised a foot or so over the ground, and passing cattle and carts improved the lines and caused the staff to sing Watt's hymns and other items of sacred music.

"By-and-by it was discovered that all the insulated wire that had been laid with much trouble under fire was wanted for the purpose of connecting mines to blow the enemy up with. Down came the lines again, and Campbell had to go around gathering all the scraps of wire that he could find in the town, tie them together and endeavor to stretch 100 yards into ten times that length. Metallic circuits were out of the question, as they would have necessitated the use of double the quantity of line. Earth circuits were formed, and the earth-plates consisted of iron buckets filled with mud, and rolls of zinc that had been shelled off the roofs in town. Occasionally a wire end was fixed to an iron rail on the top of a bomb-proof shelter, and that acted as well as anything else.

"Everything was nicely settled, as far as it went, and the telephone headquarters was established in the local postoffice, until it was found that it would be more convenient at the staff headquarters, a quarter of a mile away, and subsequently in the headquarters dug-out around the corner. Each of these shifts meant the taking down of the instruments, the elongation of the wires and the fixing up of the instruments again. As new works were formed at the front, and our lines of defence were thrown out farther and farther, the demand for lines of communication became more and more frequent, and longer lines had to be established. The construction party went gray through thinking of their load of work and wondering where they would get the wire. At last somebody made a splendid find in the shape of thousands of yards of manganese wire, which the inmates of the gaol were told off to insulate by wrapping calico around it and tarring it over. Eureka! the difficulty was solved.

"At home a heavy storm or a big snow does damage to your lines, and causes the maintenance staff to use bad language. Here in Mafeking we had no snow, but the showers of iron were too much for the wires. Scarcely were we ever shelled but they were smashed, and the men had to go out under fire to set them right again. Times innumerable the cutting was done by Mauser bullets, and once during a heavy wind a tin roof sailed off a house in the market square, and, of course, fate willed that it should fall right on the entire system of wires and fracture them. It was a warm moment when Mr. Campbell and his staff came out to count up the damage.

"Night and day that network of wires had to be watched and the instruments nursed like babies, and the work of repairing was never done. Many a time and oft in the darkness of the night the men were on the poles connecting up when the bullets began to whiz around them and make them shin their way to the ground again, and once MacLeod, the drawling, fat Scotch ex-sailor, who worked as linesman, was almost blown off the post by a shell. He seemed to work 20 hours out of the 24, but I only heard him growl once. He was sitting on a curbstone, looking up with tired eyes at two wires that were twisted around each other, and when I hailed him, he replied, 'A-a-h-h, mon, look y-o-o-n-der. Y-o-n's Cannon Koppie lyin' d-o-o-n on Colonel H-o-r-e.' I left him contemplating the wreck and wondering how Hore would come out from under the weight of the kopje.

"All sorts and conditions of instruments were used in the service, and there were numerous makeshifts to make the communication complete. Pieces of driving bands off the big shells fired at us made an excellent switchboard, and the ancient and modern contrivances found in the lumber room of the postoffice were hauled out and fixed in the trenches to do duty for receivers, transmitters and alarms.

"The communication department was without exception the most severely worked body in Mafeking. In addition to erecting and maintaining under the most terribly trying circumstances, they had to work the instruments or train others to work them; they had to keep watch and at the same time run the siege postoffice. Human nature could not stand that kind of thing indefinitely, and in course of time the postmaster and all hands except Campbell went sick with fever, the result of exhaustion and other ailments, and then for weeks Campbell had to take the watches of all his colleagues and run the department single-handed. For days he worked 24-hour shifts, but he did not die, as many men would have done.

"On top of his troubles came the siege surcharged stamps. Everybody wanted sets and new issues and particular, stamps to make up their collection, and his bomb-proof postoffice was each morning besieged by waiting crowds clamoring for mauve sixpennies, yellow sixpennies, sixpennies with the figure in a reclining position, and sixpennies with the 'elongated figure.' I often went over there to watch his labors and admire his patience. There is a law in nature by which a man finds rest while contemplating the toiling of another, and the sight of this brain-weary man leaving the dug-out to look after his duties elsewhere had a delicious, balmy effect. I admit the savagery of the idea.

"I wrote in a dispatch of the great rains that washed us out of our trenches. During those rains the telephone instruments suffered. They were submerged, and when the holes were baled out the receivers and transmitters were found to be full of mud. Even in this supreme trial the patience of the amazingly patient men did not desert them. They began to clean out the mud with no hope of ever being able to make sound go through the telephones again, and at the finish were surprised to find that they had once more got their machines into perfect going order.

"It will be well if telephone and telegraph people at home cut this out and read it twice each time that a snowstorm or a gale gets among their wires."

Andrae & Sons' Affairs.

About 80 per cent. of the creditors of the Julius Andrae & Sons company were present at a meeting held at the Plankinton House in Milwaukee July 17th. The sentiment expressed by nearly all those in attendance was in favor of allowing the company to continue its business. It was decided that the creditors accept 50 per cent. of their claims in full, the money to be paid in three installments within four months. A committee was appointed to obtain the consent of the creditors, and if parties holding 90 per cent. of the claims agree to the action a representative of the Milwaukee National Bank is to be put in charge of the company's affairs as treasurer and the firm will be saved from bankruptcy proceedings. It is probable that the electrical portion of the business will be continued, as there are a large number of contracts on hand, but the bicycle business will not be operated until some time after January 1st. There are 315 creditors in all, representing an aggregate indebtedness of $106,000.

Siemens & Halske Company Disposes of Its Real Estate.

The Siemens & Halske Electric company of Chicago has sold to Robert McAllister Lloyd and Walter H. Johnson of New York city six blocks at the northwest corner of West Sixteenth street and Robinson avenue, in the township of Cicero. The consideration of the deed was $200,000. The property conveyed is 641 by 1,886 feet in size, together with the buildings and fixtures thereon. The sale does not include the electric or other cranes located on the premises nor the machinery and tools at hand suitable for making apparatus. This equipment is still owned by the Siemens & Halske company and used in the operation of its plant.

First Annual Meeting of the Chicago Union Traction Company.

The report of the officers of the Chicago Union Traction company at the first annual stockholders' meeting, Tuesday, July 24th, is full of interest, as it represents the first year's operation of the consolidated North and West Side street-railway systems of Chicago. The net earnings were somewhat smaller than had been expected in financial circles, owing to extensive improvements and additions to equipment made during the year, and also to the industrial strikes. The report for the year ending June 30, 1900. President J. M. Roach says in his report to the stockholders:

"The business done by your company during the last fiscal year, June 30, 1899, to June 30, 1900, which we have the honor to report, has been excellent, showing a satisfactory increase over business done the preceding year by the leased lines, notwithstanding the trying conditions under which the company has passed during this, the first year of its existence.

"The conditions upon which our earnings are based, since the 1st of February, 1900, have been very unfavorable. Unsatisfactory conditions have existed with the various industries which have not, up to this time, been satisfactorily settled. The weather for the months of April, May and June was anything but good for the railroad business. The Northwestern Elevated road, starting up as it did on May 31, 1900, also had its effect on the income of this company.

"Notwithstanding these unfavorable and embarrassing conditions to the management, our books show that we have earned a dividend on the preferred stock of the company and besides the roadbed and rolling stock are in better condition than ever they have been during the history of these companies.

"There were large amounts of money expended on boulevard crossings, repairing and relettering of cars, overhauling and remodeling 300 summer and winter cars, besides adding 80 new cars to our equipment, with everything incident in the shape of motors, etc. There have been no pains spared in keeping all of the electrical construction first-class and up to date.

"There have been the following amounts spent on the property of the company:

Construction:	
Track construction	$ 74,625.42
Electric-line construction	42,063.13
Real estate	158,922.01
Equipment:	
New engines and machinery for power houses	60,577.13
Additional machinery at shops	4,627.49
Cost of new cars	88,451.02
Cost of rebuilding and vestibuling old cars	26,218.91
Cost of new electrical equipment for cars and plows.	78,073.40
Cost of building four new snow plows, wagons, horses and harnesses	10,812.79
Other property accounts	60,838.80
Reconstruction	216,026.26
A total of	$821,236.36

"With the industrial question settled and with reasonably fair weather, which we shall expect, and with the general prosperous outlook for the future, I predict that the stockholders of the Union Traction company who continue in the holdings of the company will find it a good, profitable and safe investment.

"It has been, and shall be in the future, our desire to obviate friction and cater to the wants of the public by broad-gauge management of its affairs and courteous treatment in the handling of the public.

"I will not attempt in this address to give any financial details of the company, inasmuch as the auditor, Mr. F. E. Smith, has furnished a detailed report under our system of bookkeeping of the entire financial operations of the road. Mr. James H. Eckels, treasurer, will also furnish a short statement, showing the reduction of fixed charges in the operation of the road since he became treasurer. For the splendid condition and relations that now exist you are much indebted to our former and distinguished president, Mr. Jesse Spalding, for the manner in which he has handled the property of the company and turned it over to the present officers."

The treasurer of the company, James H. Eckels, presented a report showing that since he had taken charge of the office of treasurer the annual fixed charges of the company had been reduced for the ensuing year to the extent of about $28,000, accounted for in the following manner.

By retiring $115,000 West Chicago Street Railroad company 6 per cent debentures	$ 6,900
By arrangement with the Illinois Trust and Savings bank to carry $298,000 of North Chicago Street Railroad company debentures at 5 per cent instead of 6 per cent	2 980
By refunding of first mortgage bonds North Chicago City Railway company, $500,000 from 6 per cent to 4 per cent for 27 years	10,000
By reduction in registration fees on North Chicago Street Railroad company, North Chicago City Railway company, West Chicago Street Railroad company, and Chicago West Division Railway company	800
Estimated discount by cash payments on material bills	7,400
Total	$28,080

The income account, showing earnings of $4,075.54 in excess of the five per cent. preferred dividend for the year ended June 30, 1900, was as follows:

Passenger receipts	$7,468,797.98	
Chartered cars	2,122.50	
Mail	6,477.58	
Gross earnings from operation		$7,477,398.06
Maintenance—Way and structures	$ 193,666.90	
Maintenance—Equipment	381,082 87	
Transportatioo	2,619,647.41	
General	567,400.18	
Total operating expenses		$3,761,797.36
Net earnings from operation		$3,715,600.70
Advertising	$ 33,576.95	
Rent of land and buildings	35,622.14	
Rent of tracks and terminals	10,000.00	
Dividends on stocks owned and leased.	764,603.49	
Interest on deposits	17,690.11	
Miscellaneous	2,441.13	
Premium on bonds sold	4,416.83	
Total income from other sources		868,350.65
Gross income		$4,583,951.35
Taxes accrued	$ 246,033.88	
Interest on loans accrued	41,776.80	
Rentals accrued	3,688,451.70	
Premium on bonds purchased	3,613.43	
Total deductions from income		3,979,875.81
Net income		604,075.54
Dividends on preferred stock, 5 per cent		600,000.00
Surplus as per balance sheet		$ 1,075.54

What will most interest managers of other roads, however, are the traffic statistics and operating expenses, which are as follows:

Car mileage		29,691,850
Passengers carried:		
Revenue	149,521,755	
Free	784,660	
Transfer	58,184,147	
Total		208,490,562
Per cent. of transfer passengers		38.71

	Per Car Mile Cents.	Per Revenue Pass. Cents.	Per Total Pass. Cents.
Gross earnings	25.18	5.00	3.58
Expenses:			
Maintenance—Way and structure	0.65	0.13	0.09
Maintenance—Equipment	1.29	0.26	0.18
Transportation	8.82	1 75	1.26
General expenses	1.91	0.38	0.27
Total operating expenses	12.67	2.52	1.80
Net earnings	12.51	2.48	1.78
Income from other sources	2.92	0.58	0 42
Gross income	13.43	3.06	2.20
Deductions	13.40	2.66	1.91
Net income	2.03	0.40	0.29
Per cent. of expenses to earnings			50.31
Per cent. of expenses to gross receipts			45.07
Per cent. of deductions to gross receipts			47.69
Per cent. of net income to gross receip.s			7.24

The old board of directors was re-elected as follows: Jesse Spalding, John M. Roach, R. A. C. Smith, Walter H. Wilson, H. B. Hollins, Charles L. Hutchinson, James H. Eckels, C. K. G. Billings, P. A. B. Widener, William Dickinson, John V. Clarke.

Fewer than a dozen shareholders were present, the voting, with the exception of 4,000 shares, being by proxy. The meeting was a brief one, lasting not more than 20 minutes. President John M. Roach presided.

The New England Street Railway Club.

The organization with the above name came into existence on July 18th at Young's Hotel, Boston. A meeting was held at that time to discuss arrangements for an outing in September, to include all interested in street railways in the New England states. About 35 were present, and it was decided not only that the outing would be a very enjoyable affair, but also that a social club should be formed, known as the New England Street Railway Club. This club, being for social purposes only, does not interfere with the Massachusetts Street Railway association in any way. The club will have as members not only operating street-railway men, but all interested in that work. The officers elected were: President, H. E. Bradford of the Marlborough street railway; vice-president, L. H. McLain of the Newton and Boston street railway; secretary, R. H. Derrah of Boston; treasurer, George H. Burgess of the Leominster and Clinton. The executive committee consists of the officers and F. L. G. Henderson, Newton street railway; E. E. Potter, Union street railway, New Bedford; J. F. Whatles, Boston; W. G. Meloon, Portsmouth-Kittery-York street railway, and D. F. Burritt, Palmer and Munson street railway, Palmer, Mass. A meeting will be called later to arrange for the September outing.

Enlargement of the Northern Electrical Manufacturing Company's Plant.

The Northern Electrical Manufacturing company at Madison, Wis., has completed and is occupying a new substantial brick office building. It has also begun the erection of an extensive addition to its already commodious shops. The one-story plan is being followed the same as in the main plant. The new building will be finished in about 30 days, and as soon as the equipment of machinery can be installed the capacity of the works will have been increased something over 50 per cent. The business of the company has increased very rapidly the past two years, and it is the present intention to add the manufacture of alternating-current machinery to the present line.

The Lancaster (S. C.) Cotton Mills will erect a huge new mill structure in which the machinery will be run by electric power, generated at Landsford, on the Catawba River.

CORRESPONDENCE.

London Letter.

London, July 7.—The present would appear to be a favorable opportunity for making electric light popular now that the gas companies all over the country are enforcing an increase of from eight to 12 cents per thousand feet. As is generally recognized, the initial expense to the consumer of having the light brought into his premises is a great deterrent to anything like a general adoption of electricity as a medium of lighting. Taunton, a small town in the west of England, and which was one of the first, if not the first, towns in the country to adopt electricity for street lighting, has found that the co-operation of the so-called Free Wiring company has been a valuable aid to the increase of consumption. I say so-called because it cannot be, and is not free, for though a heavy inaugural outlay is spared to the consumer, he has to pay at a slightly increased rate for the light, or, to be precise, he does not receive the same rebate on his bill as the renter who has paid outright for the wiring. The advantages are obvious to ordinary tenants, who, by this method, do not, if they quit the premises a short time after the installation, leave the wires and fittings for the benefit of the landlord. A proof that the system is appreciated is afforded by the fact that in Taunton nearly 5,000 lamps had been installed up to the end of 1899 under contract, and free wiring. A very equitable arrangement appears to exist between the wiring company and the corporation, and the consumer cannot complain, for if he finds his consumption is such that it would pay him better to obtain the rebate, he can buy out the company by paying them the cost price of the installation plus 20 per cent. and less 1½ per cent. per annum depreciation. At Taunton also the demand-indicator system is in vogue, charging 12 cents per unit for the first hour's demand and seven cents after, and this is found to work out that 10 cents per unit is the average received under the rebate system, and also the net amount from those whose premises have been wired by the company on the terms described.

London's new Central electric railway is expected to be open to the public within a fortnight. Most of the stations are rapidly nearing completion, but some will yet require a few days to complete. Omnibus companies are contemplating reducing their fares to compete with the railway.

In many parts of London the supply of electric light suddenly ceased on Wednesday evening about half past nine. The deficiency was rectified as speedily as possible, but, as may readily be imagined, a good deal of inconvenience was caused, especially in the hotels and public houses. The mishap was due to a short-circuit. The result was almost terrifying at headquarters, where one of the men in charge was temporarily blinded by a sudden burst of brilliancy, and one of the dynamos caught fire.

The secretary of state for foreign affairs has received a dispatch from her majesty's acting consul-general at Warsaw, stating that tenders are invited by the Russian government, not later than the 28th proximo, for the telephone service at Warsaw, St. Petersburg, Moscow, Odessa and Riga. The contracts will probably be secured by American firms.

The American Society of Civil Engineers held its annual convention on Monday of last week in Westminster. Sir Douglas Fox, president of the Institution of Civil Engineers, offered a welcome to the visitors and then expressed sympathy with them in the sad event which had taken place at Hoboken. To this Colonel Haines and other American gentlemen responded in most friendly fashion, and the rest of the day was taken up by the discussion of professional subjects. On Tuesday the members were personally received by the queen, at Windsor Castle, on Thursday by the lord mayor at Guild Hall, and on Friday by the Countess of Warwick at Warwick Castle.

The Petit Bleu was on Tuesday night a participant in the first experiment in telephoning on overhead wires from Brussels to Bordeaux, a distance of 800 miles. The civic authorities and the editor of the Petite Gironde were at the other end of the wire, and their voices could be heard most distinctly.

Such accidents as that which happened at Slough the other day are quite capable of being rendered impossible. The power of protection rests on automatic electric signaling. Systems exist which have been proved to be quite trustworthy and have also been accepted as such by the advisory engineers belonging to the great railways. The cost of their introduction bars the way to their adoption. The arrangements are so perfect that when the sema-

phore is lowered to danger it immediately brings into operation the electric apparatus. If any train should pass a given point after the semaphore is lowered at danger the alarm bell on the engine, equally with the alarm bell on the guard's van, is brought into full activity, and continues to ring until stopped by the guard or the engine driver.

Mr. Carew's second attempt in the House of Commons to get rid of the Dublin electric-lighting bill fared better than the first. The question at issue was simple. It was whether a private syndicate of capitalists or the corporation of Dublin should have the electric lighting of Dublin City. The corporation won by 174 votes to 168.

W. H. B.

New York Notes.

New York, July 21.—At Schenectady on Thursday last the stockholders of the General Electric company held a special meeting at which it was voted to increase the capital stock of the company $4,415,000, or to $25,242,200, to consist of 25,512 shares of preferred stock, of the par value of $100 each, and 226,910 shares of common stock, of the par value of $100 each. In June, 1892, the company issued $10,000,000 30-year five per cent. gold coupon debenture bonds, redeemable in stock at the holder's option, of which there is still outstanding $5,298,000; and the amount of common stock necessary to redeem these remaining debenture bonds is $4,415,000. The new stock authorized will be issued for the purpose of redeeming these outstanding bonds as they may be presented.

Captain Louis Wendel of the First Batallion National Guards of New York last Sunday celebrated the completion of the Amsterdam avenue trolley line to One-hundred-and-ninety-fourth street, with a banquet and picnic at Fort Wendel. The members of the first battery attended in full-dress uniform. The opening of the line to Fort George has been worked for by Captain Wendel for 10 years.

Activity in compressed-air projects continues fierce (on paper), the latest being another gigantic consolidation, as recorded by an item in the Tribune of yesterday, as follows: The Compressed Air company is now practically organized. It is a consolidation of the American Air company, which has a capital of $7,000,000, and the Compressed Air Motor company of Illinois, capitalized at $2,000,000. The capital of the new company has been fixed at $8,000,000, divided into $755,000 six per cent. cumulative preferred stock and $7,245,000 common stock. Henry B. Cooke will be chosen as president. He is interested as a stockholder in the Illinois company and is an expert in air power. The Metropolitan Street Railway company retains an interest in the new company, which will build the improved air-motor cars which will shortly be operated on the Twenty-eighth and Twenty-ninth streets cross-town lines.

The storage-battery cars will to-night go into service on the Thirty-fourth street cross-town line. It is not expected that this system will be as economical as the trolley, but it is the best thing available under the circumstances.

Judge Shipman of the United States Circuit Court last Wednesday handed down a decree in favor of the Thomson-Houston Electric company on its claim to ownersbip of the Walter H. Knight patent for improvements in electric-motor regulators as against the claim set up by the Lorain Steel company. A perpetual injunction restraining the Lorain Steel company from using the patents was granted and damages were allowed, the amount to be determined by John A. Shields as master. The patent is No. 428,169, issued May 20, 1890.

A stroke of lightning this evening caused a panic among the women in an Eighty-third street trolley car, which resulted in the injury of seven people, mainly through jumping off the car. Several people on board received shocks and the car equipment was slightly damaged by lightning, but the most serious effect was the panic caused.

A rear-end collision took place on the Brooklyn elevated railway Thursday evening. A Bay Ridge electric train was stopped by the burning out of a fuse and a Rockaway express train of the Long Island railroad, which does not stop at Fulton street station (just beyond which the stop occurred), came along at such speed that it could not stop before striking the electric train. A curve obstructed the view and no precautions were taken to flag the express train. The motorman, who was under the car, was killed.

Fred D. Rounds, general superintendent of the Metropolitan Street railway and general manager of the Third Avenue railroad, has resigned. The office of general superintendent has been abolished and O. Root, Jr., appointed assistant general manager of the Metropolitan. Thomas A. Delaney has been made superintendent of transportation and John Shea superintendent of the Second and Third avenue divisions.

The Consolidated Gas company's stockholders have voted to increase the capital stock from $54,595,200 to $80,000,000. This increase is in accordance with the plan for taking over other gas and electric-light companies. This is the second time the capital of this company has been increased within six months. In January the capitalization was raised from $39,078,000 to $54,595,200, to acquire the New York Gas and Electric Light, Heat and Power company.

Deputy Attorney-general Edward P. Coyne Wednesday listened to arguments on the application of ex-Senator P. H. McNulty of Brooklyn, asked for the annulment of the charter of the Brooklyn Heights Railroad company, the parent road of the Brooklyn Rapid Transit company, on the ground that a 10-cent passenger fare to Coney Island is unlawfully exacted. Stephen C. Baldwin appeared for Mr. McNulty and William F. Sheehan for the company. No action has been taken as yet.

A trolley car on the Staten Island Midland Railway company's line jumped the track going down a short grade at Concord Tuesday afternoon. It cleared a deep gutter and climbed the bank at the right side of the roadway. The 30 passengers were thrown in a heap and a few were hurt enough to need medical attendance.

M. L. G.

From the Buckeye State.

Columbus, Ohio, July 20.—There has been some talk of proceedings at law to compel Director Kauffman to operate the municipal light plant, which was closed down some time ago. It is hard to tell just what will be done, however. It would seem that this is one of the most aggravated cases of municipal ownership that has existed for some time. What the city of Columbus needs is a brand new City Council, with the exception of Dr. Gladden and a few others, and new city officials who have the interests of the people in mind. This might be an innovation in city government, but it certainly would be a good one.

Contracts for material for the buildings of the Consumers' Carbon Works at Lancaster have been awarded, and the buildings will be under way as soon as arrangements can be made to get at them. A great deal of preliminary work has been necessary to get the company in shape to go to work in earnest.

The Cincinnati Street Railway company has been given a vote of thanks by the people of Clifton for the early completion of the line from McAlpin avenue to Clifton.

The City Council of Springfield has granted a franchise to Harry Fry for an electric road, which will extend from that place to Willmington. Mr. Fry has already secured franchises through Green and Highland counties.

The Millcreek Valley Railway company has begun work on the line from Cincinnati to Hamilton. The contracts for all the work have not yet been awarded, but will be within a few days.

The Zanesville, Adamsville and Coshocton Railway company has prepared a petition asking for a franchise through Muskingum and Coshocton counties. The officers have secured the consent of more than 95 per cent. of the property owners along the line.

The Cleveland, Elyria and Western Electric Railway company will build a new power house at Elyria. It will be 52 feet wide and 350 feet in length, and will be made almost entirely of iron and steel.

After a contest of nine months, the town of Bellevue has granted a franchise to the Toledo, Fremont and Norwalk Railway company to pass through the town on Main street. The Wheeling and Lake Erie Railway company opposed the franchise and did everything possible to keep the electric road.

The new plant of the Piqua Electric company at Piqua is now about ready to be put in operation. It will have double the capacity of the old plant.

W. A. Garver has secured the right-of-way for an electric road from Uhrichsville to Barberton. This will give the Uhrichsville people a line from there to Cleveland, as the line between Akron and Barberton is now practically assured.

The electrical contractors have voted not to tolerate Inspector Vorhees of the Ohio Inspection Bureau, an insurance-inspection bureau, at Columbus. They claim that he goes to the property owners when he discovers a defect in their work, instead of going to them, and that he has lost them a number of good contracts. It will be difficult for them to get rid of him, however, as the bureau is a recognized institution in the state, and makes the rates for insurance according to the hazard, and the property owners want him to see everything in order, that a proper rate may be made on their buildings.

There are prospects for an electric road from Cambridge to Byesville, in this state. Judge J. W. Campbell of Cambridge is interested in its construction, and is now in New York endeavoring to interest eastern capital in the enterprise.

The case of Samuel L. Nelson against the American Railway company has been transferred from the Clark County Common Pleas Court to the United States Court at Cincinnati. Nelson claims that the American Railway company owes him $72,750 for negotiating the purchase of the People's Railway company at Dayton and the Springfield Light and Power company at Springfield.

The directors of the Bullock Electric company of Cincinnati have elected the following-named officers to serve the coming year: President, George Bullock; vice-president, J. S. Neave; treasurer, Stephen R. Burton; secretary, J. W. Bullock. The president's report showed that the company had received orders amounting to $84,000 the two days previous to the annual meeting. Vice-president Neave will go to Europe within a short time to look after some business there. Their motors are becoming quite popular abroad.

A. K. Detwiler of Toledo has made application for the use of the Miami and Erie Canal from Maumee to Defiance, for the Toledo and Maumee Valley Electric Railway company. The company will extend its line to Defiance, if the use of the canal is granted.

The canal commissioners have leased two miles of the Ohio Canal to the Columbus, Buckeye Lake and Newark Traction company.

The Village Council of Lorain has granted the Sandusky and Lorain Electric Railway company a franchise through the village.

The bonds of the Chillicothe and Hillsboro Traction company have been disposed of in the East, and the company is now ready to begin the construction of the road.

There are prospects for the construction of an electric line from Bowling Green east to Napoleon. Local capitalists have subscribed almost $50,000 toward the formation of a company to build the line. Captain Black is at the head of this movement. W. T. Reese and John Chaney are at the head of another syndicate which wants to build the road. It is said that Cleveland capitalists are also looking into the matter.

The canal commissioners have not leased much of the berm-banks of the canals, as yet, for railway purposes, and it is said that they will not do so. Just what their reasons are for this is not known. There are a number of capitalists after the privilege of using the bank, and the state would doubtless realize a goodly sum for rentals if the commissioners would let them go for that purpose.

The Ravenna Village Council has signified its intention of granting the Portage Lake Traction company a franchise through the town if the company will agree to build a line to connect with some Cleveland line.

O. M. C.

Northwestern Notations.

Minneapolis, July 21.—The Albert Lea and Geneva Railway company has bought a site in Geneva, Minn., on which to erect a power house for its proposed line.

The electric-light company of Clear Lake, Iowa, has just put its new station into operation. Considerable new equipment has been put in.

The Milwaukee railroad has put on hourly trains between Cedar Rapids and Marion, Iowa, and makes the run in 10 minutes. The Cedar Rapids and Marion Street Railway company has a line also, but its time is 30 minutes. The better time and the same rate on the steam car has resulted in cutting down the street-car traffic materially. It is rumored the latter will cut its rate. The railroad could not follow suit without being subject to an order from the State Railroad Commission to make a corresponding rate all over the state.

The council of Great Falls, Mont., has appointed a committee to wait on the manager of the electric-light plant and secure from him the best possible rates that can be given for street lighting. A newspaper war has been waged against the present rates, which are said to be exorbitant, and this is the outcome.

Citizens of La Crosse, Wis., threaten to prevent the extension of electric-railway lines on the boulevards, even to the extent of chopping down the poles if they are erected. The street-railway company has asked an injunction to prevent such action being done.

The Electric Light and Power company of Carroll, Iowa, has plans completed to install a hot-water heating plant.

The Fox River Valley Electric Railway company has taken possession of the local street-railway and electric-lighting system at Appleton, Wis., and will extend and improve it. The Fox River company now operates the interurban line to Neenah.

The council of Jefferson, Wis., is arranging for the purchase of the local electric-light plant.

The McElroy Iron Works of Keokuk, Iowa, made a contract with the J. C. Hubinger company to furnish electric power. The latter also installed a motor, which it now claims was temporarily to enable the McElroy company to ascertain the relative cost of electric power. The McElroy company claims that the contract was to provide a motor, as well as the power. The Hubinger company demanded rent for the motor, and finally sent for the motor. The McElroy company secured an injunction to prevent this. The case will be tried on its merits later.

The Automatic Electric Works of Des Moines, Iowa, has bought the stock and fixtures of the Iowa Electric and Construction company.

The repairs to the electric-light power dam at Fergus Falls, Minn., will probably result in shutting down the plant for about six weeks, while the improvements are going on.

The telegraph and electric wires in La Crosse, Wis., are all to be put underground.

C. H. Porritt of Fargo, N. D., secured the contract to install an electric-light and water system complete, for $28,244.

The Tri-city Railway company is welding its tracks in Davenport, Iowa.

The street-railway company of Winona, Minn., is testing fenders on its cars.

The St. Croix Power company is stringing wires from the new electric power dam at Apple River Falls, in Wisconsin, to St. Paul, and it is expected that the company will be sending power to St. Paul by the middle of August.

The new electric-light and pumping station for Austin, Minn., is about completed.

Work will be begun at once laying rails for the

new Seattle and Tacoma electric railway. Work will be pushed from both ends, and the company hopes to have the line in operation in October.

Lightning struck the electric-light power station at Mazomanie, Wis., setting it afire, and it was completely destroyed. The station is part of the new electric-light and power plant, which has been completed lately. Work will be begun at once to rebuild the plant.

R. D. Harrison of Mantorville, Minn., has made a proposition to that village to install an electric-light plant, and it has been accepted.

A case in the Circuit Court at La Crosse, Wis., has resulted in a court decision that a street railway cannot maintain poles in the center of the street, with but a single track. A test case is being carried to the Supreme Court, and if it is confirmed, will result in the entire town being double-tracked.

R.

PERSONAL.

A. L. Cherry, electrician of the Hamilton, Grimsby and Beamsville Electric railway, has resigned and is succeeded by his former assistant, Alfred Oaks.

H. E. Ross, formerly in charge of the municipal lighting plant at Chambersburg, Pa., has taken the position of general manager of the Edison Electric Light company at York, Pa.

Dr. I. A. Lumpkin of Mattoon, Ill., president of the Illinois State Telephone association, and well known in telephone circles throughout the state, was in Chicago last week on a combined business and political trip.

Walter H. Woods of Ann Arbor, Mich., has recently joined the engineering force of Kohler Brothers, electrical machinery engineers and contractors, 1804-12 Fisher building, Chicago. He will also assist in the sales department of the firm, his principal territory being Chicago.

John A. McDowell, superintendent of construction of the United States Telephone company, and Miss Clara J. Dorn of Columbus, Ohio, were married recently. They will take up their residence, for the present, at Logan, Ohio, where the groom is looking after some long-distance construction work for his company.

ELECTRIC LIGHTING.

The Austin (Texas) Rapid Transit Railway company will build a new power house.

The City Council of Salem, Ohio, has decided to erect a municipal electric-light plant.

The waterworks trustees of Madisonville, Ohio, have decided to purchase a 75-light arc dynamo.

J. W. Hockaday of Itaska, Texas, is in the market for two medium-speed 30-kilowatt, 110-volt dynamos.

R. D. Harrison of Minneapolis has closed a contract to furnish Mantorville, Minn., with electric light.

Dr. J. H. Heron and J. B. Smale are interested in a new electric-light plant project at Leadville, Colo.

The Edison Illuminating company of Detroit, Mich., is about to increase capital stock and make improvements.

George H. Mole has sold his electric-light plant at Lockhart, Texas, to Mr. Bachman, who will make improvements.

At Aurora, Ill., the city council has granted a franchise to the Aurora Street Railway to operate an electric-light plant.

The La Porte (Ind.) Electric company has increased its capital stock from $75,000 to $150,000, and will increase the capacity of its plant.

The council of College Hill, Pa., adjoining Beaver Falls, has instructed a committee to advertise for bids for an arc and incandescent plant.

The Dayton (Ky.) Electric Light and Power company has been incorporated, with $50,000 capital. H. M. Stegeman is one of the directors.

D. X. Murphy & Bro. of Louisville, Ky., have a contract to install an electric-light plant in the Indiana Cotton Mills at Cannelton, Ind.

J. B. Nelson of Indianapolis, Ind., has been engaged to draw up plans and specifications for the Richmond, Ind. municipal electric-light plant.

The Irondale (Ala.) Water, Light and Power company, with $100,000 capital, has been incorporated by F. W. Turpin, N. H. Sewell and R. R. Zell.

The charter of the Memphis (Tenn.) Light and Power company has been amended to permit of an increase of the capital stock from $300,000 to $500,000.

The Jerseyville (Ill.) Light, Heat and Power company has been incorporated, with $25,000 capital stock, by G. D. Rosenthal, O. Ford and J. Rosenthal.

The plants of the Radford (Va.) Electric Light and Power company and the Radford electric railway have been consolidated under one management to develop a waterpower three miles from Radford and put in a plant.

The W. T. Weaver company of Asheville, N. C., has been chartered and will establish an electric-power plant on the French Broad River, near Asheville. The capital is $30,000.

The Beeville (Texas) Light company has been incorporated, with $10,000 capital stock, for the establishment of an electric-light plant, by P. H. Swearinger, B. Dubinski and S. J. Brooks.

The Greene County Electric Light and Machine works of Union Point, Ga., wants prices on a 250-light dynamo and other electrical apparatus, wire, etc., required for an electric-light plant of the size mentioned.

The La Grange Manufacturing company at La Grange, N. C., is a new company, with a capital of $50,000. The company has the power to manufacture cotton goods and also to operate an electric-light plant.

ELECTRIC RAILWAYS.

The Union Traction company, Pottsville, Pa., will build a branch to Middleport, next fall.

G. R. Williams of Omaha is promoting an electric line to connect Omaha and Fremont, Neb.

The Indiana Railway company, operating a line through Goshen, Elkhart and South Bend, will extend to Niles, Mich.

The Toledo, Fremont and Norwalk Electric Railway company has been granted a right-of-way through Bellevue, Ohio.

The Asheville (N. C.) Street Railway company has asked for a franchise to lay 2,000 feet of double tracks on a part of its line.

The American Universal Underground Electric Railway company, with $200,000 capital stock, has been incorporated at Trenton, N. J.

At Bay City, Mich., a new street-railway company, the Traction and Power company, has asked the council for a franchise. T. A. E. and J. C. Weadock are interested.

The Washington Traction and Electric company is the name of the corporation which has merged the street-railway and electric-lighting interests of Washington, D. C. The consolidation includes eleven street-railway companies, operating 163.9 miles of single track and 533 cars. The Capital Traction company is not in the consolidation. The officers of the new company are: President, F. C. Stevens; vice-president, George H. Harries; treasurer, H. D. Wick, and secretary, James B. Lackey. The capital stock is $12,000,000, of which $10,000,000 has been issued.

AUTOMOBILES.

W. K. Vanderbilt, Jr., is reported to have made a trip to Boston and back from Newport on his French automobile at an average running speed of over 3 miles an hour. At any rate, he went fast enough so that he was arrested at Milton, Mass., and detained until he could pay his fine.

The Stanley Automobile company of New York city, with a capital of $5,000, has been incorporated to acquire automobile patents. The directors are Amzi L. Barber, S. T. Davis, Jr., Frederick DeP. Foster of New York city, and David S. Walker and John Brisben Walker of Tarrytown.

A quick-firing automobile gun started from Fort Sheridan, Ill., 24 miles north of Chicago, July 19th, to take a trip to Washington, D. C. Major A. P. Davidson and three cadets from Highland Park Military Academy form the crew. Gasoline is the motive power of the vehicle and the weight, fully equipped with gun, is 2,300 pounds. The trip is for the purpose of demonstrating the practicability of the machine for this use.

C. E. Woods, promoter and general manager of the Woods Motor Vehicle company of Chicago, has resigned as general manager of that company. He still remains a stockholder, however, though his activities will be devoted to another line. His successor as general manager is S. J. Moore of Niagara Falls, secretary of the Carter-Crume company, manager of the Niagara Falls Silver company, and connected with several other large corporations in London and elsewhere.

Schlesinger & Mayer, the Chicago department store firm, have put in service an electric omnibus line from their store at State and Madison streets to the Chicago and Northwestern Railway depot. Five-cent fare is charged. Three buses are already running and seven more will be put on as soon as they are ready. This is the first service of the kind in Chicago. It is the firm's intention to extend the service indefinitely to depots and other important points as fast as the returns in the way of fares and increased trades seem to justify it. The buses belong to the Illinois Electric Vehicle Transportation company.

It is understood at Middletown, Conn., that the local plant of the Worcester Cycle company has been purchased in its entirety by the New York Motor Vehicle company. The latter, which has a capital of $500,000, is said to have on its books orders for vehicles which will amount to $1,000,000. The Worcester company's plant, it is announced, will be opened at once, and will employ 200 men at the start. Brooklyn men are largely interested in the Vehicle company. P. H. Flynn is the president, Frederick S. Cocheu is vice-president, B. Sherwood Dunn, secretary and treasurer, and T. F. Flynn, general manager.

The first installment of the vehicles for the American Autocarette company of Washington, D. C., has arrived. This company was incorporated but a few months ago, with a capital of $200,000, and the appearance on the streets of its automobiles took place July 19th. The vehicles are to be run on the storage-battery system, and are equipped with solid-rubber tires. Each vehicle has accommodations for 20 passengers. The first line to be permanently established will run the entire length of the city, on a route passing nearly all the government buildings. Later cross-town lines will be established. A five-cent fare will be charged.

PUBLICATIONS.

The American Blower company of Detroit, Mich., has issued a new illustrated catalogue, treating of its A. B. C. exhaust fans. A great variety of fans is shown.

Western Electric company bulletin No. 7007 describes that company's series enclosed alternating arc-lighting system recently brought out, and will be sent to anyone interested in the subject.

The Richmondt Conduit company of Milwaukee, Wis., describes its superior conduit tubing in a folder which brings out the conduit's strong points. This tubing is lined with enamel and coated otherwise with a new galvanic process.

The Great Western Smelting and Refining company, Chicago, has just issued a handsome booklet devoted to "Iron Fiend," a flux that has gained a deserved recognition in the brass-foundry trade. The company's list of brass foundries is very comprehensive, but it requests anyone in the trade who has not received this booklet to drop it a line.

The Fuller company, manufacturer of electrical and ventilating apparatus, of Detroit, Mich., has prepared a catalogue of illustrations of its apparatus for distribution among its customers. The illustrations, which are finely executed on heavy paper, show the company's engine-generator, slow-speed generator, enclosed automatic engine, yacht engines, ventilating and steel-plate fans, and miscellaneous electric equipment. The catalogue may be had on application.

"Edison Incandescent Lamps" is the title of a neat 110-page booklet now being sent out by the General Electric company. It contains many handsome illustrations of the best examples of incandescent illuminations, selected from the various leading public buildings of the country. It also gives a full discussion of the life and candlepower of lamps and takes up the subject of the relative value of arc and incandescent lighting, and the correct use of light, in a very excellent manner.

Phono-electric, the new wire for trolley, telephone and telegraph use, has a few of its many advantages set forth in a very attractive booklet that is now being distributed by the Bridgeport Brass company of New York. This company states that Phono-electric is now being used for trolley wire by many of the leading electric railways throughout the country, and that telephone and fire-alarm companies are large users of the new wire. Its absolute homogeneity, high tensile strength, elastic limit and great ductility are said to make it the ideal wire for line wire and also for distributing wires.

The official catalogue of the International Tramways and Light Railways exhibition, held from June 23d to July 4th at the Royal Agricultural Hall, Islington, London, shows care in its production, and was undoubtedly found very useful by those in attendance at the exhibition. It is a book of 176 pages and is neatly bound, with an artistically designed cover. Lists of patrons, officers and exhibitors are given, and the larger portion is taken up with detailed descriptions of each exhibit, blank pages being provided for notes. The exhibition was promoted by the proprietor of the Tramway and Railway World, which journal issued a special exhibition number for July, containing a review of progress in electric and other traction and several interesting and well-illustrated articles.

SOCIETIES AND SCHOOLS.

The Ohio Electric Light association will hold its annual meeting at Toledo from August 14th to 16th.

The American Section of the International Association for the Testing of Materials will hold its third annual meeting in New York, October 25th to 27th. At this meeting reports of a number of committees as to proposed standard specifications will be submitted for discussion. Among these are specifications for steel axles, steel forgings, steel castings and wrought-iron.

MISCELLANEOUS.

The Richmond Locomotive and Machine company of Richmond, Va., has made a contract with the Virginia Electrical Development company to

furnish the works with electrical heating and power, to the exclusion of all other methods.

City Electrician Ellicott of Chicago has arranged to have employes in his department paid twice a month instead of once a month, as formerly, and has notified them that if they patronize pawnshops any more they will be discharged.

A. A. Green, a Chicago University student, has employed an electrical contact device with great success to the photographing of moving trains. Some very excellent pictures have been taken of trains moving over 60 miles an hour on the Burlington road, the photographs being clean cut and well centered on the plate. A stick is stuck in the ground between the rails for the pilot to strike and a cord from this stick jerks a piece of pasteboard out from between two contact plates. When the circuit is closed a spring is released which presses the bulb.

TRADE NEWS.

The Leather Preserver Manufacturing company of Chicago has completed its new factory at Hawthorne, near Chicago.

The Western Electric company announces that it carries a complete stock of Sprague, Greenfield and loricated conduits in Chicago stock, which can be sold at the lowest market prices. All orders are delivered with promptness.

The Safety Armorite Conduit company, Rankin Station, Pa., announces that it suffered a heavy loss by fire in its factory during last week, but is again in position to fill all orders promptly, and solicits the further patronage of its customers.

Owing to the rapid increase of its business, the D. & W. Fuse company of Providence, R. I., has been compelled to enlarge its facilities and has recently moved its entire plant. It now occupies a large building at 407 Pine street, with about five times the floor space of the old quarters. It has added largely to its machinery equipment and expects soon to be in a position to handle all orders promptly. It is putting out several lines of new goods, which are meeting with success.

The world's biggest steel and iron mill, states a dispatch from Cleveland, Ohio, is to be erected in that city. For six months the American Steel and Wire company has been secretly at work buying up a large tract of land opposite its present Newburg plant in Cleveland, which was formerly the Cleveland Rolling Mills. In all, 200 parcels of land have been purchased. The company intends to double the capacity of its Newburg plant and center a large part of its business there. The completed work, it is said, will give employment to about 10,000 men.

The Electrolysisproof Conduit Manufacturing company, 605 Manhattan building, Chicago, of which W. F. McCarthy is manager, is out with a circular calling the attention of the electrical world to its electrolysis-proof insulating conduit. This conduit is made of asphalt paper. It has been subjected to severe tests, and the manufacturer claims that it has successfully withstood the testing and that it fulfills the essential requirements lacking in most conduits. The company also issues a copy of a test made by the Sunset Telephone and Telegraph company to show the electrolytic effect on cable through vitrified terra-cotta duct.

The Miller-Knoblock company, South Bend, Ind., manufacturer of communtators and armature coils, has consolidated with the Northwestern Electric Manufacturing company of Chicago, maker of magnet wire, electromagnets and spark coils, and the combined business will be conducted under the name of the Miller-Knoblock Electric Manufacturing company, at South Bend, Ind. The machinery composing the covering plant of the Northwestern company has been moved to South Bend and set up, and is now in operation. The Miller-Knoblock Electric Manufacturing company will immediately build additional insulating machines, and while the plant it is now operating produces silk and cotton-covered magnet wire from No. 18 to No. 40, the new machines will increase the line from No. 0 to No. 40. With increased capitalization, the company contemplates large improvements, not only in the commutator and armature-coil business, but in the magnet-wire business. As the plant occupied is said to be large and well adapted to the work, the product should be equal to any on the market, and as South Bend is believed to be an ideal point for manufacturing and selling, there is every prospect that the company's business will continue to increase. The company will make a specialty of fine covered wire and coils for telephone.

BUSINESS.

Berthold & Jennings, St. Louis, Mo., report a good demand for their poles. They have just been filling a contract for 5,400 Idaho cedar poles, from 35 to 75 feet long.

The United States Carbon company of Cleveland, Ohio, is mailing postal cards to its customers containing some "Anti-Trust" prices that are said to be of interest to carbon users.

The Electric Appliance company, Chicago, reports a splendid business right through the dull season, in the lighting line, and states that the sales of A. B. arc lamps show the largest percentage of increase.

The Garl Electric company, Akron, Ohio, recently installed its full hotel system, including the fire and burglar alarms, annunciator board, etc., in the Herbert, a new hotel, built by D. Defenbacher at Canal Dover, Ohio.

The Central Manufacturing company, Chattanooga, Tenn., reports that while business generally is not as good as it has been, the company has no cause to complain, as its business has kept up remarkably well, owing, it thinks, to its custom of filling orders promptly.

The Chicago House Wrecking company has just purchased from Armour & Co. 72 boilers which have recently been replaced by larger ones at the new Armour power plant. Of these 48 are five by eight feet, 12 are five by 16 feet and 12 are 4½ by 16 feet in size. They are all horizontal tubular boilers and in good condition. This company has recently completed one of the largest machinery halls to be found in the country. It has a space 200 by 360 feet, used exclusively for the sale of the large quantities of machinery and electrical supplies it has to offer.

The demand for Banner weatherproof wire the past 30 days is evidence of its superiority and at the same time indicates more than usual activity in construction work. The Central Electric company is, however, prepared to take care of all orders for weatherproof and Okonite wires as well as for all other construction material promptly from its large, well-selected stock.

Hartwig & Miller of Detroit report that their orders for Anthony boring tools, which are claimed to be especially useful for interior wiring, are increasing daily. When they first began the manufacture of these machines they made them up in lots of 25. Now they are made in lots of 200. The machine is stronger and better than ever before, and is now carried in stock by all leading hardware and electrical supply houses.

The Sprague Electric company, New York, has recently taken some large orders for direct-connected, slow-speed motors and generators from the following well-known firms, which are building new factories in their respective cities: The Weston Electrical Instrument company, Newark, N. J.; the Ithaca Wall Paper Mills, Ithaca, N. Y., and Charles M. Higgins & Co., Brooklyn. The motors for the last-named firm are of the new enclosed type. These plants are to be entirely equipped with the Sprague apparatus.

The Ball Engine company of Erie, Pa., has work for many months ahead. Among the contracts on hand are those for two large vertical engines for Japan, two horizontal engines for Korea, two vertical cross-compound engines for the Pennsylvania Railroad company, two engines for the Cincinnati (Ohio) Gas Light and Coke company, and a number of single orders of engines, ranging between 175 and 500 horsepower, for different firms throughout the country. The Ball company is also installing at the present time four 125-horsepower tandem-compound engines in the United States post-office at Kansas City; six 350-horsepower engines in buildings in Cleveland; three 400 vertical, cross-compound engines at Brooklyn navy yard, one horizontal tandem-compound at League Island navy yard and two vertical cross-compound for the Apollo Iron and Steel company, Vandergrift, Pa.

J. Holt Gates & Co., 15 Monadnock building, Chicago, have been awarded the contract for a new electric-lighting plant at Centerville, S. D. They will install a 60-kilowatt Warren single-phase alternator and switchboard, and will use the Bernstein system of series incandescent lighting. The firm also has the contract for the new addition to the municipal electric-lighting plant at Princeton, Ill., where a 100-kilowatt Warren machine will be installed and the Bernstein system used. It is the intention to run both arc and incandescent lights on this machine, as well as the small power factor in motors. Another contract awarded the firm is for the entire new municipal electric-light plant at Newberry, Mich., consisting of a 60-kilowatt, 7,200-alternation Warren dynamo, direct-connected to a 13 by 12-inch Erie Ball engine. This contract also includes a Bernstein series incandescent system for street lighting.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 17, 1900.

653,649. Underground System of Electric Railways. Charles A. Balph, Pittsburg, Pa. Application filed September 14, 1897.

In an underground system for electric railways, the combination with a suitable conduit, of a plurality of yielding sectional conductors, a main conductor electrically charged, a casing completely inclosing the main conductor, a tube entering the casing, a plunger on the sectional conductor, and within the tube, the plunger and the tube being severally provided with circumferential grooves, and a collapsible hood surrounding the upper end of the tube and plunger and engaging the grooves.

653,685. Electric Cut-out. Hiram P. Maxim, Hartford, Conn., assignor, by mesne assignments, to the Columbia and Electric Vehicle company, Jersey City, N. J. Application filed January 20, 1899.

The combination with a storage-battery circuit, of a cut-out in the circuit, comprising a device operated by the amperage of the battery, and a device operated by the potential of the battery, the devices coacting to open the circuit upon a fall of the potential below a predetermined minimum while the amperage is normal. (See cut.)

653,698. Electric Switch. James T. Robb, New York, N. Y., assignor to the Mitchell Vance company, New York, N. Y. Application filed January 31, 1900.

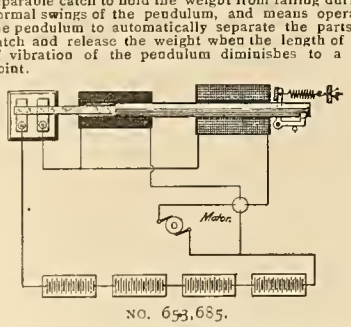
An improved switch, comprising a frame, a pair of stationary contacts, a sleeve or boss, a shank movable longitudinally therein, a movable contact carried by the shank, a head connected to the shank and having a pair of cam-teeth, means for preventing rotation of the head, a spring surrounding the shank and engaging the head, a rotating head having a pair of cam-teeth, engaging the other cam-teeth, and a key for turning the rotating head. (See cut.)

653,708. Hydro-electro-therapeutic Apparatus. Johann J. Stanger, Ulm, Germany. Application filed April 29, 1899.

In an electrotherapeutical device for curative purposes, an evaporating apparatus provided with roses adapted to serve as electrodes, and two tubes connecting the roses with the apparatus whereby the steam jets pouring out transfer electricity to the human body, and that the body forms a conductor in the steam.

653,713. Electric Clock. Samuel P. Thrasher, New Haven, Conn. Application filed January 14, 1899.

In combination, a swinging pendulum, a weight, and a portion moved longitudinally of the pendulum by the fall of the weight and adapted to contact with the pendulum to transmit the force of the fall of the weight to the side of the pendulum with a gradually increasing effect, a separable catch to hold the weight from falling during the normal swings of the pendulum, and means operated by the pendulum to automatically separate the parts of the catch and release the weight when the length of the arc of vibration of the pendulum diminishes to a certain point.



NO. 653,685.

653,715. Apparatus for Electrically Treating Fabrics for Waterproofing or Other Purposes. Jean T. Van Gestel, New York, N. Y. Application filed November 1, 1898.

An apparatus for electrically treating fabric to render it waterproof, consisting of a source of electric current, a bath provided with suitable electrodes, two frames or sections each provided with endless, traveling, conducting belts, the electrodes of the bath and the conducting belts being arranged in parallel circuits or branches and each of the branches being provided with a graduated resistance.

653,725. Electric Motor. Daniel C. Woodward, Hartford, Conn. Application filed September 6, 1898.

In a shunt-wound motor, an armature having a plurality of circuit windings, field windings, means to place the armature windings at times in series and at other times in parallel and a plurality of series of resistances interposed in the field circuit, one of the series being greater than the other, the latter being introduced into the field circuit when the armature windings are in series, and the former of the series being placed in the field circuit when the armature windings are in parallel.

653,730. Telephone Transmitter Arm. James F. Craven, Pittsburg, Pa. Application filed March 22, 1900.

A transmitter arm comprising two conducting members lying side by side and having their meeting faces conforming to each other to form a single arm, means for uniting the two members and suitable insulation between the meeting faces of the members.

653,763 Electrogalvanic Battery. Horatio J. Brewer, New York, N. Y. Application filed July 7, 1899.

In a galvanic battery a carbon electrode is claimed which has two metallic strips countersuck in part into the carbon and a bolt and nut for clamping a conductor between the projecting ends of the metallic strips.

653,764. Electrogalvanic Battery. Horatio J. Brewer, New York, N. Y. Application filed July 7, 1899.

In a galvanic battery an electronegative element consisting of a carbon electrode having a flat bearing surface in the form of an oblique plane converging upward with relation to a vertical line passing through the body of the electrode, a slab of conglomerate material formed with a flat surface supported on the oblique bearing surface on the carbon electrode and a band surrounding the electrode and slab and binding them together, whereby the weight of the slab is utilized in conjunction with the oblique bearing surface of the electrode to keep the band taut.

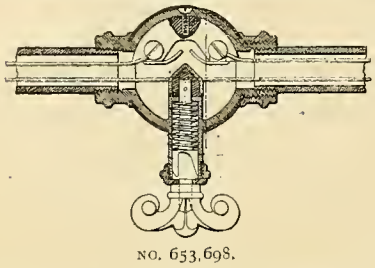
653,765. Electrogalvanic Battery. Horatio J. Brewer, New York, N. Y. Original application filed July 7, 1899. Divided and this application filed November 15, 1899.

In an electronegative element for galvanic batteries the combination of an electrode consisting of an elongated vertical plate of carbon the longitudinal edges of which converge from the bottom upward to form an inverted

wedge, and a tubiform mass of depolarizing material formed with an internal passage of greater area in cross section than the area in cross section of the carbon plate but of less diameter than the width of the lower portion of the plate, whereby the tubiform conglomerate is suspended upon the longitudinal edges of the carbon plate, and longitudinal passages extending the whole length of the conglomerate are formed between the sides of the carbon plate and the opposed internal surface of conglomerate, so as to afford unobstructed circulation vertically between the sides of the carbon plate and the opposed surfaces of conglomerate.

653,770. Galvanic Battery. Albrecht Heil, Frankfort-on-the-Main, Germany, assignor to Columbus Electricitäts-Gesellschaft mit Beschränkter Haftung, Ludwigshafen, Germany. Application filed April 9, 1900.

A cell having an anode, a catbode, and a depolarizing agent consisting of calomel and carbon mixed with an electrically indifferent body capable of absorbing hydrochloric acid, the mixture surrounding the cathode.



NO. 653,698.

653,784. System of Electrical Distribution. Charles De W. Anderson, Chicago, Ill. Application filed April 10, 1899.

A commutator having in combination two cyclic groups of contacts, an electrical connection with alternate contacts of one group, an electrical connection with alternate contacts of the other group, an electrical connection with the remaining contacts of both groups, and a plurality of brushes for each group contacting with dissimilar contacts.

653,785. Electric Arc Lamp. Sigmund Bergmann, New York, N. Y., assignor to the General Incandescent Arc Light company of New York. Application filed March 18, 1899.

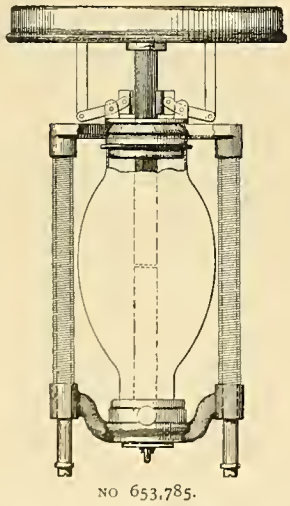
In an electric-arc lamp, the combination with an arc-inclosing globe, of a gas-cap, an annular plate provided with an independent seat for the gas-cap made of thin metal, rods depending from the plate, a yoke for supporting the globe, and an elastic-tension device interposed between the plate and the yoke. (See cut.)

653,806. Electric Meter. Caryl D. Haskins, Newton, Mass., assignor to the General Electric company of New York. Application filed May 8, 1899.

In an electric-motor meter, the combination with the lead field coils and the armature in shunt across the mains, of a starting coil also in shunt, and means for adjusting the relative position of the armature and starting coil to vary the friction compensation. (See cut.)

653,841. Electric Fuse. Thomas H. Brady, New Britain, Conn. Application filed January 2, 1900.

In an electric fuse, the combination shown of the conductors adapted to form part of an electric circuit, the fusible metal interposed between such conductors, the case inclosing the fusible metal, and the spring connected under tension to the fusible metal and extending exteriorly of the case.



NO 653,785.

653,857. Electrical Controller. Edgar H. Wise, Johnstown, Pa. Application filed January 19, 1900.

Claim one reads: A resistance pile composed of two electrically independent coils, each coil having its terminals separate from those of the other coil and arranged for connection in series or in multiple with the terminals of the other coil.

653,875. Process of Manufacturing Homogeneous Mixtures for Filaments of Incandescent Electric Lamps. Karl Ochs, Berlin, Germany. Application filed October 21, 1898.

The process of manufacturing homogeneous glowers for lamp conductors of the class designed to burn in the open air, which consists in producing a homogeneous solution of mixtures of metallic salts precipitating the corresponding oxides of the metallic salts from the salt solution, thereby producing a homogeneous mixture of oxides and forming the precipitated oxides into a paste with a suitable binder and producing glowers therefrom.

653,883. Secondary Battery. Arvid Reuterdahl, Providence, R. I., assignor of two-thirds to Leonard H. Campbell and George F. Weston, Providence, R. I. Application filed February 12, 1900.

The combination of a frame, made of a material which is a non-conductor of electricity, having perforations through two opposite parts thereof at corresponding intervals and in alinement, respectively, and one of its parts provided with two parallel, longitudinal slots, and an opposite part provided with two parallel, longitudinal grooves, an electrode having parallel cross bars extending angularly therefrom, which are adapted to pass through the perforations of the frame, two thin, perforated holding plates, made of a material which is a non-conductor of electricity, and adapted to pass through the slots, and to be seated in the grooves, and a mass of active material surrounding the cross bars and filling the space between the perforated holding plates and the inside edges of the frame, and capable of electrolytic action, when in contact with a suitable electrolyte, substantially as described.

653,885. Casing for Electric Car-lighting Apparatus. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, New York, N. Y. Application filed April 4, 1900.

A tight casing for the dynamo-driving mechanism of electric-car lighting apparatus inclosing the driving part on the car-axle, the driven part on the dynamo and the connecting part and having between its end portions an extensible and flexible portion which is tightly connected with the adjacent portions of the casing and which permits the latter to lengthen and contract and to bend laterally in accommodating itself to the variations in the relative position of the dynamo and car-axle.

653,906. Alternating-current Motor. Edgar W. Brown, Dayton, Ohio. Application filed January 29, 1900.

In an alternating-current motor, the combination with a field core having polar projections, of main coils connected in two separate sections and placed on every alternate polar projection, and starting coils on every polar projection between each two of the polar projections having the main coils, the starting coils being wound so that the current will pass through every alternate coil in the opposite direction.

653,933. Electrode for Electrolyzing Apparatus, René Moritz, Lille, France. Application filed November 29, 1899.

The combination, with a carrier-plate provided with a supply channel and a discharge channel, each extending entirely across the plate, and a plurality of grooves extending from one of the channels to the other, of an electrode applied to the carrier plate between the channels.

653,934. Page-printing Telegraph. Donald Murray, New York, N. Y., assignor to the Postal Telegraph-cable company, New York, N. Y. Application filed November 28, 1899.

The combination of a single main telegraph line connecting separated stations, a suitable circuit-changing transmitter in the line at one station, a movable medium as a paper tape or strip, at a second station, means for advancing the medium step by step, a device to perforate the medium with a series of successive holes arranged in a single right line, a main-line relay controlling the step-by-step mechanism through the medium of a local circuit and a polarized magnet in the main line controlling the perforating device.

653,935. Page-printing Telegraph. Donald Murray, New York, N. Y., assignor to the Postal Telegraph-cable company, New York, N. Y. Application filed February 7, 1900.

The combination of a main telegraph line and a pole-changing transmitter at one station, with an electromagnetic perforator, including a reciprocating punch and a paper feeding device, at a second station, a polarized main-line electromagnet controlling the paper feed, and a polarized main-line electromagnet controlling the punch, both the magnets having their coils in the main line.

653,936. Page-printing Telegraph. Donald Murray, New York, N. Y., assignor to the Postal Telegraph-cable company, New York, N. Y. Application filed February 27, 1900.

The combination of a main telegraph line, an automatic transmitter at one station, an electromagnetic perforator at a second station the perforator including a spacing magnet and a punching magnet, a local circuit for each of the magnets, an automatic circuit-breaker operating to make and break the circuits alternately and a main-line relay operating break points in the punching-magnet circuit.

653,941. Telegraph Switching Apparatus. John F. Skirrow, East Orange, N. J. Application filed January 5, 1900.

A main telegraph line, a main station, a loop connected in the line at the main station extending to a substation, a multiple-contact spring-jack at the substation having its first and second contact points connected to the two sides of the loop, respectively, and its third and fourth points connected to one side of the loop and the ground, respectively; in combination with a jack-plug having two contacts forming the respective terminals of suitable telegraphic apparatus, the plug being capable of taking three separate contact positions; first, registering with the first and second jack contacts, connecting the instrument into the loop; second, registering with the first and fourth jack contacts, connecting the instrument into the first grounded side of the loop; and third, registering with the second and fourth jack contacts, connecting the instrument into the second grounded side of the loop.

653,945. Commutator Segment. James Burke, New York, N. Y. Application filed January 27, 1899.

In a commutator, the combination of counterpart segments having straight surfaces, suitable insulation, and securing devices, the segments being interlocked against radial displacement.

653,957. Magneto-electric Generator for Gas-engine Igniters. Garrett W. Henricks, Indianapolis, Ind., assignor to the Henricks Novelty company, Indianapolis, Ind. Application filed April 30, 1900.

A low-voltage electric generator for gas-engine igniters, including a rotative armature and a commutator mounted on a shaft, a pair of opposing pole pieces having a greater length than the length of the armature, a pulley secured to the armature shaft, a magnet attached to the pole pieces and extending beyond the ends of the armature, and commutator brushes engaging the commutator between the pole pieces.

653,963. Dynamo-electric Machine. William M. Mordey, London, England. Application filed October 25, 1898.

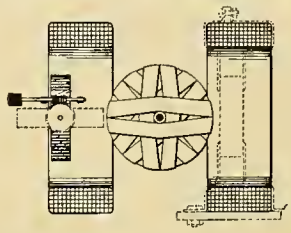
In a dynamo-electric machine, the combination with a field magnet, of a slotted armature core provided with a winding comprising elements, each of which is divided into unequal portions splayed or spaced apart. (See cut.)

653,970. Electric-railroad Track. Ekko Sollmann, Hoboken, N. J., assignor to the George Borgfeldt & Co., New York, N. Y. Application filed April 24, 1900.

As a new and useful article of manufacture a railroad track consisting of rails bent up of sheet metal, having hollow treads and inwardly projecting teats or lugs, and a double-pointed pin adapted to enter the treads to form good electrical and mechanical connections.

653,982. Electric Headlight. James W. G. Becker, Kansas City, Mo., assignor to the United States Headlight company, Buffalo, N. Y. Application filed April 23, 1900.

The combination with the bumper of an electrically propelled railway car having a dashboard extending upwardly therefrom, of a headlight case, a stand therefor adapted to be secured to the bumper, a hollow sleeve communicating with the interior of the case and extending to the bottom of the stand, a vertically movable socket holder within the sleeve, and means for securing the stand to the bumper.



NO. 653,806.

653,984. Electric Arc Lamp. Henry G. Carleton, New York, N. Y., assignor to the Carleton Electric company, New York, N. Y. Application filed November 7, 1899.

In an arc lamp, the combination with a carbon controller, of a solenoid for automatically varying the position of the controller, means for securing the carbon to the controller, and electrically controlled operating devices for the means, the devices being separate from and always in circuit with the solenoid.

654,050. Trolley Pole. Charles A. Brown, Lorain, Ohio, assignor of one-half to Albert V. Hageman, Lorain, Ohio. Application filed August 22, 1899.

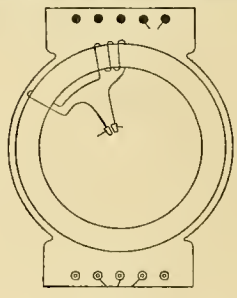
A trolley pole and supporting mechanism by which it is adapted to drop down out of reach of the guy wires, means to release the pole connected directly with the trolley wheel and comprising a rod lengthwise in the pole and an arm pivoted across the end of the pole carrying the trolley wheel on the opposite side from its pivot.

654,067. Electric Low-water Alarm. Frederick Leadbeater, Detroit, Mich. Application filed April 2, 1900.

In an electric low-water alarm, the combination with a steam pipe, of a contact device, a support for the contact device, a sleeve carried by the upper end of the support, an electrical circuit connected with the contact device, an expansible tube communicating at its lower end with the steam pipe, a rod supported upon the upper end of the tube, an additional spring-actuated rod above the first-named rod movable in the sleeve by the expansion of the tube and projecting therethrough to contact with the contact device to close the circuit, and a signal device in the circuit.

654,096. Hygienic Appliance for Sound-transmitter Mouthpieces. Thomas R. Owen, Los Angeles, Cal. Application filed January 30, 1900.

A hygienic appliance for sound-transmitter mouthpieces comprising a flexible strip and means for holding the strip and guiding it across the mouth of the mouthpiece.



NO. 653,963.

654,104. Measuring Instrument. Karl O. F. Schrottke, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed September 2, 1899.

In an alternating-current motor, the combination with a field winding therefor, of a Wheatstone-bridge circuit for adjusting the phase of the magnetism due to the field winding, the winding constituting a lateral portion of the Wheatstone bridge, substantially as described.

654,105. Electric-railway Appliance. Daniel E. Shoop, Turtle Creek, Pa., assignor of one-half to John F. Baxter, Pittsburg, Pa. Application filed December 9, 1899.

The combination with an overhead electric system, having its conducting wires supported from beneath, of a trolley mechanism comprising a pole having at the free end thereof two trolley wheels having a common center of rotation, adapted to engage alternately the upper side of the conductor wire, substantially as described.

654,113. Battery Electrode. Gustavos Heidel, St. Louis, Mo., assignor to the Globe Electric company, St. Louis, Mo. Application filed October 2, 1899.

An electrode for batteries provided with openings extending transversely therethrough, and non-active hollow resilient plugs located in the openings.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, AUGUST 4, 1900. No. 5

Gilmore Selector System of Typewriting Telegraphy.

A practical typewriting telegraph has been long sought for and many machines which did well on laboratory tests have been exploited. In practical work they have, however, almost without exception, proved inadequate, and not adaptable to commercial conditions. An apparatus that promises to be something more than a laboratory experiment has been on exhibition in Chicago recently. This new typewriting telegraph is the invention of Zalmon G. Sholes and Alfred C. Gilmore of Chicago. Mr. Sholes is the Sholes of Remington-Sholes typewriter fame, being the inventor of that machine, and Mr. Gilmore is also of the Remington-Sholes company, being formerly with the General Electric company at Milwaukee.

One feature which distinguishes the Gilmore selector system for typewriting telegraph from all systems heretofore exploited is that the signals are transmitted over an ordinary telegraph line by dots and dashes, just as an ordinary Morse code, so that as far as the transmission line is concerned the requirements in no way differ from ordinary telegraph systems, and messages can be duplexed or quadruplexed on one wire just as at present. Furthermore, the system is not affected as most others are by the variation in current strength due to factors which influence the current strength on long lines. Any current that will work a relay will operate the receiving instrument and its typewriter, and, in fact, that is just the way it is done on the apparatus. The receiver is worked by a relay, the relay being worked by the dot and dash impulses of the line current.

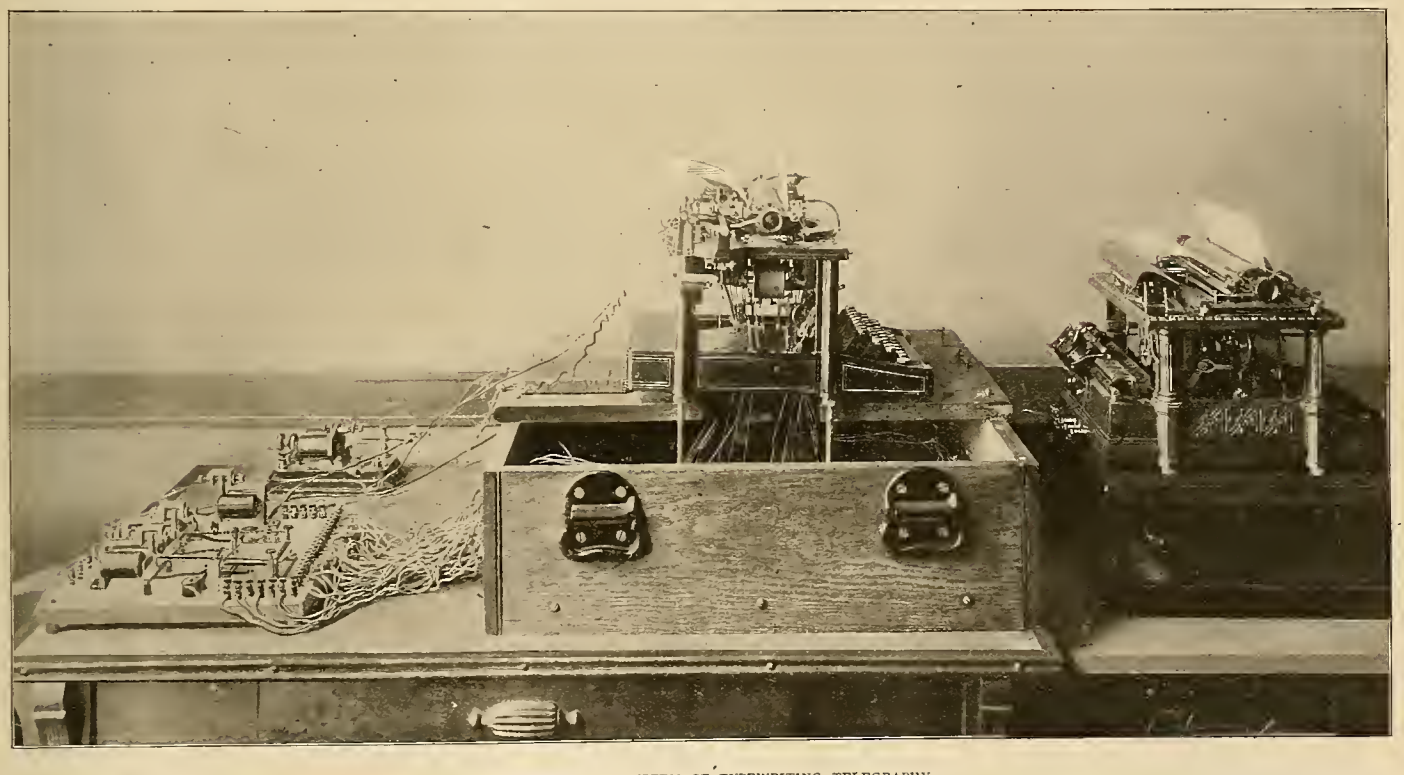
The whole apparatus is surprisingly simple. The sending instrument, as the apparatus stands now, consists of a typewriter of ordinary Remington-Sholes make with a sending apparatus attached. This sending attachment consists of a contact drum which is driven one revolution by a tiny electric motor each time a typewriter key is depressed. That is, normally the drum is stationary, the motor running continuously. When a typewriter key is struck the motor drives the contact cylinder one revolution. At the same time a contact finger corresponding to the letter struck is brought down against the cylinder. On the cylinder are contact strips for each letter which correspond to the Morse alphabet dots and dashes for each letter. Thus, if a letter A is struck the contact finger for A presses down on to the corresponding space on the cylinder which has contacts on it to make the dots and dashes of letter A. The result is that the impulses go out over the line just as if a telegraph operator were sending them, only more rapidly.

At the receiving end the line circuit operates a standard 150-ohm relay which works the receiving apparatus. The impulses from the line are received by means of an electromagnetic selector apparatus which separates the impulses giving the dots and dashes. By means of a contact arm moving over contacts the different combinations of dots and dashes that form the different letters are made to operate the keys of the receiving typewriter, the actual working of the keys being accomplished by electromagnets placed in a box beneath.

The accompanying illustration shows all the mechanism and apparatus comprised in the invention outside of the local batteries necessary to operate the relays, electromagnets and the motor on the transmitting machine. The typewriter on the right is the sending machine, from which the line wires lead to the selector apparatus shown mounted on a marble slab at the extreme left of the picture. This apparatus is connected by wires to the electromagnets that operate the keys of the receiving typewriter. This receiving instrument, shown in the center, is an ordinary Remington typewriter changed to meet the necessary requirements. In some future issue the Western Electrician hopes to present a detailed description of the entire mechanism of the invention.

The machine as it stands at present has a different kind of typewriter for sending from that used in receiving messages, but there is no reason why the same typewriter could not be used for both, and it is intended so to do in practice.

The longest line over which messages have yet been sent with this apparatus is 265 miles of the Central Union Telephone company's lines in Illinois. In its present state the system will transmit a message at about the same speed as the average telegraph operator. In time, it is probable that the speed will be considerably increased. It is not, however, the object of the inventors to produce a machine for exceedingly rapid work. The main object is to save labor expense by doing away with the necessity for a skilled operator to receive messages, or send them, and also increase accuracy. The apparatus will appeal very strongly to telegraph men because it involves no new problems as regards line working and can be attached to any line now working by substituting the receiving instrument and selector apparatus for the usual sounder and the sending instrument for the usual key. The same rules that apply to relays on present telegraph lines apply to this, and it can be operated on equal distances in the same way.



GILMORE SELECTOR SYSTEM OF TYPEWRITING TELEGRAPHY.

Paris Underground Railroad Opens.

With very little ostentation the beginning of an extensive system of underground transportation was opened last month in Paris. The line now open is only 8½ miles out of the 39 contemplated. This line will be a great facility to business, as it crosses the center of Paris. It starts at the Porte Vincennes and runs just north of and parallel to the Seine, under the Rue de Rivoli, the Place de la Concorde, the Avenue des Champs-Elysses and the Avenue de la Grande Armee to the Porte Maillot, the entrance to the Bois des Boulogne. The journey takes a half hour, as compared with an hour by the street cars. The fares are but three cents for second and five cents for first-class passengers. Trains run every 10 minutes. They are made up of an electric locomotive and one first-class and two second-class cars, which are well lighted, as is also the tunnel in which the tracks are laid. The road was inaugurated without ostentation, and even without the knowledge of many Parisians; but, nevertheless, on the first day it carried 30,000 passengers, who enjoyed the low temperature of the tunnel, 55 degrees, while on the streets the mercury stood at 97. The roof of the tunnel varies from 16 feet to a few inches below the paving. Westinghouse electrical apparatus is used.

The People's Power company of Davenport, Rock Island and Moline has voted to increase its stock from $300,000 to $600,000, to extend its plant and service lines.

Proposed Plans for Chicago Subways.

The accompanying illustrations are from plans submitted to the Chicago street-railway commission by John M. Roach, president of the Chicago Union Traction company, as a suggestion for the proposed street-railway subways for the downtown district of Chicago. These plans were submitted by Mr. Roach personally, simply as an engineering suggestion and without any consideration of the questions of franchise or who will build the subways, if they are built. Although the Union Traction company would not undertake to build them, it is understood that there would be no difficulty in forming an independent company to construct them if the franchise terms are right. There is, however, a strong sentiment in favor of the city building these subways. The street-railway companies would not object to abandoning the street and taking to the subways provided they were secured against the occupancy of the street surface by any other street-railway company after they had given it up. The cost of construction is estimated at $2,000,000 a mile approximately.

In drawing up these plans the subways of other cities were carefully considered, but as they did not suit Chicago conditions, it became necessary to devise something more complete.

The plans are notable when compared with those of the Boston and New York underground work in that they make such excellent provision for water and gas pipes and all kinds of underground wires. In Boston these had to seek the side of the street. In New York they will have to do the same in most cases. Such a scheme would be a very poor makeshift in Chicago.

The plans call for six loops around the heart of the city, and the loops are so arranged that passengers desiring to transfer to one line from another will in no case be required to walk more than one block, and to accommodate such transfer passengers a corridor one block long is proposed in the subway on Madison between State and Dearborn streets.

The plans make provision for carrying all the wires in conduits between the roof of the tunnel and the surface of the street. The bottom of the subway drain pipe is 32 feet below the surface of the street, and drainage into the river is provided for by electric pumps, as this is below the river level.

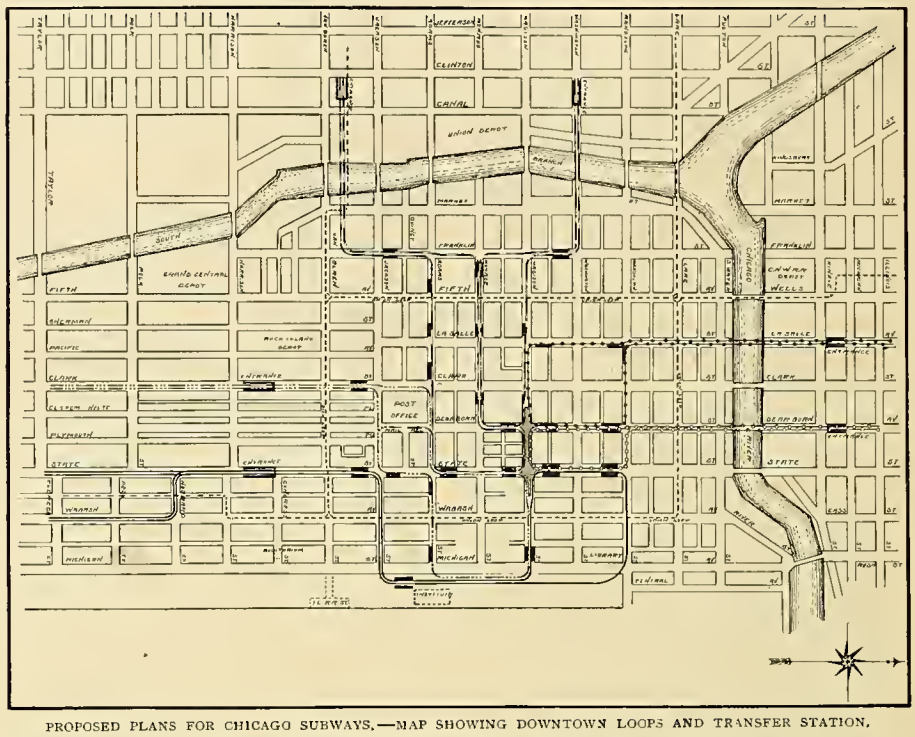
A new tunnel under the river at Dearborn street for the North Side lines is one of the features.

Some plans which have been proposed provide for running gas pipes in an open conduit, which is a rather dangerous practice because of the danger of leakage into the conduit where air is available to support an explosion. These plans place the gas pipes so that they are covered with earth.

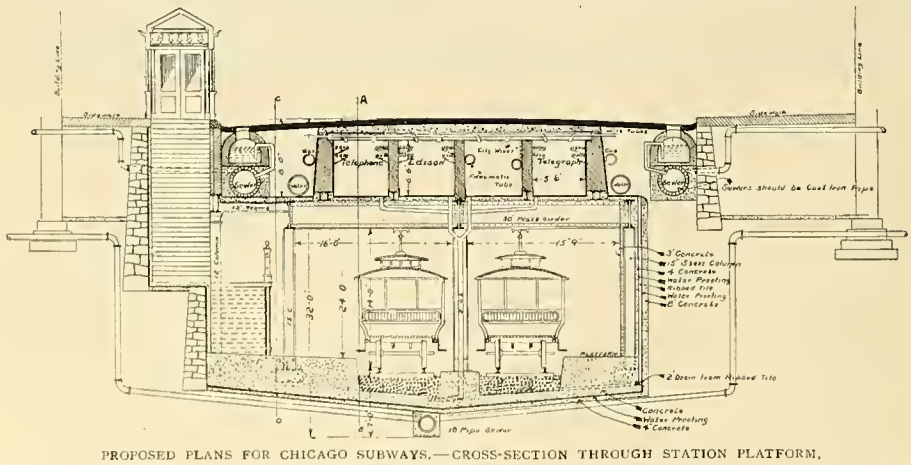
Each of the three divisions of the city has two loops, there being two for the North Side cars, two for the West Side and two for the South. The North and West Side loops are both approached by tunnels under the river, the only tunnel not now in existence being that proposed at Dearborn street. The State street and Wabash avenue cars both come in under State street, turn east under Jackson to Michigan avenue, north under Michigan avenue to Randolph, west under Randolph to State, south under State to Madison, east under Madison to Michigan avenue, and out the way they came in via Jackson. The South Side Clark street cars come in under Clark street to Jackson, east under Jackson to State, north under state to Adams, east under Adams to Michigan, north under Michigan to Madison, west under Madison to State, south under State to Adams, west under Adams to Clark, then out under Clark street.

The West Side cars coming in under the river at the Van Buren street tunnel, turn north under Franklin to Adams, east under Adams to State, north under State to Madison, west under Madison to Dearborn, south under Dearborn to Monroe, west under Monroe to Franklin, south under Franklin to the tunnel. The West Side lines coming under the river at Washington street continue under Washington to Franklin, south under Franklin to Madison, east under Madison to Dearborn, south under Dearborn to Monroe, west under Monroe to Franklin, and north under Franklin to Washington.

The North Side loops are the simplest, one loop running in under La Salle street to Madison, east under Madison to Dearborn, north under Dearborn to Randolph, west under Randolph to La Salle, and the other running in under Dearborn street and following Madison, State and Randolph streets. A siding for mail cars is shown under Dearborn street, opposite the postoffice. Three of the six loops pass the postoffice. It will be noted that the subway avoids the route of the Union Elevated Railroad at all points.



PROPOSED PLANS FOR CHICAGO SUBWAYS.—MAP SHOWING DOWNTOWN LOOPS AND TRANSFER STATION.



PROPOSED PLANS FOR CHICAGO SUBWAYS.—CROSS-SECTION THROUGH STATION PLATFORM.

Large Power Company In Virginia.

The Virginia Electric company of Richmond, Va., whose large power house on the site of the old Haxall mills is rapidly progressing, is making a large number of contracts for both light and power service, and connections with its street conduits are being made in a large number of business houses. Until the completion of the dam across the James River and the turning of water into the big canal carrying the water to the large turbines, the generators will be driven by the auxiliary steam power. This company controls the entire power of the James River at this point, and will undoubtedly introduce a new era in the use of electricity in Richmond. It is thought that manufacturers desiring cheap power and cheaper cost of labor will avail themselves of the opportunity to establish themselves in that city.

Instruments that May Be Imported Free of Duty.

So much doubt seems to exist in the minds of customs officials and others as to what goods are entitled to entry free of duty, that the Treasury Department has called attention to these special provisions of the tariff. For instance, when entry is made of any article which is entitled to entry free of duty, the oath or declaration to that effect must be made at the time of entry, and no bond for the subsequent production of same will be acceptable.

When instruments and the like for use in colleges, etc., are imported, an affidavit of the fact must be made within seven days before their arrival by the secretary, treasurer, or other responsible officer of the institution, under its corporate seal, that such articles have been imported by the order and for the sole use of the institution, and not for distribution or sale.

According to different treasury rulings, the following articles are classed as implements for mechanical or professional use in the arts, and are such as are more usually employed in the trades and professions for performing operations incidental thereto, for instance: Grenet batteries, electric batteries for generating electricity, used largely in experiments; inductive Ruhmkorff coils, used for a variety of purposes; galvanometers, used for detecting electrical currents; laboratory thermometers, unmounted, used for scientific purposes; Geissler tubes, used by scientists; anemometers, used for measuring the velocity of the wind; hygrometers, used for measuring moisture in the atmosphere; aneroid barometers, used for measuring pressure and weight of the atmosphere.

The following articles are held to be philosophical and scientific apparatus, utensils, instruments, and preparations within the meaning of and entitled to free entry under the provisions of Paragraph 638 of the present tariff, viz.: A scale indicating one-twentieth milligram, and a maximum weight of 100 grains; an analytical balance, sensible to the seventeen-millionth of an ounce; electrical instruments, consisting of a standard resistance, an alternating-current wattmeter, and a Siemen's wattmeter; chemical laboratory hydrometer; maximum and minimum thermometers, and Kipp's apparatus.

The following articles are among those held not to be philosophical and scientific apparatus, utensils, instruments and preparations within the meaning of the paragraph named, and are, therefore, not entitled to free entry: Chemical thermometers, manganese, india-rubber tubing, electric storage batteries, dynamos, ammeters, voltmeters, compasses, railroad and rectilinear lenses, pocket compasses, Zander's mechanico-therapeutic apparatus, passometers, mathematical instruments, philosophical instruments imported for sale.

Under a decision of the department it was decided that instruments, to be entitled to free entry, must be only such as are used for the purpose of making observations and discoveries in nature and developing and exhibiting natural forces and the conditions which they call into activity.

The Red Bluff (Cal.) Electric Light and Power company has filed articles of incorporation, with Henry A. Gesford, R. S. Masson, H. C. Donnels, P. S. Coke, W. I. Priest, W. F. Wallace and A. R. Kanaga as directors. The capital is $125,000, of which $700 is subscribed.

Electric Railway System of Moscow.

Electric traction is making slow but steady progress in Russia. At the present time, however, there are only a few cities where electric traction has been introduced; and in the great majority of places the passenger traffic is still carried on by means of horse-car lines, and there are many cities in which not even horse-car lines are to be found.

This state of affairs may, at least to a large extent, be attributed to the fact that horses are, as a rule, exceptionally cheap in Russia, and as a consequence, carriages, cabs, and the like vehicles, are commonly used over the whole of European Russia, to the exclusion of other methods of transportation. Another reason for the slow development of the electric tramways in Russia is that the people are not in such a hurry, and have not the reasons for hurrying from one place to another, as is the case in the west of Europe and in the United States.

This fact was carefully taken into consideration by the First Tramway company of Moscow, which controls all the street-car lines of that city (the total length of which is only some 85 kilometers, or about 53 miles). To begin with, electric traction was substituted for horses on only three of the principal and most-frequented streets on which cars were already in operation. These lines connect the inner parts of the city with the busiest outskirts, namely, with the Petrowsky Park, in the north, and the villa and racing districts, which surround the park, where, especially in summer, the traffic is so great that the horse cars were unable to cope therewith.

The first of the lines mentioned starts from the Strastnoy Monastery, as shown in Fig. 1, about one kilometer distant from the famous Kremlin (which is the center of the city), and runs on one of the most important business streets, the Twerskaya, to the Butyrskaya Sastawa, in the neighborhood of which Fig. 2 shows the electric cars. This line is 3.2 kilometers (two miles) in length. A continuation of the first line runs from the Butyrskaya Sastawa up to the northern end of the Petrowsky Park, a distance of 2.35 kilometers (1.46 miles).

The third line begins at the end of the Twerskaya and runs in an almost parallel direction to the second line on the Petersburg Chausse. Its length is 2.45 kilometers (1.52 miles) to that point. Then it continues to the southwestern end of Petrowsky Park. This latter line is connected by a branch line of 1.2 kilometers (0.74 mile) in length, with the station building, which is situated at about the middle of the second line. The total length of the lines is thus about 9.2 kilometers (5.7 miles). All the lines, with the exception of the branch mentioned, are double track, with a gauge of 1.525 meters (five feet). The distance between the tracks is 3.64 meters (11.94 feet). On the first and second lines, so-called "Phœnix" rails, weighing 30.2 kilograms to the meter (60.85 pounds to the yard), are in use, while on the second, Vignol rails of 20.4 kilograms to the meter (41.13 pounds to the yard) were employed.

The smallest curve diameter is 17.06 meters (56 feet), the greatest incline 23.2:1,000, on a length of 90 meters (295.29 feet).

A special station supplying the current for all the lines is connected with the station building. The energy is obtained from the electric-power station of the Moscow Electric Power company—situated about seven kilometers (4.3 miles) from the station—in the form of three-phase current of 200-volt tension. The current is transmitted by means of subterranean, triple-strand, high-tension cables, and is transformed by rotary transformers into direct current of 550 volts. Each of these transformers consists of a rotary-current motor of the Siemens & Halske type, and a direct-current generator of 85 kilowatts, of the Siemens inner-pole ring type. Both machines are directly coupled together by means of an elastic, insulating strap pulley. At the present time four rotary transformers are installed, and in connection with them a buffer battery, for compensating the fluctuations of the current. The battery consists of 275 cells of a capacity of 1,000 ampere-hours at 400 ampere discharge; it is installed in two series outside of the plant, and can, by means of resistance coils, be charged to a tension of 2.6 volts per cell, which has to be done about every two months. Each of the feeders is automatically regulated at the station by means of a switchboard. A main switch at the transforming station renders it possible, by one pull, to cut out the battery, and by a second pull the high-tension transmission, thus cutting off the current entirely.

The rolling stock consists of 23 motor cars, of which there are 10 with two motors, each of 20 horsepower, the other 13 with one motor each, and of the trailing cars, for which common horse cars of different sizes are used. The average weight of a loaded motor car is 10.7 tons, and that of a trailing car 4.7 tons. On the second line trials are also made with an accumulator car, equipped with a battery of 200 Tudor cells, of 30 ampere-hours each, and of a weight of 2.8 tons. The motor cars afford accommodation on two seats for 20 passengers, and for eight on each platform.

The station buildings include the depot and workshops, the transforming station, the accumulator hall and the administration buildings. The switching service, to the tracks of the depot, is carried on only by means of two switches. The depot is 53.3 meters (175 feet) in length by 27.3 meters (89.5 feet) in width, and affords room for 30 motor cars. Under the front part of the depot, for the length of three cars, a cellar has been built. The rails are fastened on iron supports. These supports, with the exception of the space between the rails, are covered with wooden boards, so that the motor cars can be examined, and repaired from below. In the rear part of the hall is a blacksmith shop, a paint shop, a storeroom, etc. The repair shop is equipped with an electrically driven spindle lathe, drilling machine, shaping machine, boring machine, shears, etc.

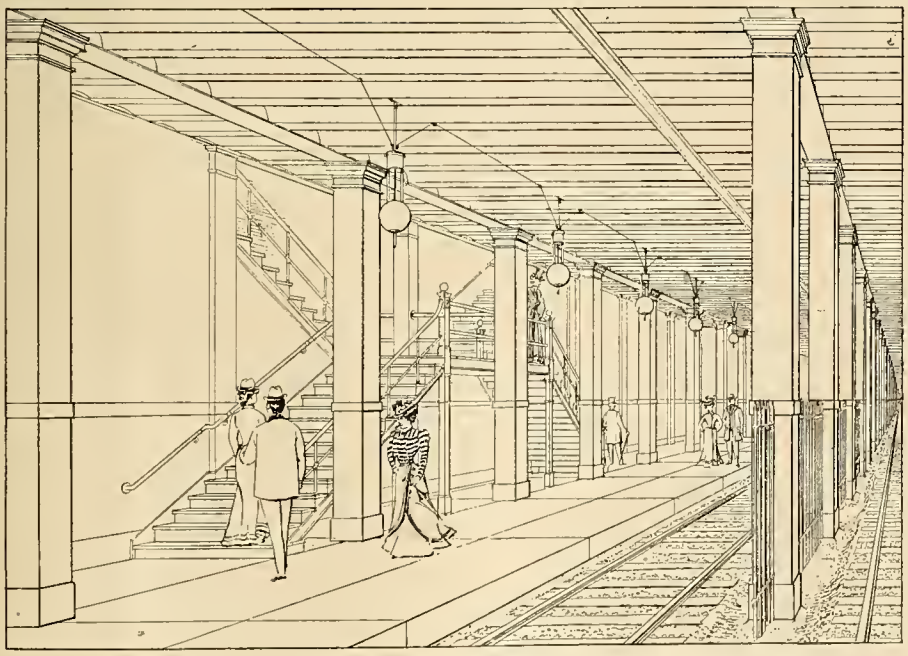
The end stations at Petrowsky Park and at the Butyrskaya Sastawa are lighted by incandescent lamps, while the lighting of the main-station building is effected by three-phase current, transformed to 120 volts. A part of the lighting system can, in case of need, be switched on to the battery. For carrying on the traffic, 18 to 19 motor cars are in daily use from 7:30 a. m. to 12:30 p. m. The speed limit is fixed at 10.7 within the city proper and outside of the city at 12.9 kilometers an hour. Stopping places are marked by signs at intervals of from 250 to 300 meters. Cars run every four minutes within the city and every 10 minutes outside of the city.

The construction of the whole plant was executed by the Russian Siemens & Halske company of St. Petersburg. It was started in August, 1898, and the Butyrskaya-Projesd part was opened for traffic in March, 1899. The whole lines were opened for traffic on July 27, 1899. At the present time further extensions are under way of construction.

Fig. 1. View at Strastnoy Monastery Showing the Kremlin.

Fig. 2. View Near the Butyrskaya Sastawa.

ELECTRIC RAILWAY SYSTEM OF MOSCOW.



PROPOSED PLANS FOR CHICAGO SUBWAYS.—PERSPECTIVE VIEW OF STATION PLATFORM.

Michigan and Ohio Electric Railway.

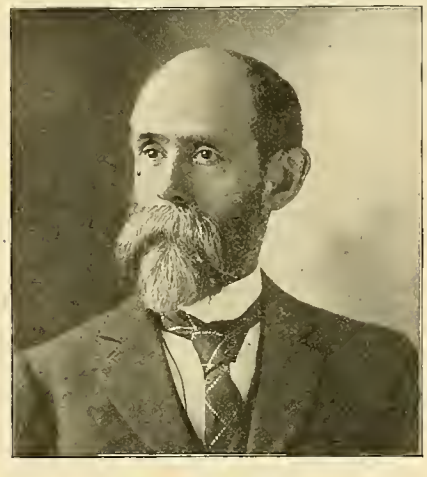
The Michigan and Ohio Electric Railway company was incorporated at Lansing, Mich., recently by Washington I. Robinson, W. W. Johnson, J. W. Donovan and Milton Carmichael. The capital stock is $200,000. It is the intention of the incorporators to build the road from Toledo, through Temperance, Ida and other towns of Monroe County, Mich., reaching Dundee, Scofield, Maybee and other Michigan towns. Later on the road may be built to Detroit and some of the larger cities. The general offices will be in Detroit. It is announced that the road will use the Murphy sectional third-rail system and that the General Electric company will likely furnish the power plant. The road will be capitalized largely by eastern men, although there will be western stockholders also. The proposed line will pass through a thickly populated territory and will probably be of great advantage to the towns it touches.

The Lake Geneva, Sycamore and Southern Electric railway has been sold to the Illinois and Wisconsin Electric Railway company. This latter is a new company, organized with a capital of $10,000,000, and it will take up the work and build the line as laid out through McHenry County and Woodstock to Geneva Lake.

Death of John E. Zeublin.

John E. Zeublin, general superintendent of the Chicago Telephone company, was killed suddenly by falling from the platform of a fast west-bound train on the Pennsylvania road, near Bucyrus, Ohio, on the morning of July 26th. Mr. Zeublin, with his wife, was returning to Chicago from the East, where they had been spending a few weeks in the mountains and along the seashore for the benefit of Mr. Zeublin's health, which had been impaired by overwork. His health had improved greatly and he was on his way home to resume his duties with the Chicago Telephone company. The accident occurred early in the morning and was undoubtedly caused by Mr. Zeublin's mistaking the vestibule door for another door of the car, and not realizing his mistake until it was too late. When the train backed to where the body lay, life was extinct.

Born in Chester County, Pa., nearly 58 years ago, the life of John E. Zeublin was full of activity. He received an early training in telegraphy under Stoughton A. Fletcher, Jr., railroad superintendent, and was one of the first operators to learn to read by sound. During the civil war Mr. Zeublin served at different posts as military operator, and at one time had the distinction of being President Lincoln's private telegraph operator. Soon after



JOHN E. ZEUBLIN.

the close of the war he married Miss Henrietta Follett, the daughter of Judge Follett of Newark, Ohio.

For several years Mr. Zeublin served as night manager of the Western Union Telegraph company in Philadelphia, and left that position to become superintendent of the American Union lines in New Jersey and Pennsylvania. When, in 1881, the American Union and Western Union lines were consolidated, he was made superintendent of the Western Union in Pennsylvania, New Jersey, Delaware, Maryland and the District of Columbia. His district was exceptionally large, containing 34,000 miles of wire and 1,000 offices. Later he became general manager of the Bell Telephone company of Philadelphia, but resigned the place in 1884 to become general western superintendent of the Baltimore and Ohio Telegraph company. His headquarters were in Chicago, where he has since remained. In 1888 Mr. Zeublin accepted the general superintendency of the Central Union Telephone company, and in 1892 became general superintendent of the Chicago Telephone company, a position which he has since held. Under his management the business of the company has been more than doubled.

Mr. Zeublin was a man of untiring activity and zeal, and had a most attractive personality. He was greatly beloved by his associates in the Chicago Telephone company, and his sudden death came as a great shock. Mr. Zeublin leaves one son, Professor Charles Zeublin of the Chicago University. The funeral services were held at Newark, Ohio.

Roentgen Society of the United States.

The Roentgen Society of the United States, which was organized in St. Louis on March 31st last, will meet in New York city on December 13th and 14th, at the Academy of Medicine. Papers have been promised by several eminent men abroad and from this country, and a successful meeting is looked for. Hospitals, physicians, surgeons, investigators, manufacturers and others interested in X-ray work are requested to send their names and addresses to the chairman of the committee on arrangements, Dr. S. H. Monell, 43 East Forty-second street, New York city. Those desirous of becoming members or who wish to read papers before the society may address the secretary, Dr. J. Rudis-Jicinsky, Cedar Rapids, Iowa.

History of Anglo-American Company's Telegraph Cables.

During its existence the Anglo-American Telegraph company has laid eight cables, the first being laid in 1857-58, the others in the following-named years: 1865, 1866, 1869, 1873, 1874, 1880, and the last in 1894. The 1857-58 cable was a total failure; it broke in 1857, and then failed, after a brief existence, in 1858. But it must be remembered that not only the making and laying of cables was in its infancy at that time, but navigation by steam was still in its early days, and thus the cable project was abandoned for the time; in fact, nothing practical was done until 1865, when another attempt was made, the result being that the cable broke when about half laid, but the enterprise was completed in the following year. From 1866 to 1869 there was uninterrupted cable communication across the Atlantic; in the following year there was an interruption of 31 days, the next year—1871—of 171 days, followed by a year of successful operation, with no interruptions in 1872. In 1873 this cable died, so that its total length of life was seven years.

The 1866 cable showed its first flaw in 1867, when there was an interruption of 99 days, in 1868 of 69 days, in 1869 of 93 days, in 1870 of 153 days, and in 1871, 154 days. Then followed two years of uninterrupted business, followed, in turn, by an interruption of 92 days, with no further interruptions until 1877, when this cable also died, after a life of 10 years.

The cable that was laid in 1869 showed no interruptions until the year 1872, and then only for 19 days. In 1873 there was a total interruption of 35 days, none in 1874 and 1875, followed again by an interruption of 61 days in 1876, and this again followed by two years of uninterrupted business. In the year 1879 there was an interruption of 169 days, followed in succeeding years by interruptions as follows: In 1880, 50 days; in 1881, 202 days; in 1882, 186 days, and then another year of uninterrupted business. The interruptions for the next few years were as follows: In 1884, eight days; in 1885, 65 days; in 1886, 87 days; in 1887, 343 days; in 1888, 216, and in 1889, 78 days; in 1890, no interruptions; in 1891, 56 days; in 1892, 134 days, and in 1893, 272 days; thus, during the total life of that cable, amounting to 24 years, the total number of interruptions was 20, and the total number of days lost was 1,981 days, or about 5½ years out of its life. The cost of the repairs to the company was, in round numbers, $150,000, and 1,100 miles of cable were employed in the repairs. It is an unfortunate fact that there are two ridges in the Atlantic Ocean bottom, and it is over these two ridges that the breaks are always reported to have occurred.

The cable laid in 1873 seems to have been more fortunate, as no interruptions occurred until 1880, when 13 days were lost, followed by another period of successive operation lasting until 1891, when there was a loss of 46 days, followed by another of six days in 1895, or a total interruption of 65 days, and of this the longest interruption at any one time was 1½ months.

In the cable laid in 1874 there were no interruptions until the year of 1880. Since that time there have been six interruptions, the longest of which was one year and two weeks. In 1884 the Commercial Cable company laid a cable across the 1874 cable, and, while it might be simply a coincidence, yet it is rather noteworthy that the 1874 cable broke in the neighborhood of that crossing. An expedition was sent out to repair it, but failed, and not only failed, but increased the break, until it was 125 miles in length. The following year the company repaired the break, at a cost of 273 miles of new cable. The cost of the two expeditions for that purpose was in the neighborhoood of $435,000.

The 1880 cable showed its first break in 1883, when there was an interruption of 42 days, followed by another of 16 days in 1884; of 21 days in 1891, and of 80 days in 1896, or a total interruption of 42 days. The latest cable laid by the Anglo-American company is that of 1894, in which there has been no interruptions up to the present time.

The general impression seems to be that better material is used in the modern cables than was the case in those of the earlier construction, but it is claimed by the officials of the company that there has been no material improvement between the years of 1865 and 1894, and, in one particular element of construction—guttapercha—there has been a very material deterioration, as there is so much adulteration, but, in addition to this, it must be remembered that harder iron wire is being employed, and thus a greater breaking strain is being secured. The greatest improvement is the covering of the iron wires with thin guttapercha, which was first employed for this purpose in the cable of 1880. This prevents the wire from coming in immediate contact with the ocean bottom, and, as a consequence, prevents oxidization.

From the above it will be seen that the Anglo-American company has laid eight cables, and that it is at present operating four, all of which go in the same direction. Of the seven Atlantic cables belonging to the associated companies, Anglo, Direct and Western Union companies, as many as four have been broken at one and the same time; take, for example, the year of 1894, when four out of the seven were out of operation at one time; but this was the only instance in which the number ran over three.

Street Lighting.[1]

By H. H. Wait.

The following remarks are a continuation of the discussion of the subject of the cost of arc lighting and the relative economy of enclosed and direct-current lamps, as taken up in a communication to the American Institute of Electrical Engineers, on December 27th.

This subject is of special interest to the operators of small central stations, because most of the arc lamps in such stations are located rather long distances apart, and it is under these conditions that there is the greatest amount of uncertainty as to which is the most satisfactory lighting system to adopt.

We wish now to consider especially the intensity of illumination at the street surface obtained with different systems. We shall see that the arc lamps cannot compete with incandescent lamps or Welsbach lamps placed nearer together, if the minimum intensity of illumination at the street surface is the only specification to be fulfilled. The fact that alternating enclosed lamps give more light, relatively to their maximum, at angles near the horizontal, has led those interested in the introduction of alternating lamps to call particular attention

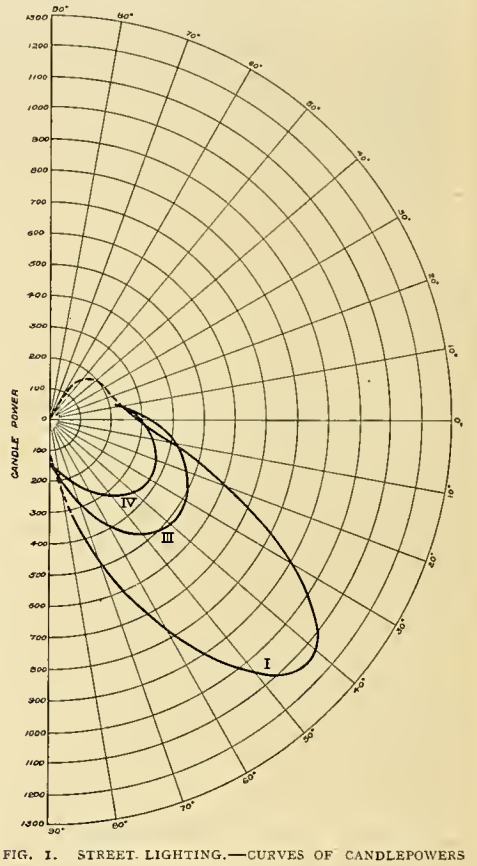


FIG. 1. STREET LIGHTING.—CURVES OF CANDLEPOWERS OF ARC LAMPS.

to this point of minimum illumination. For example, it has been customary to hang an alternating lamp some distance from an open arc, and it is quite frequently found that at a point midway between the two lamps, the alternating lamp will throw the darker shadows, and it has been claimed that the excess of light underneath the open arc is a disadvantage rather than an advantage, because it makes the less-illumined portions seem darker by comparison.

The writer wishes again to call the attention of electrical men to the danger of this method of establishing the value of street lighting on account of the competition mentioned before.

In the American Institute paper the curves of street illumination from enclosed lamps, both direct and alternating, were taken mainly from some curves submitted to the American Institute by Professor Matthews. He has since stated that these curves did not show as high efficiency as the lamps now on the market. The candlepower curves used in the accompanying diagrams are obtained by averaging a considerable number of curves published by Marks, Matthews, Thompson and Hilbish, curves made in the General Electric company's and in the Western Electric company's laboratories, and a number of older curves on open arcs. It is quite probable that the values obtained in this way, representing the results of the averages obtained by different experimenters using different methods, give a better idea of the relative values of the different lamps than can be obtained from tests in any single laboratory.

The candlepower curves shown in Fig. 1 have all been placed on one plot, and the direct-current enclosed lamp with clear globe has been left out, as has also the small curve of alternating lamps with-

1. Read before the Northwestern Electrical association, a Waupaca, Wis., June 28, 1900.

out reflectors. The radial distances from the center represent the intensity of light at any given angle in candlepower. In the report submitted to the National Electric Light association on May 23d, the luminous intensities are given in Hefner units, and they consequently have to be multiplied by 0.88, to compare them with the accompanying curves. The following table gives the data relative to the curves:

	Watts at Arc.	Watts per Mean Spherical Candle-power.	Watts per Mean Hemi-spherical Candle-power.
I—Direct-current open arc	450	1.2	.8
III—Direct-current inclosed arc, alabaster inner globe with reflector	450	...	1.2
IV—Alternating-current arc, alabaster inner globe with reflector	450	...	1.6

It will be seen that both the direct-current and the alternating enclosed lamps give slightly more light at angles close to the horizontal, and also that there is a slightly greater diffusion of light directly under these lamps. At all other angles, however, the open lamp gives very much more light than either of the enclosed, and the direct-current enclosed gives quite a little more than the alternating, so that as far as the simple production of light is concerned, the old open arc is considerably superior to either of the enclosed lamps, and it is only the superior steadiness of the light and the lesser cost of running that make the enclosed lamps successful competitors of the open arcs. This matter has been discussed elsewhere, and we will leave it to consider the street illumination corresponding to these curves.

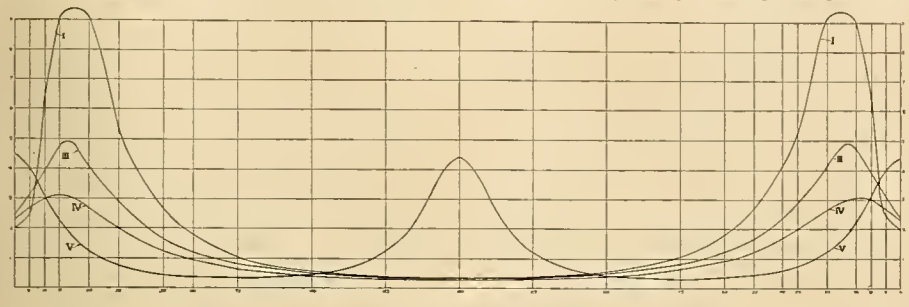


FIG. 2. STREET LIGHTING.—CURVES OF STREET ILLUMINATION.

The street-illumination curves shown in Figs. 2 and 3 represent the illumination from a whole row of lamps located as specified. The intensity of light from the candlepower curves given in Fig. 1 is read off at the angle corresponding to the direction of the ray of light from the lamp to the point in question, and this intensity is then divided by the square of the distance to conform with the law of light radiation. The same thing is done with the lamp on the other side of the spot in question, and so on, to the lamps in the row on both sides, as far as they give enough light to affect the result. The summation of these intensities gives the intensity of light at the point taken without considering the direction of the light. To get the actual intensity of illumination on the street surface each value would have to be multiplied by the sine of the angle between the ray of light and the street, but as it is desired to illuminate surfaces and objects at all angles, as well as the street surface, it is probably sufficiently fair to take the bulk intensity irrespective of direction. If the sine values were used, the comparison would be very much more favorable to the incandescent lamps, as the light falls at more direct angles.

The curves of Fig. 2 show the street illumination from the lamps given in Fig. 1. The arc lamps are spaced 300 feet apart and 25 feet high in this case. Superimposed on the arc-lamp curves is one from bunches of incandescent lamps 150 feet apart and 15 feet high. Each cluster of incandescent lamps is assumed to give 100 candlepower in the lower hemisphere.

If these incandescent lamps consumed three watts per mean spherical candlepower (a figure which is readily obtained with modern lamps), and, in addition to this, we should place a reflector over each cluster, which would save one-third of the light otherwise passing upward, we would then get a net figure of 2¼ watts per mean hemispherical candlepower. The enclosed direct-current and alternating lamps used in making up the arc-lamp curves were all provided with reflectors, so that the incandescent lamps are thus on approximately the same basis as the enclosed-arc lamps. The open-arc lamp has a very small upper hemisphere, so that a reflector would make very little difference. On the above basis the clusters of incandescent lamps would consume a total of 450 watts for every 300 feet of space, which is the same as the power consumed by the arc lamps.

Fig. 3 shows the street illumination from the same arc lamps when spaced 600 feet apart and 25 feet high. Curve (V) superimposed on these shows the light from clusters of incandescent lamps, located 100 feet apart and 15 feet high. This curve (V) is made up on the assumption that each bunch of lamps gives 50 candlepower in the lower atmosphere. Allowing 450 watts for each 600 feet for either the arc lamps or the incandescent lamps would mean that we would have to get a net efficiency of 1¼ watts per mean hemispherical candlepower, in order to come as high as 50 candlepower per cluster. This would probably represent the maximum condition that we could reach with the present form of incandescent lamps for several years to come. This efficiency would correspond with an efficiency in the lamp itself of 2.7 watts per mean spherical candlepower and 80 per cent. efficiency in the reflector. This latter would seem to be about as high as could be obtained with a reflector which would withstand the weather. Curve (V), in Fig. 3, is drawn at this efficiency to avoid confusion.

In the following table, which gives the maximum, minimum and mean values of the curves in Figs. 2 and 3, the values have been added which have been derived from curves of incandescent lamps consuming 2¼ watts per mean hemispherical candlepower, as in Fig. 2, and also at an efficiency of three watts per mean hemispherical candlepower which could be readily obtained from incandescent lamps without the use of reflectors.

Fig. 2.—450 watts in arc lamps 300 feet apart and incandescent lamps 150 feet apart.

	Intensity of Illumination in Candle Feet at Street Surface. Max.	Min.	Mean.
I.—Open arc lamp	0.94	0.037	0.124
III.—Enclosed direct-current arc lamp, opalescent inner globe with reflector	0.49	0.037	0.15
IV.—Enclosed alternating-current arc lamp, opalescent inner globe with reflector	0.31	0.030	0.11
V.—Incandescent lamps with reflector at 2.25 watts net per mean hemispherical candlepower	0.44	0.034	0.14

Fig. 3.—450 watts in arc lamps 600 feet apart and incandescent lamps 100 feet apart.

I.—Open arc lamp	0.93	0.015	0.13
III.—Enclosed direct-current arc lamp, opalescent inner globe with reflector	0.49	0.18	0.087
IV.—Enclosed alternating-current arc lamp, opalescent inner globe with reflector	0.31	0.015	0.061
V.—Incandescent lamps with reflector at 1.5 watts net per mean hemispherical candlepower	0.21	0.037	0.11
V.—Incandescent lamps with reflector at 2.25 watts per mean hemispherical candlepower	0.14	0.025	0.073
V.—Incandescent lamps at 3 watts per mean hemispherical candlepower	0.11	0.018	0.055

A consideration of these curves and tables shows us that at the higher values of street illumination, such as are obtained with the arc lamps located 300 feet apart, the minimum illumination is about the same for all four methods, and that there is no very great difference in the mean illumination, except that the mean, as well as the maximum for the open arc is considerably higher, the light from the alternating lamp being somewhat lower than the others for maximum, mean, and even the minimum.

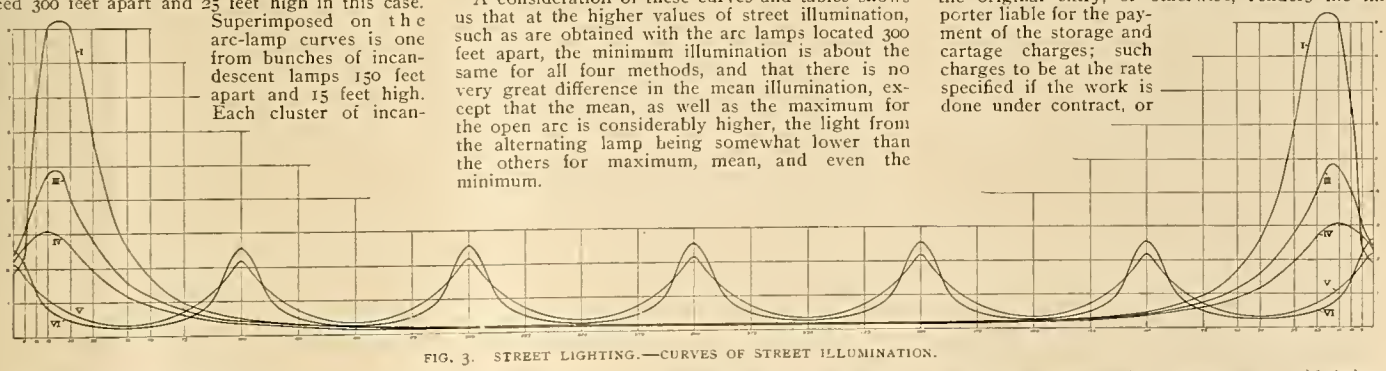


FIG. 3. STREET LIGHTING.—CURVES OF STREET ILLUMINATION.

At the low values of illumination, as with the arc lamps 600 feet apart, we find that the incandescent lamps appear more favorable if we consider the minimum values. For example, at the net efficiency of 2¼ watts obtained with the reflector, which is a figure consistent with good practice, we get a minimum value of nearly double that obtained from the open arc and the alternating arc, and considerably larger than the direct-current enclosed arc. We find, however, that the maximum value from the incandescent lamps is way below the others, and the mean value is lower than all the others except the alternating. This leads us to the conclusion alluded to in the beginning, namely, that if we are going to have low minimum values as the only requirement specified, arc lamps cannot compete with incandescent lamps or Welsbachs. It is only by considering the mean and maximum values that arc lamps can continue to hold the field.

A consideration of the conditions leads the writer to suggest that a modern specification should comprise the following elements:

First—That the minimum illuminaton should not fall below a specified figure.

Second—That the mean illumination should not fall below a specified figure.

Third—That the fluctuation of the lamps from time to time should not cause a variation of more than 50 per cent. from the above specified average figures. This clause would prevent the use of any but the best open arc lamps, and they would have to be run in the best possible shape even then. A variation of 50 per cent. in the light from an arc lamp is not very noticeable in street lighting, and if the intensity did not change more than this, there would seem to be no objection to the use of open arcs.

Fourth—That the arc lamps should not be hung lower than a specified minimum of, say, 18 feet, and that incandescent lamps should not be hung lower than, say, 10 feet.

It would be desirable if some specification could be adopted which would limit the amount of color allowed in the light so as to avoid the unpleasant hues of the Welsbach lights or the extreme purple of very long enclosed arcs, but there seems no reasonable commercial method of determining this, except to leave it as a matter of personal opinion.

The foregoing specifications seem decidedly impracticable to apply to cases where only a small amount of lighting is to be done, but the points involved are all likely to come up and be made the subject of lawsuits in places where there is a strong competition. The various electric associations should, therefore, endeavor to get the matter standardized, so that the relative value of the different lamps for different purposes can be specified on a basis of watts at the arc, combined with certain restrictions in regard to carbons, globes and reflectors.

Cartage and Storage Charges on Goods Held for Appraisement.

A ruling has been requested at the hands of the Treasury Department upon the question as to whether drayage charges on regularly invoiced and entered merchandise ordered to the bonded warehouse used as and in lieu of an appraiser's store should be borne by the government or by the importer.

Replying to the request, the department holds that where merchandise is regularly entered and entry is made complete, the cartage and storage charges are not required to be paid by the importer for the conveyance of the goods to and the retainment of the same in the appraiser's store, or in any place used as such, for the purposes of examination and appraisement. Failure to remove goods at the expiratin of two days—exclusive of legal holidays—after notice to do so has been given, on completion of the appraisement of the merchandise, will lay the importer liable for the payment of such storage and labor charges as may accrue after the expiration of such period, at the customary rates prevailing in any certain port, in accordance with principles which have already been enunciated by the board of general appraisers.

In all cases where merchandise is entered on appraisement orders, or on defective invoices, or of which incomplete entry has been made, or an insufficient entry as to particulars, either for want of the original entry, or otherwise, renders the importer liable for the payment of the storage and cartage charges; such charges to be at the rate specified if the work is done under contract, or else by duly licensed cartmen, as provided in a treasury ruling, June 2, 1891.

Much has been said in the daily press recently regarding the arrival of Charles T. Yerkes in London, for the alleged mission of securing control of the transportation systems of that city. In an interview, Mr. Yerkes said he was there simply to talk over matters with parties who have a charter for an underground road, and expressed the opinion that London transportation systems are open to considerable improvement, which latter statement probably no one well posted would deny.

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CONVENTIONS AND EXPOSITIONS.

Ohio Electric Light association, Toledo, O., August 14th to 16th.

Inter Ocean Automobile Meet, Chicago, Ill., September 18th to 22d.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

Among the millions of Uncle Sam's nephews there are not a few of the electrical persuasion who will regard the report of the commissioner of labor for the year 1899, recently issued, as one of the most important of the public documents distributed from the old gentleman's extensive publishing department. The reason for this lies in the fact that the book (it is a cloth-bound volume of 983 pages, with many tables and an index) is designed to bring out the essential facts relating to private and municipal ownership of waterworks, gas works and electric-light plants. The report is made by Mr. Carroll D. Wright, the commissioner of labor, and it embraces what is undoubtedly the most complete compilation of statistics bearing on the municipal-ownership problem so far presented to the American public, exhibiting, as it does, 56 per cent. of the value of the product of the utilities represented. Forty-five per cent. of the total value of the electricity produced by the whole number of the plants in the United States was generated by the plants for which details are given in the report. The year covered by the figures is usually a fiscal year ended in 1898, although for some plants the year reported ended as far back as 1897. The data given relate to the equipment, production, prices, etc., of water, gas and electric-light plants, as a basis for the study of questions arising from the operation of these plants under private and under municipal ownership or control. As the investigation was made with disinterested motives and under the direction of the government, the importance and value of the report is manifest. No doubt every student of the municipal-ownership question will seek to possess himself of a copy of the book to study for himself the detailed figures; but in the meantime a brief outline of the facts presented, in this place, should prove useful.

Mr. Wright states at the outset that the facts classified will not settle conclusively the merits of the two systems of management. However, he presents his carefully gathered figures, analyzes them and gives the results, for the instruction of all interested. No names of owners are given, as the returns solicited and received were confidential. No isolated plants are included.

The total number of private central-station electric plants in the United States is reported to be 2,572, with 460 municipal plants. The total investment in the private plants is $265,181,920 and in the municipal plants $12,902,677. The value of the product of the private central stations is $56,490,652 and of the municipal stations $3,531,605. Of the total of 3,032 electric-light plants thus reported 85 per cent. are private and 15 per cent. are municipal. About nine per cent. of both the private and municipal plants are located in places of less than 1,000 population at the census of 10 years ago. This is an astonishingly large proportion for very small villages, although it is to be remembered that a plant in a small town may supply a large outside area. However, no plants in places of less than 1,000 population are included in the detailed tables in the report. The tables do, however, include data for 632 private plants ($113,917,815 investment) and 320 municipal plants ($10,908,929 investment). As a basis of comparison for size, the horsepower capacity of engines or waterwheels is taken in lack of a better unit.

The tables of data of electric-light plants are most elaborate. With the preliminary analyses, they fill 460 closely printed pages of the book. There are 11 of them, each divided into 16 groups, according to the size of the plants. Of course, no more than the most general mention of the character of the information gathered and tabulated can be here attempted.

Referring now briefly to the data presented in the tables, Table I. deals especially with the physical features of the plants—engines, boilers, waterwheels, dynamos, circuits, transformers and lamps. Table II. is intended to show the cost and kind of fuel consumed and data of feed-water supply. Quite generally, bituminous coal is used, but anthracite coal, coke, wood, natural gas and oil are also reported. The cost of coal varies from 11 cents a ton for bituminous slack in Plant No. 629 to $8.25 a ton for bituminous coal in Plant No. 67. This range alone shows the lack of value of comparison of electric-lighting costs unless all conditions are given. In Mr. Wright's report an effort has been made to present all needful data, and the result is the mass of figures of which some idea is here given.

The amounts invested in the plants are shown in Table III. Any amounts paid for franchises are included in the costs of private plants. Some idea of the variation in size may be obtained from the statement that the total investments—land, buildings, machinery and all—range from $1,400 to $9,553,209, both being private plants.

Table IV. relates to municipal plants only, and shows the manner in which the funds for construction have been raised. These funds are found to have been raised in three ways—by taxation, including sums derived from a special tax as well as those drawn from general taxation; by transfer from other municipal funds and by the issue of bonds. The gross income of plants, both private and municipal, is shown in Table V. As a rule, the greatest portion of receipts is from the incandescent lights. A very wide discrepancy in the percentage of receipts from motor service is noticeable.

Coming to the cost of production (Table VI.), elaborate tabulation is given. The heads under which "cost" is given are salaries, office expenses, insurance, legal expenses and damages, miscellaneous general expense, wages, fuel, power-house supplies, lamp supplies, maintenance of buildings and plant, and estimated depreciation of buildings and plant. The total cost of production is figured in each case with and without estimated depreciation. Taxes are also given in the case of private plants, and figures including taxes and depreciation are given.

In relation to salaries and wages in private and municipal plants, a summary is given showing that so far as salaries are concerned the average cost in municipal plants is smaller in every group presented, while as regards wage cost the figures about balance. Of the figures on depreciation this is said:

As regards the amounts given as estimated depreciation, it is only necessary to say that they represent in every case the closest obtainable estimate of the loss in value during the year of each of the plants exclusive of land over and above the expenditures for repairs and renewals, the estimate being based on the best judgment of the official of the plant who furnished the answers to the inquiries submitted by the department. Much difficulty was encountered in the effort to secure this information, and the per cent. of depreciation of the total investment, exclusive of land, varies considerably. * * * * Some plants systematically charge off an amount for depreciation each year and with it create a fund for the rehabilitation of the plant at the end of a given time, but in many of the instances investigated no attention whatever was given to this feature beyond the expenditure of whatever was necessary in the way of repairs and renewals from year to year to keep the plant in working order.

Table VII. includes municipal plants only and shows the income from private users, the difference between that sum and the cost of production showing, it is said, the net cost or profit of the light to the taxpayers. However, this table should be considered in connection with Table VIII., which deals with certain elements of cost of production, which, in the case of municipal plants, Mr. Wright regards as "theoretical." These elements are: Estimated rental value of quarters occupied rent-free, estimated taxes, interest on total investment and other items, as free water, etc. Central-station men will regard these items as very real additions in the proper computation of cost and as not "theoretical" at all; but it is due to the commissioner to say that he gives the reasons for the existence of the table very fairly.

Profit and loss in private plants is shown in Table IX., ranging from an annual net loss of $59.804 to a profit of $106,880. No percentages of the losses are given. The greater number of the private plants are operated at a profit, the percentage on the investment reaching 60.45 in one instance. However, as the estimate of depreciation is not uniform, the comparative value of these figures is greatly impaired.

Prices of private plants and cost of production in municipal plants are dealt with in Tables X. and XI. Prices of arc lighting are reduced to the basis of the kilowatt-hour, but in the case of incandescent service, prices are entered under the various kinds of contracts. In analyzing these tables Commissioner Wright makes a number of interesting comparisons in summaries or short tables which cannot be given here for lack of space. He leaves out the "theoretical" elements of Table VIII., although again calling attention to them, and shows that, without them, the cost of production of municipal plants is generally less than the commercial prices of private plants. However, he is careful to point out that comparisons should be made with great care, especially between the smaller plants.

This report is one in which both the municipal-ownership advocate and the central-station man can find comfort; the "certain additional elements theoretically entering into cost in municipal plants" form the gist of the whole contention. From practical experience, central-station men insist that these "theoretical" elements should be figured in the cost. For the rest, the book is a very storehouse of statistical information and a most valuable addition to the already voluminous literature of the subject.

Report of the New York Railroad Commission on Brake Tests.

The report of the competitive tests of street-car brakes, held by the Board of Railroad Commissioners of the state of New York, has been issued and contains a large amount of valuable information for electric-railway men. The technical part of the report is made by Charles R. Barnes, electrical expert of the commission. It is very complete and gives a history of the work from its beginning. On March 29, 1899, circulars were sent out inviting all makers of street-car brakes to enter application for the tests, which were to take place on the tracks and cars of the Metropolitan Street Railway company of New York city. Twenty-six applications were filled out and 25 were accepted. The results of tests were recorded by an automatic attachment, so that no complaint could be made as to unfair treatment by any of the contestants. This device was built and carefully calibrated by Mr. Barnes and W. A. Pierson, electrical engineer of the Metropolitan Street Railway company. On each car 14 official speed records were taken, three at eight miles an hour, three at 12 miles an hour, three at 15 miles an hour, three at 16 miles an hour, and two at 16 miles an hour with sand on the track.

Air brakes were submitted to test by the following-named companies: Magann Air Brake company, Christensen Engineering company, Standard Air Brake company, John E. Reyburn.

Electric brakes were tested from the General Electric company, Columbia Electric Light and Brake company, Price, Darling & Co., Electric Selector and Signal company.

Hand-power brakes were submitted by Sterling Supply and Manufacturing company, M. H. Vogel, Sauvage Street Car Brake company.

Brakes classified as friction brakes were entered by the Peckham Motor Truck and Wheel company, J. G. Brill company.

Track and wheel brakes tested were from the Devlin Street Car Brake company, Philip Bach and Bernard Schlegel.

A system of brake levers entered by the Safety Appliance company was also tested.

Most of these appliances are familiar to readers of the Western Electrician. The air brakes were all of the "straight air" type, the differences being in methods of compression and details of apparatus. Among electric brakes the General Electric and Electric Selector were the only ones that met the requirements of the test. The latter is a magnetic brake, attached to the regular brake rigging and operated by the trolley current. Among hand-power brakes the Sterling is that used by the Metropolitan Street Railway company of New York city, and consists of gear wheels applied to the ordinary spindle, which multiply the force applied to the brake. The Vogel brake uses eccentric gear wheels on the ordinary brake spindle, so that the leverage is increased the nearer the brakes are set, while at first the slack is quickly taken up at a reduced leverage. The Sauvage brake system is constructed on the principle of a wedge working against a wheel. The Peckham brake was the brake known as the "Price momentum," which originated on the Chicago City railway. The Brill company also presented a friction or momentum brake.

The following table (No. 1), from the report, gives the averages of all the tests in feet and seconds required to stop the car at different speeds:

TABLE NO. I.

Showing average stops made with all brakes tested at 8, 12, 15 and 16 miles per hour, and at 16 miles per hour with sand.

Name of Brake.	8 Miles per Hour.		12 Miles per Hour.		15 Miles per Hour.		16 Miles per Hour.		16 Miles per Hour, With Sand.	
	Feet.	Seconds.	Feet.	Seconds.	Feet.	Seconds.	Feet.	Seconds.	Feet.	Seconds.
Peckbam Motor, Truck and Wheel Company	42.41	7.03	59.52	6.44	70.50	6.87	81.25	7.43	79.91	7.51
Devlin Street Car Brake company	54.08	7.38	65.80	8.86	92.36	9.58	93.63	9.51	84.91	7.98
Christeoseo Air Brake company	56.86	6.20	88.25	7.88	123.80	8.60	130.75	9.74	93.70	6 63
Staodard Air Brake company	54.19	5.79	76.08	5.48	86.83	7.32	104.47	8.48	93.04	6.58
General Electric company	45.00	5.34	111.02	8.95	114.86	8.32	134.72	8 62	116.66	6.58
Columbia Car Light and Brake company	65.80	6.16	99.94	5.46	139.50	7.30	155.08	7.70	203.66	7.55
Sauvage Street Car Brake company	46.11	4.00	78.58	5.67	129.16	8.50	138.27	8.60	143.25	7.31
J. G. Brill company	35.11	3.16	67.83	6.12	121.88	7.50	108.44	6.22	127.16	7.47
Safety Appliance company	40.27	3.15	68.36	4.54	135.11	5.92	140.69	6.07	†	†
Vogel Brake company	50.86	7.56	72.83	7.86	92.11	9.62	119.9.	10.56	106.58	9.35
G. P. Magann Air Brake company	42.72	6.75	56.80	7.33	81.80	9.12	95.66	9.17	89.16	8.70
*Price-Darliog company	45.27	7.23	.....	.....	.....	.....	.....	.....	.....	.....
Sterling Supply & Maoufactur ng company	41.50	6.99	57.00	7.91	75.27	9.59	81.41	9.35	90.66	9.45
Electric Selector and Signal company	38.75	7.71	50.00	7.95	60.02	8.28	72.33	9.35	73.08	8.92
†Bach & Schlegel	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
‡J. E. Reyburn	66.80	7.17	94.00	8.55	.....	.....	.....	.....	.....	.....

*No tests after 8 miles per hour. †No test. ‡No tests after 12 miles per hour.

The comparative average stops at all speeds are shown in table No. 2:

It should be stated that the cars used were double-truck, mounted on Brill maximum-traction trucks, with 30 and 20-inch wheels. The weight of the car in each case was 20,816 pounds, except the General Electric, which was 24,000.

Table No. 3 shows the result of a test made with a car equipped with the ordinary spindle hand brake, such as is in common use. This test was made on the same car (with same brake levers) that was tested with the Sterling brake, the results of which are given in table No. 4. This test was made for comparing the efficiency of the ordinary brake now generally used with one of the improved brakes. The comparison was made with the Sterling brake because the change from the ordinary handle to the Sterling brake could be made more conveniently than any other.

Tests were also made to ascertain the comparative amount of force exerted by a motorman with the Sterling brake and the common brake. An 18-inch hand-wheel was used in these tests. The average of all stops made by the Sterling brake, with this equipment, was 58.73 feet, and the average of the power applied 77.08 pounds. With the common brake, the average stop was made in 56.87 feet and the average of the power applied 92.5 pounds.

Three stops were made from 15 miles an hour with a car equipped with the Electric Selector and Signal company's electric brake on rails that had just been flooded. This test on the wet rail was made to compare it with the same equipment on a dry rail. The rails were wet by running a sprinkling cart over them three times. The result shows that the average stop on the wet rail was 71.73 feet and on the dry rail 60 feet.

In conclusion, the board expresses its thanks to the officers of the Metropolitan Street Railway company for furnishing cars, tracks and men free to the state for the tests, and other valuable aid and co-operation.

The report of the commission is a valuable addition to technical literature, and is the first thorough investigation of street-car braking ever made the results of which are public.

TABLE NO. II.

Showing comparative average stops at all speeds.

Name of Company.	Feet.
Electric Selector and Sigoal compaoy	58.83
Peckham Motor, Truck and Wheel company	66.71
Sterling Supply and Manufacturing company	69.16
G. P. Magann Air Brake compaoy	73.22
Devlin Street Car Brake company	78.15
Standard Air Brake company	82.92
Vogel Brake company	88.46
J. G. Brill company	92.08
Christeosen Air Brake company	96.67
General Electric Company	104.45
Sauvage Brake company	107.07
Columbia Car, Light and Brake company	132.80
*J. E. Reyburn	.....
*Price-Darling Brake	.....
*Safety Applianoe Brake	.....
*Bach & Schlegel	.....

*Not tested on all speeds.

TABLE NO. III.

Showing result of curves and other information in reference to test of car equipped with single chain spindle brake, same brake leverage as used on test of Sterling brake, car equipped with ordioary brake handle, 14-inch sweep, tested November 23, 1899.

Initial Speed, Miles per Hour.	Stop. Feet.	Stop. Inches.	Stop. Seconds.	Direction of Car.	Number of Passengers.	Average Stop. Feet.	Average Stop. Seconds.	Remarks.
8	44	6	6.45	Down	12	.....	.....	.....
8	49	.....	6.40	Down	12	.....	.....	Did not skid.
8	35	6	5.30	Down	12	43	6.05	Did not skid.
12	60	5	7.20	Down	12	.....	.....	Did not skid.
12	64	....	7.60	Down	12	.....	....	Did not skid.
12	61	5	6.50	Down	12	61.94	7.10	Did not skid.
15	77	.....	7.85	Down	12	....	.....	Did not skid.
15	76	5	7.70	Down	12	.....	.....	Did not skid.
15	73	4	6.88	Down	12	75.58	7.47	Did not skid.
16	86	6	8.90	Up	12	.....	.....	Did not skid.
16	86	8	8.45	Up	12	....	.....	Did not skid.
16	89	6	8.70	Up	12	87.55	8.68	Did not skid.

Sun shining, track dry.

TABLE NO. IV.

Showing result of curves and also number of pounds exerted by motorman on brake wheel in test of car equipped with Sterling brake with 18-inch brake wheel in place of brake handle, car tested November 24, 1899.

Initial Speed, Miles per Hour.	Stop. Feet.	Stop. Inches.	Stop. Seconds.	Direction of Car.	Number of Passengers.	Average Stop. Feet.	Average Stop. Seconds.	Number of Pounds Exerted on Brake Wheel.	Remarks.
8	32	10	5.15	Dowo	12	.....	....	80	Did not skid.
8	27	7	4.60	Dowo	12	.....	....	80	Did not skid.
8	28	2	4.83	Dowo	12	29.52	4.86	75	Did not skid.
12	49	..	6.75	Dowo	12	.....	....	85	Did not skid.
12	48	6	6.48	Dowo	12	.....	....	65	Did not skid.
12	46	6	6.25	Down	12	48	6.49	70	Did not skid.
15	87	2	9.45	Dowa	12	.....	....	75	Did aot skid.
15	81	..	8.70	Up	12	.....	...	80	Did aot skid.
15	80	..	8.80	Up	12	82.72	8.98	80	Skid rear wheel, 6 feet.
16	75	9	8.40	Up	12	.....	..	80	Did not skid.
16	75	..	7.87	Up	12	.....	..	75	Did not skid.
16	75	6	7.95	Up	12	75.41	8.07	80	Skid rear wheel, 6 feet.

Clear, track dry.

Proposed New Telegraph Company for Board of Trade Quotations.

There is talk of a new telegraph company to be formed by grain men interested in the Chicago Board of Trade and other speculative centers to furnish telegraphic quotations in place of the Western Union and Postal companies, which withdrew their quotation service from the Chicago Board of Trade August 1st, and meetings of grain men from various parts of the country last week and this week pledged support to the new scheme. The present telegraph companies withdrew their service because the Board of Trade demanded that they cease furnishing quotations to bucket shops, whereas the telegraph companies brought up the fact that, under the law, the telegraph companies are common carriers and have no legal right to refuse to furnish quotations to anyone who will pay for them. It may be a question whether the proposed new company would not come also under the court's definition of a common carrier, though probably the organization could be effected in such a way that it would not.

Charles Counselman, of the Chicago Board of Trade, one of the committee to consider means for suppressing bucket shops and securing telegraphic service between leading centers, is reported as saying:

"We had a most representative gathering, which alone is sufficient guarantee that we are in earnest in our determination to get rid of bucket-shop trading in every form and shape. The telegraph companies, and I believe they are perfectly sincere, state that they are compelled by law to furnish quotations to the bucket shops over the country. This we will not tolerate. We therefore propose forming a telegraph company of our own, building our own lines and doing everything on a cash basis. It should be a paying enterprise aside from the patronage of the various exchanges which we shall supply. It will take a year to carry out our plans, the details of which have not yet been considered. In the meantime, after August 1st, we shall give out five-minute quotations over the wires of the present telegraph companies. This will effectually smash bucket-shop trading hereabouts, as prices are liable to jump so much in the five minutes that no bucket shop would have any success."

Trouble Over Kenosha Street-railway Franchise.

A franchise known as the Haynes-Clausen street-railway franchise was recently passed by the City Council of Kenosha, Wis., over the mayor's veto. This franchise, which granted permission to build an electric street railway through Kenosha, is now owned by B. J. Arnold of Chicago, who is at the head of a company which seeks to build a line from Kenosha to Waukegan, to connect with the Chicago and Milwaukee electric road. Mr. Arnold offered a $50,000 bond, signed by a citizen of Kenosha, for the construction of the Kenosha part of the road, but Mayor Gorman has thus far refused to approve the bond, claiming the ordinance calls for "a surety or guarantee-company bond." The citizens, in general, are said to be in sympathy with Mr. Arnold, and the business men's association has adopted resolutions indorsing the franchise. An injunction suit has been filed by one of the residents, asking that the company be restrained from building the road by her property, and, as Mr. Arnold may try to compel the mayor through the courts to accept his bond, it is probable that a long legal war is ahead and the construction of the road will necessarily be delayed.

Water to Be Used as Fuel.

Next in wonder to making water run up hill, says the Canadian correspondent of the Western Electrician, is that of the invention of a gentleman in Montreal, A. G. Ingalls, a graduate of McGill University, in that city. His invention is a process by which water may be used so as to effect an immense saving in the consumption of coal. In fact, it may be said that water, practically, is the fuel and coal is merely an auxiliary. The method is such that a thin spray of water is spread over a coal flame in such a way, and with such auxiliaries, that the heat of the flame is wonderfully augmented. The full details of the secret are not yet made public by the inventor. The discovery can be applied to gas and other flames. Mr. Ingalls has received letters from prominent scientists proving the value of his invention.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Telephone Development in West Virginia.

Perhaps the greatest credit for the first development of Independent telephone lines in West Virginia is due to John Beeghley (now deceased) of Lightburn, W. Va.; John Koblegard and C. L. Hickman of Clarksburg, W. Va., and E. F. Hartly of Fairmont, W. Va., who some years ago built local disconnected lines and began to educate the people to the use of the telephone; while to J. H. Grogg of West Union, W. Va., credit is due for the use of superior instruments, high-grade connection, prompt and efficient service and rapid extension of lines. The telephone people of West Virginia owe much to the gentlemen named and also to the Clarksburg people, who were fought in the courts for some time by the Bell Telephone company. After some years' delay they again tried to build an exchange in the town, and this time were successful, the Bell people contenting themselves with dire threats.

Other towns had been waiting the result of this fight, and took courage at its successful termination. Work was started in various places and exchanges and lines were soon in process of construction. Here the real difficulty of the pioneers commenced. They lacked in experienced workmen and managers. Much of their work was a matter of experiment. They knew not of whom to buy the best material nor the kind of material to buy. The one thing was to get a line up, and it was of iron wire, hanging slack as a clothesline, on any kind of pole, or very frequently on trees, bushes or fence posts by the side of the road. It followed all the windings of the crooked mountain roads, and no thought was had of clearing its path of dangerous timber. Such a line would ring a bell, and a fragmentary conversation could, at first, be carried on. The farmer and his whole family hailed its advent with joy. But such lines soon got out of order. Limbs grounded the wires. Falling trees broke the line. Small poles set perhaps a few inches in the ground regardless of curves soon lopped over, and constant repairs were necessary. Each company at this time gave only a local service and little territory was covered. The opposition of the Bell Telephone company, and the general belief that it owned all the principal patents used in telephoning, kept capitalists from investing in the local companies. During the business depressions of 1893-1897 J. H. Grogg became interested in the western extension of the United Telephone system under John Beeghley. He introduced a better grade of instruments and material and insisted upon better construction. These improvements proved so successful and remunerative that the western division was in 1898 organized into the West Virginia Western Telephone company, with headquarters first at West Union, afterward at Parkersburg, W. Va., the present location.

Early in 1896 there was much communication between the various local companies relative to a connected service. Some meetings were called and agreements prepared and signed by the larger companies. The first important meeting was held at Fairmont, W. Va., about July 6th, 1896, and arrangements made for a full meeting at Clarksburg, W. Va., August 15, 1896. At the Clarksburg meeting the Central West Virginia Telephone association was formed and an organization perfected. An agreement was entered into by which each company was entitled to the use of the lines of the others upon certain conditions. The following-named persons were present at this meeting and were active in securing the formation of this association: John Koblegard and C. L. Hickman of Clarksburg, J. H. Grogg of West Union, E. T. Hartly of Fairmont, W. T. Bailey of Grafton, and John Beeghley of Lightburn. The present officers of this association are: President, John Koblegard; secretary, J. I. Alexander; treasurer, C. L. Hickman; executive committee, J. H. Grogg, C. L. Hickman, B. F. Bailey, J. W. Woodford and E. F. Hartley. This association now includes all the telephone companies in Central West Virginia. So many companies have come in and the conditions have so much changed that a reorganization is now demanded. J. H. Grogg, C. L. Hickman and J. W. Woodford have been appointed as a committee to draft reorganization papers, and it is expected that by proper effort the whole state will soon be included.

After the association was organized the telephone business grew very rapidly. All the companies built new and better lines and exchanges and gave much more satisfactory service. The telephone had come to stay. But the greatest growth was in the western portion of the state, where the West Virginia Western Telephone company held sway and fought the Bell company for supremacy. It pushed its lines through the oil and timber regions of Doddridge, Wetzel, Tyler, Gilmer, Ritchie and Wood counties, and after much difficulty secured a franchise for an exchange in the city of Parkersburg, as well as building exchanges in the towns of the western part of the state. In Parkersburg the company put in one of the finest exchanges in the country, a central-energy multiple switchboard, manufactured by the Stromberg-Carlson Telephone Manufacturing company of Chicago, with an underground and overhead cable system, and copper-metallic circuit to all telephones. All this work was done with J. H. Grogg as general manager, assisted by the able and efficient officers of the company. At first the authorized capital of the company was $75,000, but it was afterward increased to $1,000,000, only sufficient stock being sold to pay for new lines and exchanges. Mr. Grogg recently resigned his position as general manager, but is still retained as one of the directors of the company. The present officers are: President, H. C. Henderson; vice-president, C. E. Haddox; secretary, J. H. Lininger, and treasurer and general manager, R. H. Rutherford.

"The industrial development of West Virginia," said a prominent West Virginia telephone man recently, "is in its infancy. Her forests of valuable timber, her vast coal areas, her immense lakes of oil, are bringing capital into the state. The drill, the pick and the saw bring large returns to their owners. Many railroads are building up the valleys and seeking the deposits of black diamonds in her hills. Western roads are seeking connection across her borders with the eastern seaboard. With all these mighty enterprises it is apparent that the telephone business is yet in its infancy in West Virginia, and that handsome returns await the capitalist who will make discreet investments in this fruitful field."

On the need of long-distance telephone service in West Virginia, Mr. Grogg writes as follows:

"Long-distant Independent telephone lines and service are more in demand in West Virginia throughout the state and with other states than any

J. H. GROGG.

other improvement that can at present be added to the enterprise. There are a number of Independent telephone companies in this state, and they are truly independent indeed, as quite a number of them have no connection with the other companies in the state, or even other points out of the state. Therefore, it is no wonder that their message and rental service is in less demand, their profits less, and more difficult to meet competition; it is even a wonder that they have the success that they really do have, when you take into consideration the connections and present class of service. If all the companies in the state would sign up the present agreement being prepared, and join the association of this state after the reorganization that is now on foot is completed, and then would all make a special effort to secure first-class copper-metallic, long-distance toll lines between all main and important points, the public would see, and also capitalists would realize that the Independent telephone business of this state actually meant business, the public would patronize them more freely and capitalists would invest more readily. There is abundance of money in this state seeking investment, and when people see that the Independent movement is properly organized and on a permanent basis, and that it is properly and profitably conducted, they will be only too glad to invest in the enterprise.

"That the Independent telephone business, when properly and successfully conducted, is a profitable and paying investment, cannot be doubted by anyone who carefully investigates the entire situation. The writer for over five years has had experience in constructing and operating telephone lines and exchanges in this state; has been actively connected with the state association for more than four years; has visited a number of both Independent and Bell exchanges in this and other states, as well as the manufacturers, and has become fully convinced of the above-mentioned facts. After attending the annual national telephone convention, held at Cleveland, Ohio, in June, and carefully investigating the plans and purposes of the national association, the writer is fully satisfied that it is the duty of all Independent telephone companies in the United States to join the association, and I especially request that each Independent telephone company in this state at once properly investigate the state and national associations to its own satisfaction, and then without delay become a member of both organizations. This is for the benefit of each company and of the state and national associations. I am devoting my entire time and attention to the Independent telephone movement, and I am only too glad to assist in any way I can to effect and bring these matters around at the earliest possible date."

National Association Takes Charge of Bryan (Ohio) Suit.

Mention was made in last week's issue of the Western Electrician of the suit that has been brought by the Central Union Telephone company against the Bryan (Ohio) Telephone company, asking $10,000 damages alleged to have resulted to the plaintiff by reason of opposition of the Bryan company. This suit was brought to the attention of Judge James M. Thomas, president of the National Independent Telephone association, who immediately offered Will W. Morrison, president of the Bryan company, in behalf of the association, any assistance that might be desired in carrying on the litigation.

The offer of assistance of the national association has been accepted by the Bryan company, and the litigation will now be carried on by the association. Mr. Morrison, in accepting the offer, said:

"We feel that we deserve the support of the Independent companies, as we have done nothing more than every company is doing in its fight against the Bell monopoly, and should that company be able to recover damages, it would simply mean that we should be prevented from soliciting subscribers from our competitors. This action appears to be a new method on the part of the Bell company of harrassing and embarrassing the Independent companies."

In the bill of complaint brought against the Bryan Telephone company by the Central Union Telephone company in the United States Circuit Court for the Northern District of Ohio, Western Division, the plaintiff states that it has established and maintained, and is still maintaining at great expense, an exchange for telephone service within the village of Bryan, and then continues:

Your orator says that at sundry times during the month of June, 1900, and before and since, said defendant, the Bryan Telephone company, through its said officers and agents, and through other of its employes, called upon a large number of plaintiff's subscribers in the village of Bryan and, by persuasion, misrepresentation and threats and intimidation, induced a large number of said subscribers to sign a printed form of notice to plaintiff to discontinue its telephone service to said subscribers, and that on the second day of July, 1900, and before and since that date, said defendants, through their employes, did enter into the dwellings, offices and places of business of many of said subscribers, and did forcibly, wrongfully and unlawfully interfere with the property of plaintiff, to-wit, its telephones, wire, and other fixtures connecting said telephones with plaintiff's exchange in said village, and said defendants, through their employes, did disconnect said telephones, break and cut said wires, and remove the same from their proper position and fastenings, thereby injuring and destroying said property belonging to plaintiff, and cutting off plaintiff's communication with its said subscribers so that plaintiff was, and still is, unable to furnish telephone service between said subscribers and all other subscribers connected with plaintiff's said exchanges, both within said village of Bryan and plaintiff's numerous other exchanges located and operated in the various cities, towns and villages of said states of Ohio, Indiana and Illinois, and also with other parts of its connecting lines extending over and through the territory hereinbefore described.

Your orator says that the threats and intimidations hereinbefore referred to consisted in defendants threatening many of said subscribers that unless said subscribers should discontinue the service of plaintiff and use that only of defendant, the Bryan Telephone company, said defendants would use their influence to injure and ruin the business of said subscribers; and that said subscribers, fearing and believing that said defendants would do as they had threatened to do, did discontinue the service of this plaintiff to plaintiff's great damage.

Your orator further says that said defendants have induced many of plaintiff's subscribers to form combinations and agreements against the use of plaintiff's said service, to the great annoyance and interference with plaintiff's business, and to plaintiff's great damage, and that said defendants have also wrongfully and unlawfully threatened to do injury to the private business of many of said subscribers, unless said subscribers should discontinue the service of this plaintiff, and by such wrongful and unlawful threats said defendants have induced and caused a great many of plaintiff's said subscribers to discontinue said service, thereby greatly impairing the service furnished by plaintiff to its numerous other subscribers and to and with the general public.

The petition ends by asking that the Court grant

an injunction restraining the defendants "from removing plaintiff's telephones, wires and other fixtures, and from procuring and inducing plaintiff's subscribers to enter into combinations against the use of plaintiff's telephone service." In a similar bill brought in civil action, damages are asked in the sum of $10,000 for "great injury" alleged to have been done to the plaintiff's property, business and service.

Notes from Ohio.

A meeting of the grocers of Akron, Ohio, was held a few days ago, and the question of the adoption of the People's Telephone company's service exclusively was brought up. The matter was discussed from every point of view, and the resolution drawn up for this purpose was also closely studied, but when it came to a vote it was defeated almost unanimously. The grocers of that city will therefore go on as they have heretofore, and each man will use the service he thinks best suited to his business, or will put in both telephones.

Frank McConnell of Ashtabula has been made manager of the Central Union Telephone company's exchange at Youngstown, and the present manager, William W. Johnson, will be given a better position. The change takes place on August 1st.

The Independent plant at Covington, Ohio, is now in full operation, with 100 subscribers. The exchange is arranged for many more, however, and it is expected that the list will grow. Polo and Bloomer, neighboring towns, have been connected up with the exchange.

The Citizens' Telephone company has been granted a franchise to construct and operate an exchange in Circleville. The contest in that place has been in progress for several years, but until now the Central Union company has been successful in holding the field to itself. The new company will begin the construction of the plant at once.

The little town of Centerville, near Dayton, Ohio, is seeking plans for a telephone exchange and connection with Dayton and other towns. It is stated that an electric road will soon be under way from Dayton to Lebanon and Centerville, and that the promoters have agreed to allow the telephone people to place the wires on their poles. Squire Brown of Centerville seems to be at the head of the telephone project.

At a meeting of the Board of Trade at Miamisburg, Ohio, held a few evenings ago, Chairman D. H. Young of the committee appointed last winter to look into the advisability of having an Independent telephone system for the town, reported that he had received favorable replies from 16 nearby towns, and that the prospect for the proposed plant is exceedingly bright. Many business men of the town were present and all favored having the new system.

The Central Union Telephone company has issued a new book to its subscribers at Akron, which also contains a list of the persons using the service at Barberton and Cuyahoga Falls. It is stated that the Akron list is much larger than the one that the old book contained.

Owing to ill health, Manager Frank P. Ross of the Central Union Telephone company's Columbus branch has sent in his resignation, which took effect on August 1st. Mr. Ross has been with the company 15 years, and has greatly assisted in building up the company's business. Manager W. W. Johnson, of the Youngstown branch, has been chosen to take Mr. Ross' place at Columbus.

In conversation with some of the newspaper boys at Columbus, Superintendent Lloyd reiterated his statement made a few days ago that the Central Union would make no reduction in rates in competition with the Citizens'. He said that his company could not do it, and pay expenses. He said that it meant the survival of the fittest in Columbus, and that the company that gave the best service for the least money would ultimately be the only one that would do business in the city.

The council of Glouster, Ohio, has drafted an ordinance giving a franchise to the Union Telephone company, an organization made up altogether of local men. The company proposes to put in an exchange there, at a rental of $1 a month to each subscriber. The council will, without doubt, pass the ordinance within a few weeks, when the company will go to work.

Job Ridenour of Greenville has accepted a position with the Central Union Telephone company as inspector.

State Auditor Guilbert has sent out instructions to the county auditors of the state in regard to the taxation of the Bell Telephone company's instruments. The auditors are instructed to ascertain the number of instruments in their respective counties and value them at $10 each, in accordance with the opinion of the attorney-general.

The Citizens' Telephone company at Delaware, Ohio, has begun to install a farmers' service. Several instruments have been put in farmers' homes and they are allowed the same privileges as the subscribers in the town. The line to Berkshire has also been connected up.

The Bell Telephone company at Salem has about completed the new system. New instruments have been put in and the cables have been laid underground. The work of connecting the line up is now in progress.

The Home Telephone company of Uhrichsville has opened its office for business. Within a few days all the instruments will be connected with the central exchange. The company has a capacity for 400 instruments, and can easily be arranged for more. The adjoining town of Dennison has 113 instruments of the new company in use. O. M. C.

Telephone News from the Northwest.

The Fairmont (Minn.) Telephone company is building a toll line between Sherburn and St. James, Minn.

The Whitewater Wis., telephone exchange is to be rebuilt.

The Northwestern Telephone Exchange company has opened an exchange at Stockton, Minn.

The Zenith City Telephone company of Duluth, Minn., plans to complete arrangements in a month or so for toll lines connecting Duluth with the mining and lumbering towns on the range.

The telephone exchange at Blue Earth City, Minn., has put in a power generator.

The Norman County Telephone company has been incorporated at Ada, Minn., with $5,000 capital stock.

A contract has been awarded for the construction of a telephone line from Shelly, Minn., to Halstad, Perley, Hendrum and Ada.

The Wisconsin Telephone company has completed the work of rebuilding its exchange at Ashland, Wis.

J. W. Kingsley has completed arrangements to establish a local exchange at Mazeppa, Minn.

M. W. Clay of Hutchinson, Minn., is building a toll line to Heatwole, Minn.

The Fairmont Telephone company expects to have its exchange, being installed at Madelia, Minn., in operation early in August.

The new telephone company at Bemidji, Minn., expects to have its exchange completed by August 20th, and in operation.

The Wisconsin Telephone company expects to have work started at Oshkosh, Wis., on the conduit system before September 1st.

A new telephone line has been built into Glidden, Iowa, by farmers who were dissatisfied with the old connection.

The Creston (Iowa) Mutual Telephone company expects to have its new exchange in operation by October 1st.

The Bell Telephone company has completed a line between Winnipeg, Man., and Portage la Prairie.

E. A. Clark, manager of the Sioux City, Iowa, office of the Iowa Telephone company, is the inventor of an automatic switchboard, which is expected to do away with operators. The Clark Automatic Switchboard company of Providence, R. I., has been incorporated, with $1,500,000 capital, to manufacture the device. The board is declared to be one of the most important improvements ever discovered in connection with the telephone.

F. B. Rowe, the promoter of the Sioux City and Black Hills line, now contemplates a local system for Sioux City, Iowa. He has asked the council for permission to connect with all the wholesale houses now, and has secured petitions from the wholesalers indorsing his request. Ultimately he will ask the public to vote on a franchise.

The Wisconsin Telephone company has its building at Madison, Wis., for the central office nearly completed.

The executive council of Iowa finds that many of the telephone companies of the state, in reporting their mileage, have given the toll lines only, and omitted the city exchanges.

The exchange at Exira, Iowa, has been completed and put in operation.

The People's Telephone company of Superior, Wis., had 7,120 calls July 19th.

The Rocky Mountain Telephone company has completed a new exchange, with a central-energy system, at Butte, Mont.

A local telephone exchange is projected for De Smet, S. D.

There are over 500 telephones in use in Page County, Iowa.

The Sunset Telephone company of Seattle, Wash., has new switchboards, which are about to be installed.

The Wisconsin Telephone company is installing an exchange for Mondovi, Wis.

The Mutual Telephone company of Des Moines, Iowa, promises its patrons better service henceforth. Repairs and improvements are to be made at once, which will remedy the troubles which have been complained of.

The Hardin County Telephone company is installing an exchange at Eldora, Iowa.

It is reported that the Little Wolf River Telephone company of Fond du Lac, Wis., will try to reach Chippewa Falls, Wis., with its toll lines this summer.

The Pocahontas Telephone company of Pocahontas, Iowa, has been incorporated, with $10,000 capital stock.

The strike of the telephone operators in Seattle, Wash., and the investigation of the Chamber of Commerce and business men has resulted in a recommendation from the latter bodies to the council to revoke the franchise of the Inland Telephone company. The committees reported that the company had reduced wages of its operatives since 1893, in the face of improving times and better conditions, and that its service has been poor and unsatisfactory. The council has been enjoined by the company from revoking the franchise, but it has directed the city clerk to enter into correspondence with telephone companies through the country, with a view to securing another company in the field.

The Wisconsin River Telephone company has been incorporated at Stevens Point, Wis., to establish a local exchange there. It will connect with the toll lines of the Wolf River Telephone company.

The Standard Telephone company, which is installing an exchange in Dubuque, Iowa, expects to have the exchange, with 2,000 connections, talking by October. R.

Mississippi Valley Company's Extensions.

The Mississippi Valley Telephone company of Minneapolis and St. Paul announces that stock has been subscribed for doubling its capital stock, making the amount $2,000,000. Aggressive work will be prosecuted from this time on. New sub-exchanges will be established in both cities. The switchboards are both arranged to connect with 6,000 subscribers and the company expects to have that many subscribers in each town by December 1st. There is about $40,000 worth of materials on hand, which will be used at once by a large construction force which will hurry work. A new exchange will be established in South St. Paul and one in Merriam Park.

Inefficient Service Alleged at Seattle.

A dispatch from Tacoma, Wash., dated July 29th, tells of the dissatisfaction that the local telephone company at Seattle is causing, as follows: "There is a telephone strike at Seattle, and nearly four-fifths of the telephone subscribers will order their telephones taken out on August 1st, and refuse to pay the July bills, on allegation of inefficient service or no service at all. The move is headed by the business men in the city, and will mean almost the entire abolition of a telephone service for an indefinite period. Merchants are determined to bring the telephone company to time. The telephones which are retained will be of little service."

Telegraph Too Slow.

A world of practical suggestion as to the facility with which commercial transactions of all kinds can be performed by telephone, as compared with the telegraph, is contained in the following press dispatch from New York last week: "Poolroom-keepers were the easy victims of a gang of sharpers last week, and it has cost them $100,000 for the experience. The game was revealed yesterday through the arrest in St. Louis of Jabez Botsford and Walter Farrell, the St. Louis agents of the gang. They used a long-distance telephone to beat the telegraph. By this means they were able to place bets after the race was over."

MANUFACTURERS AND DEALERS.

The Electric Appliance company, Chicago, claims that its new line of telephones actually reproduces the natural tone of the voice. It has just gotten out handsomely printed descriptive matter giving illustrations and details.

The Warner Electric company of Muncie, Ind., is pleased to find that its new telephone ringer is meeting with as great success abroad as it has at home, and that it is constantly receiving orders from foreign telephone companies. It is still able to fill orders promptly even with this increased business.

The Western Telephone Construction company of Chicago has lately closed contracts for complete multiple equipment in several large cities in the East, and it has also received and finished filling three large orders for telephones from the United States War Department, Washington, D. C. This apparatus is to be used in the Philippine Islands and in China. The business of this company is reported quite heavy, requiring its increased force to work overtime in order to get its apparatus out promptly.

The American Electric Telephone company says it experienced a record-breaking week in its express-switchboard business for the week ended July 28th. Shipments for the week reached nearly 3,000 drops. This is exclusive of switchboards for the American centralized-battery system and multiple switchboards; of centralized-battery switchboards there were over 1,000 drops sent out to a dozen different towns. Contracts have recently been closed for several new exchanges to be equipped with the centralized-battery switchboards and telephones, one of which will have a capacity of 1,500 lines.

The American Electric Fuse company, Chicago, has just completed and put on the market a new style of lightning arrester and distributing board. These boards are made at a very low price, with as many lines as are desired, with carbon lightning arresters, mounted on either slate or hardwood base. There is a unique way of handling the wires as they come to the distributing board, so that they occupy little space and are compactly and handily arranged for connection with the board. For better securing the distributing wires a lock-nut binding-post is furnished. A 50-line distributing board occupies a space of three feet two inches by 10 inches.

North Supervisory Telephone System.

One of the most interesting telephone systems that has been offered to the Independent telephone field has been recently brought out by the North Electric company of Cleveland, Ohio, and is known as the North supervisory system. It is of the centralized-battery type, utilizing local transmitter batteries at the telephone, and securing automatic signaling, both in the matter of calling up and ringing off. In this system the signal to the operator by the subscriber is secured by merely removing the receiver from the hook, thus throwing an automatic restoring signal on the switchboard. The operator, on inserting the plug in the answering jack, restores automatically the line signal, and has her operator's set cut on to the line, so that she is able to respond to the subscriber immediately on the insertion of the plug into the jack. On securing the number the operator inserts the corresponding plug of the pair into the jack of the line desired, throws the lever, calling the other subscriber. She is enabled, by virtue of the supervisory signals, to tell just when the other party answers, so that if the party who is called is slow in answering, she can give repeated calls without having to listen in on the line to find out whether the parties have commenced their conversation. The operator also knows by a glance at the supervisory signals just when either party has finished, and also whether either party wants a subsequent call, without having to wait for a complete disconnection of the previous call. It will thus be seen that the operator is relieved of all talking on the line, with the exception of securing the number.

Great speed is claimed for this switchboard, owing to the facilities offered, and the manufacturer guarantees that any ordinary system can be operated on a basis of 200 lines to the operator, and in the smaller exchanges even more than this number can be used in this way. The switchboard illustrated in Fig. 1 is one installed by the North Electric company at Lancaster, Ohio, and is said to have given remarkable service from the start.

It is claimed by the manufacturer that there has been no trouble whatever in the operation of this system, and that it is entirely satisfied with its workings. One of the important features claimed by the North company is that it has accomplished results hitherto requiring condensers, impedance coils, relays, etc., by the use of the simplest apparatus. The talking circuit of this system is practically the same as in old-style systems, so that the use of toll-line service in connection with it is not detrimental in its results. Another claim which is of importance in considering the maintenance expense of exchanges is that this system has by far less battery consumption than any other of the so-called central-energy systems.

The wall telephone used at the subscriber's station (exterior view of which show in Fig. 2) is of very neat design, while all the parts are easily accessible, and of high efficiency. The new long-lever, self-contained switch hook, the adjustable self-contained receiver and hollow-arm transmitter, make this instrument exceedingly simple, and, at the same time, efficient.

One of the most important features in connection with this central-battery system is the new combination toll-line switchboard, which will at the same time permit the perfect operation of both city and toll lines. The North company claims to have accomplished this result, as it installs a high-grade system of toll-line apparatus. The toll drops for through lines are arranged with triple jacks, so that it is possible to use both legs of the line at the same time without the one interfering with the other. The line signal (Fig. 3), as well as the supervisory used on this switchboard, is of the gravity-restoring type, displaying a prominent signal, and is claimed to be several times as sensitive as any other battery signal now on the market. The signal can be adjusted to work through various resistances, so that it can be adapted to a wide range of line conditions.

The line jack (Fig. 4) is built up in banks, and is made of german-silver springs of the highest quality, mounted in rubber and insulated with mica. The whole is mounted on an aluminum base, and is exceedingly light. The line springs have platinum contacts, the platinum being riveted firmly into the springs, so that danger from the contacts becoming loose is obviated. The manufacturer states that it is using absolutely pure platinum for this work. The multiple jack, which is similar to the line jack, is mounted on one-half-inch centers, 20 on a strip. It will be noticed in the view of the keyboards shown in Fig. 5, that the toll section is equipped with special sets of ringing and listening keys, so that the operator can ring either way on the line, throwing in or out the repeating coil, or cutting herself on to the local board, so that she can assist the other operators on the board during their rush.

A very high grade of power plant is furnished with this system, especially adapted to its needs. The power switchboard is made of white marble, upon which are mounted the necessary meters, switches, etc. The consumption of battery in this system is said to be so slight that, except in large exchanges, it is perfectly practical to use any of the ordinary closed circuit batteries.

The North Electric company says that it has orders for several of these systems, and that its institution is working night and day pushing this special work to the front. Full descriptive matter covering this system can be had by writing to the North Electric company, 61-73 Frankfort street, Cleveland, Ohio.

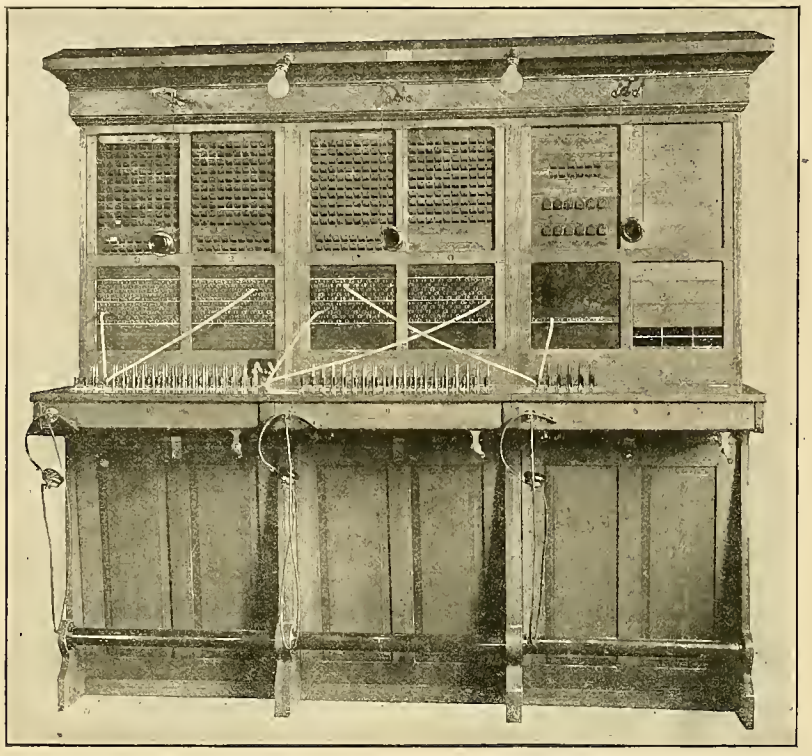


FIG. 1. NORTH SUPERVISORY TELEPHONE SYSTEM —SWITCHBOARD WITH 400 SIGNALS INSTALLED AND TOLL SECTION.

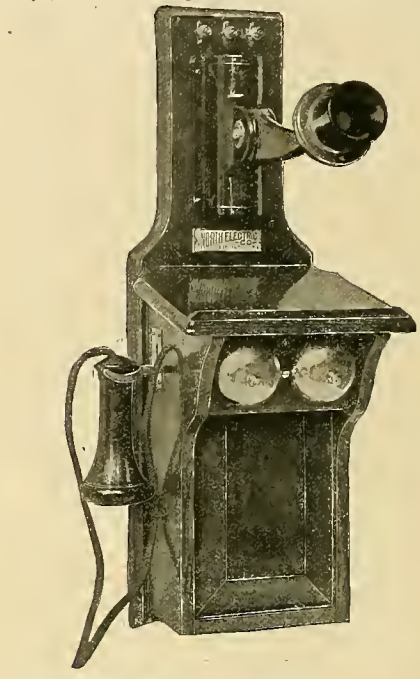


FIG. 2. NORTH SUPERVISORY TELEPHONE SYSTEM.—WALL TYPE OF INSTRUMENT.

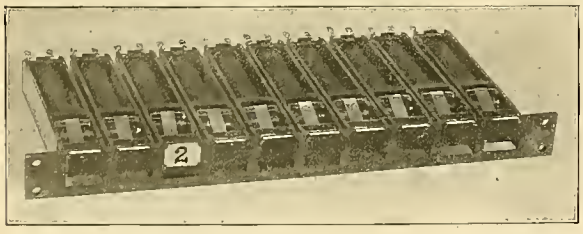


FIG. 3. NORTH SUPERVISORY TELEPHONE SYSTEM —AUTOMATIC SIGNAL.

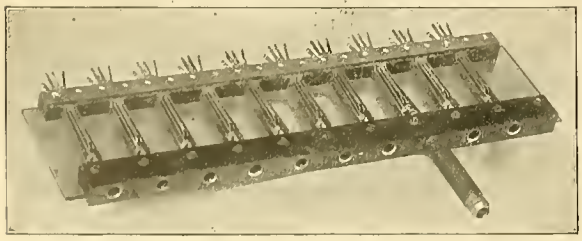


FIG. 4. NORTH SUPERVISORY TELEPHONE SYSTEM.—LINE JACK.

Incandescent Lamps for Railroad-switch Lights.

The use of incandescent electric lights to replace oil lamps on the switch targets in large railroad yards is increasing. The latest important move in this direction is that going on in the yards of the Boston Terminal company, where all the semaphore and dwarf-signal lamps are being replaced by incandescent lamps. Two lamps are being placed on each signal to insure against "outs" from lamp breakage, so that the reliability is even greater than with the tried and perfected oil lamp, and signals can be distinguished at a much greater distance during a fog.

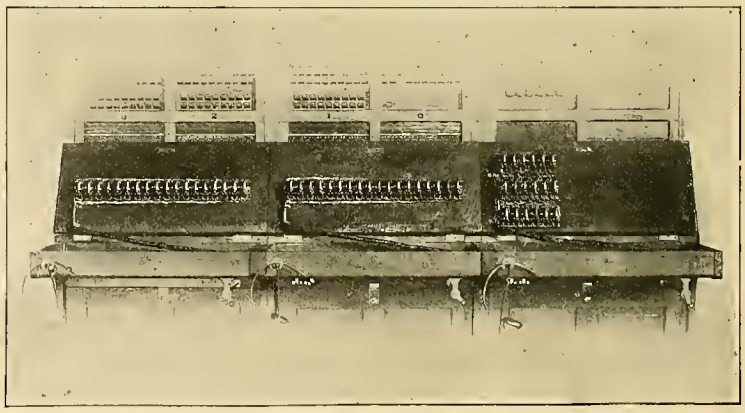
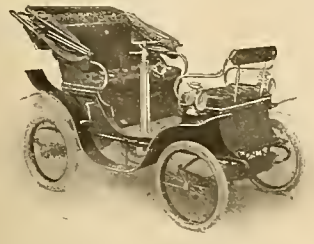


FIG. 5. NORTH SUPERVISORY TELEPHONE SYSTEM.—KEYBOARD ARRANGEMENT.

The De Dion-Bouton Motorette Company.

As has been known for some time, C. J. Field, well known in the electrical field, has been laying plans to go into the gasoline-automobile business. The new company, of which Mr. Field is vice-president and general manager, is the De Dion-Bouton Motorette company. This company has purchased the American rights to the De Dion and Bouton gasoline motors, which have been thoroughly tried and perfected by use in Europe. It is claimed over 20,000 of these motors are in use to-day. The



DE DION-BOUTON MOTORETTE

policy of this new American company is evidently a wise one, as by purchasing these rights it also purchases the experience of several years in France, which is worth many thousands of dollars to a new company, and enables it to go ahead at once with the business instead of waiting to develop all the numerous details of the vehicles. The company is a large one, with a very large manufacturing plant located at Church Lane and Thirty-seventh street, Brooklyn. The plan is not only to build vehicles, but to sell motors to vehicle makers and furnish such customers with as complete technical data as possible. This will mean that the experience of the largest and most successful manufacturers abroad will be back of the purchase of a demonstrated and approved motor. Mr. Field returned from Paris a short time ago, bringing with him everything necessary to the successful organization of the business in this country, including a large stock of sample motors and motorettes. The illustration shows one of the types.

B. & B. Commutator-truing Device.

To keep the commutators of electrical apparatus in good condition, it is necessary that they be trued up occasionally, and a device that will satisfactorily accomplish the work is consequently in demand. Such a device the Fort Wayne Electric Works, Fort Wayne, Ind., claim to manufacture in its B. & B. commutator-truing device. Fig. 2 shows the tool in position on a dynamo. The tool is very small and compact, yet it has the capacity of a large lathe, and is claimed to make it possible for one man to accomplish results hitherto found impossible. It does its work well, owing to the fact that it is mounted on the shaft bearings proper, insuring a perfectly true commutator with its periphery concentric with the shaft.

The turning is accomplished by adjusting the tool to the commutator face, then slowly revolving the device as a whole, the tool itself being fed automatically in a horizontal direction. The depth of the cut can be quickly adjusted by means of a knurled attachment. In cases where it is undesirable to remove large and cumbersome armatures from the dynamos, the turning can be accomplished by securing the device to the shaft bearings (Fig. 1) either by removing the bearing caps or slipping out the pedestals, housings or other bearing-supporting devices. The design of many machines is such that it is impossible to revolve the device as a whole, hence it was found necessary to furnish a clamp and handle which can be secured to the pulley and the armature revolved in its bearings, the truing device remaining in a fixed position. In this case the clamp which carries the bent steel rod is mounted on the end of the shaft, causing the detent to engage the star wheel as the shaft revolves, which makes the device self-feeding. The fact that the armature need not be removed, together with the short time required to rig up the truing tool, are said to be points that recommend the use of the device.

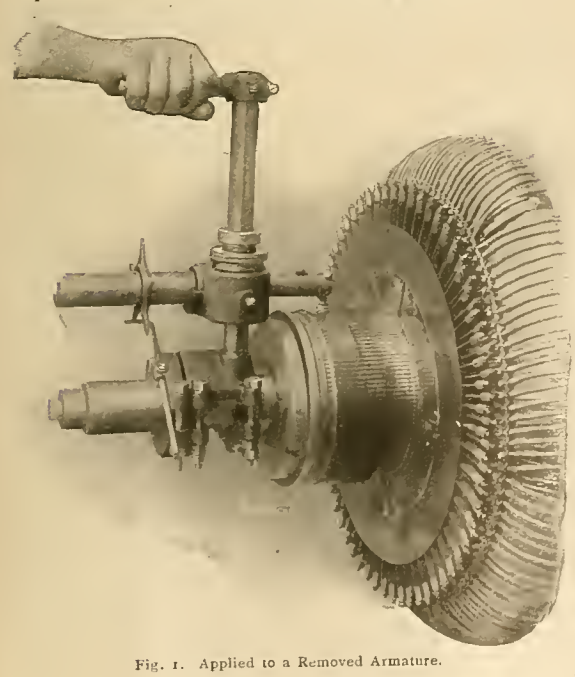


Fig. 1. Applied to a Removed Armature.

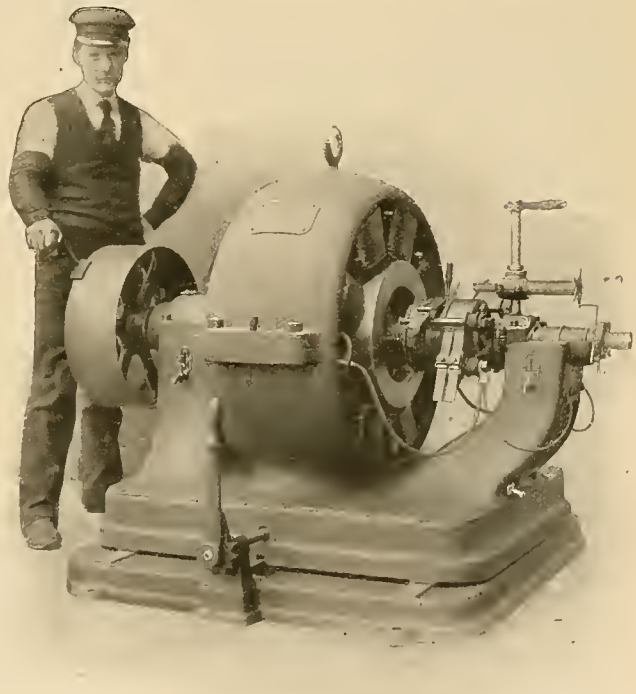


Fig. 2. In Position on a Dynamo.

B. & B. COMMUTATOR TRUING DEVICE.

Electricity in British Cities.

A few of the main thoroughfares of London, says Marshal Halstead, United States consul at Birmingham, England, will soon be electrically lighted, some poles having recently been put into position. Piccadilly had a few as long ago as the fall of 1896, and no doubt the success of that experiment is regarded as warranting extension on careful lines.

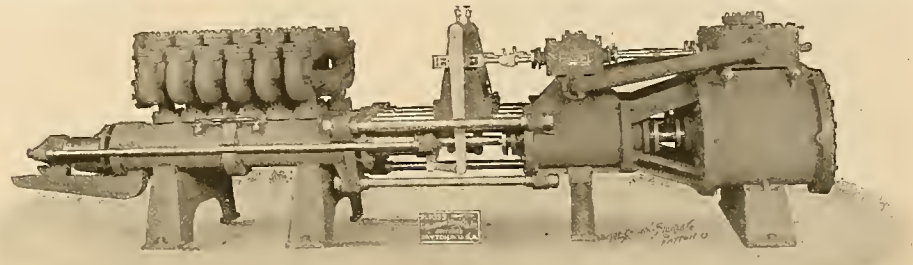
Birmingham is still a gas-lighted city, and there seems to be no street electric-lighting movement, though on January 1st last the corporation took under its municipal wing the small electric-lighting company. New mains are now being put in, and the question of electric street lighting must come up within a year or two, as must also the question of cost to consumers. Cork is one of the smallest towns with electric service and gets its electricity as cheaply as any city. The charge in Cork is 4½d. (nine cents) per unit for the electricity used in the first two hours every day and 1d. (two cents) during the succeeding hours. For motor purposes the charge is 4d. (eight cents) the first two hours and 1d. (two cents) thereafter. In Birmingham there is a uniform rate of 7d. (14 cents) per unit to the general run of consumers—that is, to the great number using 100 or less units per month. For any quantity in excess of 100 units, 4½d. (nine cents) is the charge. There is also a special provision of 4d. (eight cents) per unit up to 100 units per month for electrical energy used for motors or all-day loads, and any quantity in excess of 100 units is 2d. (four cents). A unit means here the burning of 17 ordinary incandescent lights one hour.

The Gas Department of the city of Birmingham also favors large consumers, and the result is a large use of gas engines in factories.

Stilwell-Bierce Compound Duplex Pressure Pump.

The accompanying illustration shows a compound duplex pressure pump capable of developing a maximum pressure of 700 pounds per square inch. The liquid end of the pump is of the end-packed trombone style. The cylinders are made of special metal and mounted thereupon are separate chambers for the location of the valves. The chambers are also constructed of special metal and designed with a view of facilitating quick access for the inspection of the valves. The valves are of the hydraulic pattern, made of steel, and guided from below. An extension piece is provided for supporting the water plunger, and an approved adjustment device is provided therefor.

The water end is mounted on heavy supporting columns. An engine of the transposed cylinder



STILWELL-BIERCE COMPOUND DUPLEX PRESSURE PUMP.

type is furnished, giving free access to all steam pistons, without dismantling the pump. The outside valve adjustment is a feature of this design. Full particulars regarding this pump may be obtained by addressing the manufacturer, the Stilwell-Bierce & Smith-Vaile company, 257 Lehman street, Dayton, Ohio.

Electricians for the Navy.

A recent order has raised the salary of electricians in the navy. Chief electricians now get $60 a month, electricians of the first class $50 and those of the second $40. A third class has been created which gets $30. Orders from the Navy Department regarding the duties of electricians read as follows: "Electricians will be detailed for vessels having electrical plants, and when on board ship shall be assigned to all duties pertaining to the care, preservation, and manipulation of the electric-lighting plant and its appurtenances, together with all other electrical appliances; they shall also perform such other duties as the commanding officer may direct."

Engineer Bean of Jackson, Mich., has finished the survey of the interurban road from Grand Rapids to Muskegon, via Coopersville, Nunica and Fruitport, with a branch to Spring Lake, Ferrysburg and Grand Haven.

General Electric Type H Oil Transformers.

The following extracts from a forthcoming publication of the General Electric company are of interest to central-station managers. The efficient, economical transformer of the present date is an evolution of the earlier types and the result of a great deal of study and experimental work on the part of manufacturers. Naturally those who have been longest in the business have had the best facilities for research, and the present product of such concerns is worthy of special consideration.

"Some four years ago the General Electric company introduced its type H transformer. At that time this transformer was a great innovation in transformer practice, and the company would have hesitated to make such a radical change if months of experience and tests had not proved conclusively that the changes marked an important step in the right direction. Until the introduction of the type H transformer, transformers of all kinds and sizes in this country were generally the 'shell' or 'ironclad' type, and the advantages of the 'core' type of transformer for self-cooling oil transformers of moderate sizes were not understood. On this account the superiority of the type H transformer over other existing types had to be proven by actual service before the claims, of which the designers were confident, could be really established.

"Among the more important features, on which the superiority of the type H transformer depends, are the following:

"The Core.—The core is built up of simple rectangular punchings, with interlocked joints. Each sheet is thoroughly insulated from the next, and the core is tightly held together, without the use of bolts. The joints are so interlocked as to reduce the magnetizing current to a minimum and prevent vibration humming.

"The Coils.—The secondary coils are wound directly on the core, the primary coils directly on top of the secondary. This construction gives the most compact form of winding, avoids all waste space and prevents vibration, which might wear the insulation.

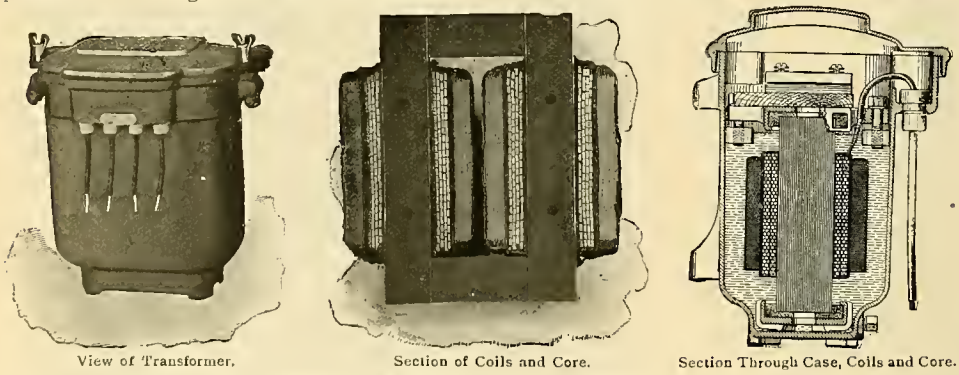
"Insulation Between Primary and Secondary.—The bounding surfaces between the primary and secondary are simple and cylindrical in outline, making it possible to provide the simplest and most effective form of insulating shield between the high and low-potential coils. In this respect the core type of transformer stands eminently in advance of previous forms.

"Relative Position of Coils and Iron.—The reversal of the relative position of coils and iron in this type of transformer, as compared with shell type, is very advantageous in the self-cooling transformer, as it insures the lowest possible temperature in the copper, as compared with the other parts of the transformer. The form of coils adopted is also such as to present a very large radiating surface to the oil.

"Temperature.—The type H transformers are the first commercial transformers in which the low temperatures consistent with reasonable life were guaranteed and obtained. Previous to this design it was not common to expect safe temperatures in transformers that were obtained in larger pieces of electrical apparatus, consequently the life of the average transformer was short and unsatisfactory.

"Case.—The form of case adopted was almost as radical a departure as the electrical design. In accordance with the General Electric company's past practice it was designed so that the transformer should be oil-immersed, and numerous improvements, compared with any previous form of case for oil transformers, were incorporated. The method of holding the transformer in the case is exceedingly simple and safe. Projecting pockets are provided at the top of the case, containing the porcelain bushings, through which are brought out the primary and secondary leads. The construction admits of locating the bushing in a vertical position and safely protects it against mechanical injury in transportation. The arrangement, while simple in itself, is a great improvement in this important detail."

Comparison.—Casual examination of transformers of different makes will not always reveal the differences. The General Electric company is desirous that the prospective purchasers of transformers should make exhaustive tests on the various makes, being satisfied that the results of such tests will show the marked superiority of the type H transformer. This company offers every facility to those desiring to make transformer tests, and will be pleased to furnish central-station managers the necessary data for conducting an intelligent and impartial test to determine the efficiencies of their transformers.

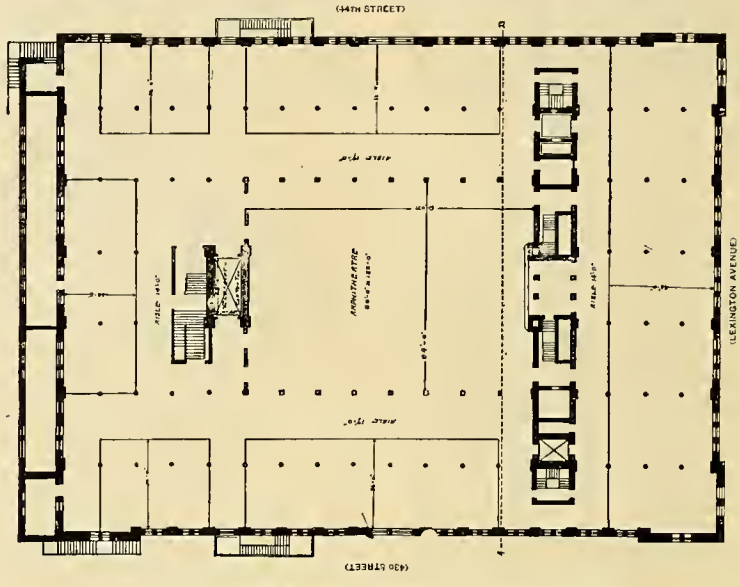


View of Transformer. Section of Coils and Core. Section Through Case, Coils and Core.

GENERAL ELECTRIC TYPE H OIL TRANSFORMERS.

New York Automobile Show.

The early applications for space indicate that manufacturers are taking considerable interest in the Automobile Show, to be held in the Grand Central Palace, New York city, from November 14th to 24th. More than ten thousand feet of space has been contracted for already, and this, with the space selected but not yet signed for, will make fully half the available space disposed of over three months before the exhibition.



NEW YORK AUTOMOBILE SHOW.—DIAGRAM OF EXHIBITION HALL.

In location, space and arrangement, the Palace has many good points, while the fact that the Automobile Show will be open during the horse-show week, is counted a distinct advantage. The latter has grown to be so important a feature that an average of 30,000 people come from out of town to attend each year. The Automobile Show will appeal strongly to precisely this following, so that these 30,000 out-of-town visitors are not likely to return to their homes without attending the automobile exhibition. The Horse Show, as heretofore, will be for one week only, the last six days of the Automobile Show, which will be open in all 10 days.

Marcus Nathan, the general manager of the Automobile Show, is doing much to stir up an interest that will extend far beyond the present users of automobiles, a fact that should, and no doubt will, mean much to exhibitors. The representative character of the exhibits, and their variety and completeness, are factors in creating a popular interest. With this in mind, the management made very low prices, abolished most of the usual extra charges and made all the conditions easy. The result is already apparent in the large advance sale of space to representative concerns.

The accompanying diagram shows the arrangement of the exhibition hall, which space, it is said, will be entirely filled with automobile exhibits. The second floor of the building will be used for automobiles and accessories.

The New Jersey and Philadelphia Street Railway company is reported to have purchased the upper Delaware bridge at Trenton for $200,000, with the intention of running cars over it, and ultimately reaching Philadelphia by way of the present road from Philadelphia to Bristol.

Interlocking Controller Handle Case.

As noted by the New York correspondent of the Western Electrician in last week's issue, Judge Nathaniel Shipman of the United States Circuit Court for the Southern District of New York, in the case of Thomson-Houston Electric company against the Lorain Steel company, on the Knight motor switch interlock patent, decided in favor of the Thomson-Houston company. The suit was brought by the Thomson-Houston company for the alleged infringement of patent No. 428,169, dated May 20, 1890, issued to Walter H. Knight (application filed March 13, 1886), for an improved electric-motor regulator. The patent claims relate to the interlocking controller handles generally in use to-day. Claim 1 of the patent reads: "The combination, with an electric motor, of a reversing device and regulator therefor, means for operating the same, and a stop for the reversing device, controlled by the regulator, whereby the reversing device can be operated only when the regulator is in a predetermined position."

The court, in substance, held that this broadly covered the interlocking controller and that mere modifications of details of construction did not evade infringement.

Three Electric-railway Accidents.

The last week seems to have been a marked one for electric-railway accidents.

July 29th, at Toledo, Ohio, three people were seriously burned and others injured by a flash due to a short-circuit on a belt-line car.

July 28th, at Worcester, Mass., a car on the Consolidated stopped at the foot of a steep incline at Richmond Heights. The motorman of the car following lost control of his car on the decline and it crashed into the car ahead, injuring 12 people, five of them seriously.

Worst of all was the accident at Dayton, Ohio, July 30th, when two cars of the Dayton and Xenia Traction company met in a head-end collision at a high rate of speed, injuring 12 people. An electric block-signal system is employed on this line, and the signals are said to have been tampered with. The cars met on a curve with such force that they stood upon end and then fell over.

New Eastern Automobile Club.

A dispatch from Mt. Vernon, N. Y., says: Automobiling has become such a popular fad in Westchester County that a number of wealthy men have decided to organize a club which will be composed of automobilists in New York, Westchester and Connecticut. A meeting to make preliminary arrangements was held at the residence of Howard Willetts, at Harrison, recently. The name of the club will not be decided upon until the next meeting, when officers will be elected and by-laws adopted. It was stated at Mr. Willetts' residence to-day that the new club will not conflict with the New York Automobile Club. One of its principal purposes will be to provide supply stations along the Albany post road, Boston post road, the new macadamized boulevards now being constructed through The Bronx, the Hudson River valleys and other cross-country roads leading to the Ardsley Casino, Westchester County Club and Knollwood Country Club. At these stations gasoline, naphtha and other material will be kept for locomobiles and arrangements will also be made for charging electric machines. Among those who are backing the club are: Paul G. Thebaud, Howard Willetts, Trenor L. Park, Oliver Harriman, Jr., Eugene Reynal, Nathaniel Reynal, William K. Vanderbilt, Jr., William E. Iselin, William Rockefeller, Jr., and many other prominent New Yorkers.

CORRESPONDENCE.

London Letter.

London, July 17.—On the Thames Embankment, close to the Charing Cross railway bridge, a big building is being erected, which, when completed, will be the generating station for the electric light with which the London County Council purposes illuminating Westminster and Waterloo bridges and the embankment. This will be the first attempt of the council to provide electricity, but Londoners remember that the embankment has previously boasted electric light. Huge arc lamps were then used, and when gas supplanted them the crystal globes were sold at $40 each to a firm of clothiers, this being about a third of their original cost. The Savoy was the first theater to use electricity, and the writer, who was at the private view in 1881, well remembers the excitement that prevailed when Mr. D'Oyly Carte broke one of the air-tight lamps, and thus, by extinguishing the light, proved the safety of the "new invention." That the Embankment should have had to wait so long for a second installment is a matter of regret, for it is a fine thoroughfare, and when the electric trams run in the roadway, as they will doubtless at no distant date, in spite of narrow and selfish opposition—it will still more be appreciated, both by Londoners and visitors.

It is officially stated that the new electric railway will be opened for public traffic a week from next Monday. The delay has been caused by reason of the unforeseen duration of the decorators' work on the superstructure of the stations, most of which, however, are now rapidly approaching completion.

Some facts concerning the telegraph work at the Epsom race meeting this year are published in St. Martin's le Grand, the organ of the Postoffice officials. They show what an extraordinary amount of interest is taken in horse-racing in this country. The total number of messages disposed of was 10,475, of which about 3,000 were dealt with at the Postoffice, and 7,500 at the Grand Stand. Over 2,000 messages were dealt with in a single hour, viz., between 3 and 4 p. m., at the Grand Stand, and these no doubt would include the Derby results, which would appear to have been numerous in proportion to the popularity of the royal owner of the winning horse. Between 1 and 2 p. m. 1,800 messages were handled, and between noon and 1 p. m. nearly 1,500, while upward of 1,000 were disposed of between 11 a. m. and noon and between 2 and 3 p. m. These figures refer to operations carried on in wooden sheds, and by a mere handful of operators, comparatively speaking.

Electric street cars are to be introduced toward the end of the month at Southend-on-Sea, the nearest seaside resort for jaded Londoners. About 7½ miles of rails have been laid.

American millionaires are thick in London just now. Mr. John D. Rockefeller, Colonel John W. Gates, Mr. P. A. B. Widener, Mr. D. H. Lauderback, Mr. O. C. Barber and Mr. Edwin Gould are among the most prominent.

In the Chancery Court last week Justice Cozens-Hardy decided a petition presented by a shareholder, asking for the compulsory winding up of the Guttapercha corporation, limited. The company was formed in October, 1897, with a capital of $1,000,000, to acquire certain patents for manufacturing guttapercha, and a stock of that commodity. The purchase price was $750,000, and the vendor received $85,000 in cash and a large number of shares. The total proceeds of sale during the two years' existence of the company were $70 only, and the stock on hand is now valued at $4,000. Justice Cozens-Hardy said the affairs of the company had been mismanaged to an extent almost beyond belief. The vendor had not fulfilled the obligations imposed on him by agreement, as to getting persons to subscribe for 50,000 preference shares, but, notwithstanding that, the directors at a very early stage paid the vendor a large sum of money. The matter required searching and public investigation.

The House of Commons committee, which, for some six weeks, has, under the chairmanship of Sir J. Kitson, been considering the merits of a number of large electric power-supply schemes, has brought its labors to a close. Four of the most important private bills of the session have gone through its hands. They comprise the Lancashire electric-power bill, which authorizes the formation of a company with a capital of $20,000,000, and the construction of four generating stations for supplying power throughout the whole of Lancashire south of the Ribble; the South Wales electrical power-distribution bill, capital, $5,000,000; three generating stations and an area including the whole of Glamorganshire and part of Monmouthshire; the county of Durham bill, capital, $1,800,000, and the Tyneside bill, capital, $3,333,330. The preambles of the first three measures were passed, but various important alterations were made in the provisions, partly with the object of meeting the objections of local authorities and partly with a view of making the clauses of the different bills as nearly uniform as practicable. The committee decided that electricity should only be supplied in bulk to organized distributors for the purpose of providing power and for the lighting, by any person supplied with power, of the premises on which the power was utilized. They also made it a condition of the passage of any of the bills that electricity should not be supplied in the area of supply of any authorized distributors, except with their consent, but such consent was not to be unreasonably withheld. Another important decision of the committee fixed the standard dividend at eight per cent., but provided for the application of the sliding-scale principle, or five per cent. discount from the amount charged to consumers, being arranged for on a rise of the dividend by one per cent. In the case of the Durham bill, it was provided that the urban local authorities should have an absolute veto on the use of overhead wires.

In a fortnight or so one-half of the Strand will be gay with electric light and the reproach of semi-darkness removed from the "most interesting street in Europe." The big standards to be used are of the shepherd-crook design, while the lights are to be of 1,000 candlepower each.

The official opening of the Paris electric metropolitan railway took place yesterday. For the present there will be only seven stoppages. The service will commence at 8 a. m. and stop at 8 p. m., until the end of next month, when it will be from 5 a. m. to about midnight. Everything is in excellent order, although the two carriages attached to each motor car will not be adequate for exhibition traffic.

W. H. B.

New York Notes.

New York, July 28.—The transferring of the wires, switchboard and office paraphernalia of the borough of Brooklyn police-telegraph system was completed on July 25th, without a break in any of the wires or a lost call. This was a remarkable piece of engineering, when taking in consideration the fact that the old switchboard was transferred in sections from former headquarters in the municipal building to the building formerly occupied by the New York and New Jersey Telephone company at 16 Smith street, the old operating room of the latter company now being used as the operating room for the police telegraph. The side walls of the room are of black walnut, and so arranged as to kill, as far as possible, all acoustic properties. As arranged, it is probably the most complete police-telegraph operating room in the world. The entire system embraces 560 miles of wire, mostly underground or on the elevated railroad in cables, 469 police-signal boxes and 500 telephones. The operating force at headquarters consists of Frank C. Mason, in command, Thomas Williams, chief operator, and 15 operators, linemen and other employes.

Atlantic City's city marshal has been equipped with a baton, which, by the pressure of a button, lights a small incandescent lamp. The marshal patrols the beach each evening and carefully inspects all the pavilions. Romantic young folk look upon this innovation as one more evidence of the incompatibility of science and love.

The deputy highway commissioner of the borough of Queens has torn up 1,000 feet of track laid last winter by the New York and Queens County railway on Greenpoint avenue from the Newton Creek bridge to Bradley avenue. The tracks were laid without a permit and the corporation counsel held that the company was a trespasser.

Certificates of merger of the Electric Illuminating and Power company of Long Island City, the New York and Queens Gas and Electric company and the Jamaica Electric Light company with the New York and Queens Electric Light and Power company were filed yesterday with the secretary of state.

The Appellate Division of the Supreme Court in Brooklyn has decided in a test case submitted that the Brooklyn Rapid Transit company has a legal right to charge a 10-cent fare to Coney Island.

Park Commissioner Clausen has issued a permit to Thomas J. Brown (who has charge of the park-carriage service) allowing him to operate four electric carriages in the park.

The Amsterdam street railway has been sold to the Fonda, Johnstown and Gloversville Railroad company.

While it is true that the New York Central railroad is trying to find some way of doing away with the smoke in the tunnel at its New York terminal, it is far from true that anything satisfactory has yet been found. The great difficulty that stands in the way of electric locomotives is the time required to make the change to or from them when trains are entering or leaving the city. Trains leave the Grand Central stations at such short intervals certain hours of the day that an attempt to change motors at Mott Haven or farther up the road would cause a serious blockade. The locomotives that haul the trains out of Grand Central station must continue to haul them for 100 miles or more if the scheme is to be a success, and presumably, there is considerable hesitation on the part of the officials as to equipping 100 miles of road for electric-locomotive traction.

Along with the change of the Manhattan Elevated from steam to electric traction there will probably come the installation of some form of electrically operated elevators. The Reno moving stairway is the most promising for this class of work, and one of these, with a capacity of 3,000 people an hour, is being put in for trial at Fifty-ninth street and Third avenue.

The New York Electric Vehicle company some time ago bought the property and franchises of the old Fifth Avenue Stage company. Thus far it has only put on four electric stages and the balance of the service is carried on by the old horse stages. The public, anxious for a change, has been somewhat critical of this state of affairs, but the statement was recently made by the company that it was still the intention to substitute the new system for the old horse-power system at the earliest possible date. The trouble was that the subject of electrical stage service was comparatively new in this country and no one had had experience enough to know just what the requirements of the new service might be. When the old company was taken over by the new, three or four electrical stages were placed in service as an experiment, and to study and complete the data necessary to the change of system. These experimental stages have been in service ever since, and something of the requirements has been gathered from the experiment with them. New electrical stages are now in process of construction at the works of the company at Hartford, Conn., and when they are completed will be placed in service on Fifth avenue. The delay has been due to the many new propositions to be met and the time required to manufacture the new vehicles intended to meet the new conditions. The Fifth Avenue Coach company has recently applied to the State Railroad Commissioners for an approval of extension of routes.

M. L. G.

Canadian Intelligence.

Ottawa, July 27.—A meteorological station will shortly be established at Dawson City, in the Canadian Yukon, from which weather reports will be sent out twice a day. This will greatly facilitate the compilation of general reports for the Pacific coast.

A new 125-lamp arc-light machine has been installed in No. 1 power house of the Ottawa Electric company, by the Western Electric company of Chicago. The machine is of the latest and most modern design.

The Montreal Automobile company is applying for a charter from the Dominion government. The members of the company are the Hon. T. Berthiaume and H. Lamontagne, F. Lapointe, Emile Lapage, J. W. Faucher, R. L. de Martigny, Louis Bolduc and Arthur Guimond. The capital is $250,000, in $100 shares.

The Ottawa Valley, in a few months, will have a large factory for the manufacture of automobiles. The formation of a company has just been completed by John Sutherland and J. Carling Kelly of Ottawa, and a great part of the stock has been subscribed for. These gentlemen are the owners of the plants, patents, drawings and machines, for the manufacture of what is said to be a most modern automobile. The product of the factory will be five vehicles a day, and the factory is expected to be in full operation in three months. The machines will sell for about $600.

The Toronto Street Railway company will be asked by its employes, in a few days, for higher wages. The present rate is 16 2-3 cents an hour, and the amount desired is 20 cents. The men claim that the earnings of the company have enormously increased of late, that dividends on capital invested are large, and that they should share in the prosperity and better times. If an increase in wages is refused, the employes threaten a general strike, to take place during the time of the Toronto Fair, next month.

The first sod on the Hamilton and Lake Erie power canal was turned at the town of Silverdale, Ont., on July 18th. Nearly 2,000 people were in attendance. The canal will start at Welland River and run six miles to Jordan Village. A diversion canal will be built, by which a fall of 225 feet will be secured. The canal will be completed about September 1, 1901. It is claimed that electric power can be produced at this point at a lower rate than at any other point where electricity is developed, as there are no engineering difficulties to be overcome. The initial plant will develop 25,000 horsepower, which can be increased to 50,000 or 60,000 horsepower, as may be required. The canal will be 150 feet wide at the bottom, 12 feet deep, with a current of 3½ miles an hour. The cost of the work is estimated at about $1,000,000.

At the annual meeting of the Royal Electric company of Montreal, the principal item of business was the ratification of the contract with the Chambly Electric company of that city. The contract provides that the Royal Electric company shall purchase all of the power developed by the Chambly

company, for a period of 50 years, at the rate of $15 per horsepower per annum for the first 15,350 horsepower, and $10 for any amount in excess of this figure. This contract does not affect the agreement with the Montreal Street Railway company. The clause in the latter agreement providing for the protection of the street-railway company refers only to the selling of power to other surface roads in Montreal. The meeting also ratified the action of the directors in securing an additional $90,000 of stock and $30,000 of bonds of the Chambly company. The shareholders of the Royal Electric company then sanctioned the sale of all their holdings in the Chambly company to James Ross of Montreal, at the price of $791,000, in accordance with an agreement adopted by the directors at their meeting on July 11th. The election of directors for the ensuing year resulted as follows: Rodolphe Forget, J. A. L. Strathy, J. R. Meeker, H. B. Rainville, George Caverhill, James Wilson, F. C. Henshaw. At a subsequent meeting of the board, Mr. Forget was appointed president, and Mr. James Wilson, vice-president.

The annual meeting of the Chambly Manufacturing company, held in Montreal recently, ratified the contract with the Montreal Electric Street Railway company, already agreed to by the company. By this contract the Chambly Water and Power company undertakes to provide the street-railway company with electric power for a period extending over 23 years, with the option of a five-years' renewal, at $25 per horsepower per year, or about $125,000 per annum. The contract with the Royal Electric company was also ratified. By this latter contract the Royal Electric company proposes to take for a period of 50 years the whole of the power developed and delivered in the city of Montreal by the Chambly company, and to distribute and sell it to its customers. The following-named directors were elected: Rodolphe Forget, James Wilson, K. W. Blackwell, Lieutenant-colonel F. C. Henshaw and C. E. Porteous. Messrs. Forget and Wilson represent the Royal Electric interests, and Messrs. Blackwell and Henshaw those of the street-railway company, on the board. W.

From the Buckeye State.

Columbus, Ohio, July 28.—Director of Law Crum of the city of Columbus has filed a suit against Director of Safety Kauffman and the board of trustees of the municipal light plant, asking that a temporary injunction be granted to restrain him from delivering the property to the trustees, who are alleged to have no authority to take charge of the plant, notwithstanding the fact that they were chosen through an action of the City Council. Mr. Crum says that there was an ordinance passed which has been approved by the people, giving the director of public safety authority to issue bonds for the maintenance of the plant, and he asks that the court compel the directors to show cause why he should not carry out these instructions and should not keep the plant in operation. The money with which the plant was constructed was secured in the same way and there has never been any question raised as to the legality of its expenditure. The court has granted a temporary restraining order and the beginning of a big legal contest seems to be on hand. Many of the people of Columbus are in sympathy with the movement to force the operation of the plant, and all the labor organizations are in readiness to do their part to bring about this end. In fact, they are urging the matter as best they can.

The stockholders of the Toledo Heating and Lighting company, Toledo, held their annual meeting last Monday, when the following-named officers were chosen: President, T. W. Childs; vice-president, J. Frank Zahm; secretary, George H. Beckwith; executive committee, Irving B. Hiett, H. E. Marvin and A. Bentley. Before another year, it is expected that a new plant will be erected by the company, to be operated in connection with the present one.

There is some complaining on the part of the people of Zanesville because of the inadequate service of the street railway there. They say that the power is furnished by the light plant, which is not large enough to supply power for both the railway and the lights. When there is a heavy railway traffic the lights are poor also. The people think that improvements should be made in some way which would give both a good light and railway service.

The Columbus Railway company is having 20 new cars built for service on its main lines in this city. They will be ready for delivery about September 20th. It is claimed by the company that these cars are the finest ever turned out of the shops where they are being built.

Meeker Bros., Columbus brokers, said in their report last week: "The feature of this week probably has been the activity in the Columbus street railway. Good earnings or a possible early settlement of franchise questions may have something to do with it, but the fact remains that both the common and preferred stock have materially strengthened and the common especially has been actively traded in. Street stock is looked upon as a prime investment."

The Consumers' Carbon Works at Lancaster have awarded the contract for the stonework of their factory to F. C. Neeb. It seems that they are having some trouble in securing brick at the time they want them, and hollow block may be used in their place. It is hoped to have the factory running by November 1st.

The commissioners of Trumbull County have granted a franchise to the Mahoning Valley Electric Railway company to build a line from Tibbetts Corners to Warren.

The Bullock Manufacturing company of Cincinnati is shipping a large amount of goods to other countries. Within the past few days it has consigned to a French syndicate four or five carloads of electrical railway goods. An 800-kilowatt generator goes to Alexandria, Egypt, and a 400-kilowatt generator goes to Algiers. Another machine has been shipped to Lyons. Besides this, the company has recently sent goods for the Russian-Chinese electric road, and is making 30 generators for United States transports.

There has been some trouble between the Board of Public Service and the Cincinnati Edison Electric company, and, as a result, the board has threatened to advertise for bids for lighting the city upon the expiration of the contract with the Edison company. The Deitrich syndicate and the Cincinnati Gas Light and Coke company will be bidders in that event. The gas company will make a proposition to use gas with Welsbach burners, or electricity. The Deitrich people will make a proposition to use natural gas, with Welsbach burners. There is also some talk of a combination of the Edison and the Deitrich interests in order to beat the gas company.

The commissioners of Madison County have granted a franchise to the Columbus, London and Springfield Electric Railway company to build its line along the national pike, to Lafayette, and from there to London, on the Lafayette pike. The course from there to the Clark County line on the west has not as yet been decided upon.

The fight in Sandusky County between the Toledo, Fremont and Norwalk Electric Railway company and the Wheeling and Lake Erie Railroad company has been taken up by the county commissioners, who have ordered the latter company to take up the track it built on the pike and on the right-of-way of the electric road.

The bonds of the Dayton and Germantown Traction company have been disposed of, and the company will, within a short time, be ready to contract for the work of building.

There is a plan on foot to build an electric road from Newark to Coshocton, to connect with the Columbus, Buckeye Lake and Newark road. Not much has been said about the matter, but Coshocton people seem to have faith in the project. It is the plan to have the line run before winter, and during the cold months secure the right-of-way. In the early spring they will then be ready to commence work on the roadbed.

President F. W. Jones of the Mount Vernon-Marion electric railway has been in correspondence for some time with a company which has furnished plans for the equipment of the road with cars propelled with liquid air, as the first statement was made, but really with super-heated water. It is not at present known whether the road will try the experiment, but it is pretty safe to say that one car will be tried before an equipment of that kind will be put on.

The management of the Sandusky, Monroeville and Norwalk Electric Railway company has announced the intentions of the company to extend the line south from Norwalk to North Fairfield, New London and Chicago Junction.

Motorman A. A. Kail, who is in the employ of the Tuscarawas Electric company at Uhrichsville, Ohio, has invented a lightning arrester, said to be different in many respects from anything now in use. It was tested at the power house of the company during a storm one day last week, and proved a success. The storm was heavy and the lightning danced over the lines in every way. One bolt struck the line and would have gone into the power house had not an arrester of some kind stood in the way. Mr. Kail's arrester worked all right, however, and the current was carried into the ground. O. M. C.

News from the Carolinas.

Charlotte, N. C., July 26.—At the annual meeting of the Wilmington (N. C.) Street Railway company's stockholders the following-named directors, all of New York, were elected: T. A. McIntyre, C. A. Leib, O. T. Crosby, B. F. O'Connor, J. H. Barnhardt, J. W. Martenis and H. A. Whiting. Officers will be elected in New York.

Charleston, S. C., may soon adopt plans looking to the municipal ownership of a lighting plant, in connection with a waterworks system.

The Carolina Light and Power company of Aiken, S. C., has given notice of an increase of capital stock from $20,000 to $50,000.

The town of Hickory, N. C., is in darkness, owing to trouble between the town and the Hickory Electric company, the company claiming it cannot make expenses at former rates and that the requirements of the board make it impossible for it to continue at the old rates.

The new railway company at Greenville, S. C., expects to begin laying the new line, seven miles long, about August 1st.

The Asheville street railroad has begun overhauling its tracks and rolling stock.

At Asheville, N. C., Zeb Weaver has asked a franchise for himself and others, to run an electric railway from Asheville to Weaverville. L.

Washington, D. C.

Washington, D. C., July 28.—The Rockville (Md.) Town Council and the Washington and Rockville Electric Railway company have at last reached an agreement in regard to the extension of the road. The ordinance recently prepared by the council is satisfactory to the railway people, and a meeting of the council will be held in a few days to pass it, after which it will be voted upon by the taxpayers. The company agrees to extend the road throughout the entire length of the town, just as soon as the law which forbids an electric railway on a street 30 feet or less in width is repealed. If the ordinance is ratified, the road will be extended from its present terminus at the fair grounds, to the courthouse, without delay.

The Portsmouth Street Railway company of Portsmouth, Va., has been sold to Philadelphia capitalists, presumably acting for the Williams syndicate of Norfolk and Richmond investors. Half a million dollars is reported as the price paid.

At the annual meeting of the stockholders of the Chevy Chase and Kensington Electric Railway company, at Rockville, Md., on July 22d, the following-named board of directors was elected: William M. Terrell, B. H. Warner, R. B. Detrick, Parker Jones, Anthony Ray, William H. Mannakee, Oliver R. Harr, John T. Freeman, R. W. Walker, A. K. Phillips and W. H. Walker.

The United Railways and Electric company of Baltimore, Md., has nearly completed a funeral car, and as soon as it is completed will put it into service. The car has an opening in the side, through which the casket may be passed, and within there is a catafalque. In this compartment are accommodations for the pallbearers and funeral director, and a space for the floral designs. Separated from this compartment by a curtain is one affording seats for the family of the deceased and the mourners. The name of the car has not yet been selected by General Manager House. "Dolores" has been suggested as very appropriate.

The Electrical Commission of the city of Baltimore, Md., has completed the subways for electric wires, which have been under construction for some time, and is now making house connections. The cost of making these connections to present electric-light, power and telephone users is borne by the city, but, in future, new customers will have to pay for the cost of such connections.

The contract for the generators and switchboard for the municipal electric-light and power plant of Hagerstown, Md., for which bonds have just been sold, has been awarded to the Westinghouse Electric and Manufacturing company. Two 175-kilowatt, two-phase engine-type generators, to be run at 189 revolutions per minute, by 300-horsepower Buckeye engines, and Westinghouse standard switchboard, will be installed. B. C. W.

PERSONAL.

B. J. Arnold, president of the Arnold Electric Power Station company of Chicago, sails from New York on the Umbria, August 4th. He will visit London, but will spend most of the month he intends to be abroad at Paris.

J. E. Woodbridge, editor of the American Electrician and recently engaged in electrical journalism, has accepted a position in the railway engineering department of the General Electric company at Schenectady, N. Y., and will leave the journalistic field.

James S. Beach, the chief clerk to C. M. Baker of the Postal Telegraph company, who so mysteriously disappeared on July 11th, has been located at Fountain City, Wis., where he is in the employ of a United States engineer. He could not explain his action. His mind had been a perfect blank for three days after he left Chicago. Mr. Baker traced him by means of the railroad passes he was known to have in his possession. Temporary aberation is the only reason that can be given for his action.

ELECTRIC LIGHTING.

Dayton, Iowa, will build a $10,000 city lighting plant.

New Wilmington, Pa., will soon build an electric-light plant.

The council of Charleston, S. C., has decided to build a municipal lighting plant.

Kirkwood, Mo., has voted to issue $17,000 in bonds for a municipal lighting plant.

Fairport, N. Y., has voted to issue $20,000 in bonds for a municipal electric-light plant.

An electric-light plant will probably be put in the Commercial Hotel at Schoolcraft, Mich.

The Prescott (Ariz.) Electric company's plant suffered in the recent big fire at Prescott.

Lakewood, Ohio, asks bids until August 10th for an electric-light plant. J. French is clerk.

The $3,000 electric-light plant at Altona, Ill., owned by Mr. Tornquist, was burned recently.

The Lemon Home Water, Power and Light company of Oakland, Cal., has been incorporated,

with $250,000 capital, by A. Hockheimer, F. Brown, F. L. Spencer and J. N. Spencer.

W. H. Keyser of Pine Bluff, Ark., has a franchise to operate an electric-light plant at that place.

Dalton, Ga., has purchased the gas plant and contemplates building an electric-light plant next year.

The Chicago Consolidated Power and Water company will reconstruct the electric-light plant at Dunkirk, Ind.

C. H. Porritt of Fargo, N. D., has been awarded a contract to erect a new electric-light plant at Hillsboro, N. D.

The Carolina Light and Power company of Aiken, S. C., has increased its capital stock from $20,000 to $50,000.

The Village Council of Cass Lake, Minn., has granted a permit to Heber Hartley to build an electric-light plant in the village.

Among recent Illinois corporations is the Jerseyville Light, Heat and Power company of Jerseyville, with $25,000 capital, organized by George D. Rosenthal, Owen Ford and Josephine Rosenthal.

ELECTRIC RAILWAYS.

The Toledo (Ohio) Traction company has a franchise to extend its line on Woodville street.

Ground has been broken at Monroeville, Ohio, for the Sandusky, Monroeville and Norwalk electric railway.

The power house of the Chattanooga Rapid Transit company has been destroyed by fire. The reported loss was $65,000.

The Evergreen Street Railway company of Allegheny, Pa., has applied for a charter. E. J. McElvaine, F. C. Sauers and H. W. Kline are promoters.

The Central London Underground railway began to carry passengers regularly on July 30th. There was a rush for the underground route, which saves 20 minutes over any other.

The Shenango Traction company of Franklin, Pa., has been organized to build eight miles of electric road. J. B. Smithman, L. M. Davison and J. H. Forbush are directors. The capital is $50,000.

Judge Kohlsaat has authorized Receiver Charles Henrotin of the Chicago Electric Traction company to issue receiver's certificates to the amount of $250,000 for the purpose of changing the road from storage battery to overhead trolley. All interested in the company favored the change. The Manhattan Trust company, one of the trustees, the receiver and the reorganization committee of stockholders joined in asking for the authority. The certificates will be issued at once, in order that work may begin as soon as possible. The certificates will be in denominations from $1,000 up, payable three years after date.

AUTOMOBILES.

The automobile license of Walter D. Glenn in Chicago, has been revoked by City Electrician Ellicott on account of certain accidents the holder of the license has been connected with recently.

An automobile race meet was held at Brantford, Conn., July 25th and 26th. Owing to bad weather and an unwise classification of vehicles, the meet lacked the success it might have had, though over 1,500 people from New York, Boston and all over New England saw the races. Louis Fisk of Detroit, who backed the meet, intends to make Brantford "the" place for eastern automobile racing.

PUBLICATIONS.

The Joseph Dixon Crucible company of Jersey City, N. J., has issued a neatly executed catalogue on facings for foundry molds.

Motor-starting rheostats are described in the Fort Wayne Electric Works bulletin No. 1011, issued July 10th. Three types are illustrated.

The Vandergrift (Pa.) Land and Improvement company is sending out a beautiful publication illustrating the city, which is the home of the Vandergrift Works of the American Sheet Steel company.

The twenty-eighth quarterly fire report of the electrical bureau of the National Board of Fire Underwriters for the quarter ended July 10th has been issued to William H. Merrill, Jr., electrician of the Chicago Underwriters' Laboratories.

"Some Practical Hints on Lighting and Illumination," with 50 original diagrams from tests made by Professor W. S. Franklin of Lehigh University, Professor Vivian B. Lewis of the Royal Naval College, Greenwich, and Dr. H. Drehschmidt, chief chemist Berlin Municipal Gas Works, is published by the Holophane Glass company, New York, and will be found interesting and valuable reading for anyone interested in the subject of illumination.

B. F. Stewart & Co., proprietors of the Century Telephone Works, 253 South Canal street, Chicago, have just issued two interesting circulars descriptive of some of their new apparatus. One circular treats of the Century express-type switchboard, explaining the construction and operation of the board in considerable detail, and the other circular describes the Century armored bipolar receiver and solid-back transmitter. The salient points and operation of the transmitter are dwelt upon at some length.

POWER TRANSMISSION.

A recent California incorporation is the Fort Miller Power company, to generate and transmit electric power. Its principal place of business is San Francisco, and its directors are W. Saunders, A. J. Morganstein, T. O. Carter, K. D. McCann, San Francisco, and F. G. Berry, Fresno. The capital stock of the company is $1,000,000, all subscribed.

The Tooele Electrical Power company has filed articles of incorporation in the office of the secretary of state of Utah. The capital stock is placed at $50,000, divided into 50,000 shares of the par value of $1 each. Joseph C. Orme is president of the company, F. M. Davis vice-president, A. J. McCuistion treasurer, Phares Dunyon secretary. The board of trustees is composed of F. M. Lyman, Jr., George A. Lyman and Charles R. McBride. The object of the company is to establish and conduct at Tooele City an electrical, milling and manufacturing company.

TRADE NEWS.

The Texas Arm and Pin company has just taken out a permit from the state of Texas to increase its capital stock from $10,000 to $25,000, in order to keep pace with its growing trade. W. H. Quaw is now interested in the company and will travel for it in Texas and also all over the United States. His home is in Chicago.

Proposals will be received at the architect's office, United States Capitol, until 12 o'clock noon of Saturday, August 11th, for furnishing and putting in place on foundation to be erected by the government, one forged-steel water-tube boiler of 250 horsepower, of the high-pressure type now in use in the capitol, and two 187½-kilowatt Westinghouse generators, direct-connected to suitable Westinghouse compound engines, with marble power panel, connections, instruments, etc., all to be similar in character and type to those now in use, and to operate in conjunction with the present plant, in the old library space of the capitol.

The possession of a reliable lacquer in all the brilliant rainbow colors for incandescent lamps has nowadays become a necessity with almost every central-station man, or dynamo tender in charge of isolated plants. Particularly nowadays is this demand appreciated, from the fact that the modern storekeeper fully understands the advantage of the colored incandescent lamp as an advertising essential in shedding light on his wares. Realizing the existence of this demand, M. L. Barrett & Co., 219 Lake street, Chicago, are now pushing in the market an extensive line of colors in incandescent-lamp lacquer. The company claims for this lacquer brilliancy, durability, that it is easily applied, and that it also dries hard in half an hour. It will not chip, or, as the Barrett people aptly put it, "rub off in the wash." Practically all the colors that might be desired are furnished, green, blue, red, gold, orange, etc. In fact, M. L. Barrett & Co. agree to match most any color desired, by its different grades of lacquers. It is asserted that these lacquers have been thoroughly tried and are no experiment. M. L. Barrett & Co. are also selling large quantities of dead-black lacquer, an imitation bauer-barff finish, for giving black finish to all sorts of metal work, dynamos and other electrical instruments, where that peculiar pure and dull-black finish is desired.

BUSINESS.

The Joseph Dixon Crucible company calls attention to its special graphite lubrication for the gears of electric and steam automobiles.

The Western Electrical Supply company, St. Louis, is sending out a revised price list on locust pins, oak pins, oak brackets and cross-arms.

Walsh's Sons & Co., Newark, N. J., dealers in scrap iron and metals, call attention to the fact that they keep an electrical junk shop, buying, selling and exchanging everything electrical. People who desire second-hand apparatus may do well to communicate with them.

The Chicago Mica company, whose main works are at Valparaiso, Ind., reports a remarkable increase in its sales of Micabond products. W. F. Hatch, secretary, is at present making his headquarters at the Ottawa office, and has closed contract for the entire output of one of the largest amber mica mines in the province of Ontario. Fully 75 per cent. of the output of this mine is what is known to the trade as silver amber mica, and used exclusively in the manufacture of the well-known No. 104 Micabond.

The Western Electric company is carrying in stock a very complete line of two and four-pin cross-arms for electric-light trade. These arms are made of selected lumber, hand painted and are full 3¼ by 4¼ inches, the regulation size. They are being sold at very attractive prices. The company is also carrying a large stock of weatherproof wire and cable, and can make prompt deliveries in almost any quantity. It makes a specialty of feeder cables for street railways and power plants and says its prices are always at the lowest market rates.

The Crocker-Wheeler Electric company of Ampere, N. J., has an order for a large generating plant from the Frick company of Waynesboro, Pa., consisting of a 400-kilowatt, 250-volt engine-type generator and also a smaller generator with switchboard. It also has a number of large orders from the Philadelphia Engineering Works to supply motors for cranes, these motors being 30, 15 and seven-horsepower standard iron-clad mill motors. But the largest and most-sought-for contract was that for equipping electrically the shops of the Chicago, Burlington and Quincy Railroad at Hannibal, Mo. This consisted of 55 motors of various sizes, from one to 50 horsepower, aggregating 440 horsepower. Many of these are of new form.

William Roche of New York says he is receiving large orders from all over the country for his gasoline-engine eight-cell battery. This cell is used by many manufacturers on account of its easy adaptability to automobiles using gasoline as a motive power. It is of the same diameter as the cell Mr. Roche supplies on United States Navy orders, but, being one inch longer, has an increased life. Eight cells are set up in series, connections being made so that different cells can be cut in as needed. Mr. Roche has recently purchased the building at 42 Vesey street, in which his business is located, and is practically occupying the whole of it. Through continued large orders the Roche goods are becoming widely known. Letters patent have been allowed Mr. Roche on his electric campaign button, which, without the picture, is a convenient and useful light.

Chas H. Besley & Co., 10 and 12 N. Canal street, Chicago, report that their general business is still very good. They are still receiving many orders for Helmet oil, and are now making shipments to Colorado, Dakota, Montana, California, and other western points. They have just received orders for two complete shop equipments to go to India, including lathes, chucks, drills, screw plates, Gardner die stocks, Helmet oil, etc. They are receiving many orders for their Gardner grinders, and have recently made shipments to Ohio, Pennsylvania, New Jersey and New York. Aside from the many orders that they are receiving for their own specialties, they note a good demand for general machinists' supplies. Their stock being so varied, and each department being so complete, they say they are enabled to make prompt shipment of any of the material shown in their catalogue, a copy of which is sent free to any address upon application.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 24, 1900.

654,130. Electric Steering Gear. Harold W. Buck, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed March 20, 1899.

In combination, a body to be moved, a plurality of oppositely rotating clutches operatively related thereto, actuating coils for throwing the clutches into operation, means for positively demagnetizing the magnetic clutches as soon as the circuit of the actuating coil is interrupted, a circuit-interrupting switch operatively related to the body to be moved, and means for closing a circuit through the interrupting switch to either of the actuating coils. (See cut.)

654,138. Electric Current-grounding Device for Fire-extinguishing Apparatus. William A. Dennett, Springfield, Mass. Application filed March 14, 1900.

The combination with the truck frame of an aerial ladder or analogous vehicle, of a metallic connection, one end of which is in electrical connection with the frame, and the other end of which is adapted to be placed in electrical connection with the earth.

654,142. Brake. Gano S. Dunn, East Orange, N. J., assignor to the Crocker-Wheeler company of New Jersey. Application filed October 31, 1899.

The combination in a brake of a brake wheel, a brake strap to be applied thereto, means for anchoring the strap at either end and means for applying it by a pull at the other end actuated by the brake wheel for adjusting the strap to determine which end shall be anchored and which end shall be pulled, so that its braking effect shall be independent of the direction of revolution of the brake wheel

654,187. Electrical Safety Fuse. Arthur L. Stevens, New York, N. Y., assignor to the Pennsylvania Manufacturing, Light and Power company of New Jersey. Application filed August 16, 1899.

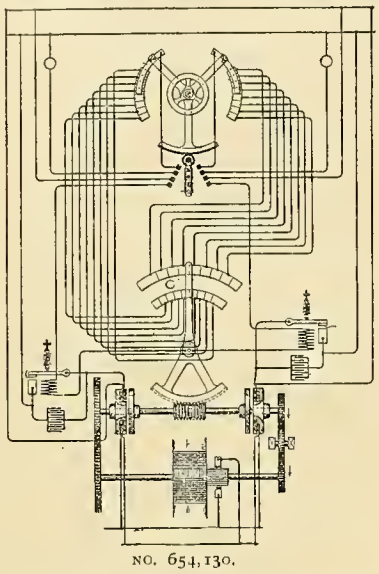
The combination of a containing vessel, having means for the insulated entrance therein of a pair of conducting wires, terminal blocks in the vessel connecting the conducting wires and the opposite ends of an electrical safety-fuse wire, a volume of oil maintained in the vessel to submerge the terminals and the greater portion of the fuse wire, a fuse block recessed to form a chamber, a pair of insulating clamping blocks supporting the same, and a perforated wedge partly filling the recess in the fuse block, the recessed block and wedge operating to maintain a section of the fuse.

654,208. Incandescent Electric Lamp. Samuel D. Washburn, Boston, and Clarence H. Tinkham, Cambridge, Mass. Application filed January 23, 1899.

In an incandescent electric lamp in combination, a bulb; a tube of glass closed at its inner end and sealed to the bulb; leading-in wires sealed in the tube; a mirror; and a wire one end of which is fast to the tube and the other end to the mirror, substantially as described.

654,239. Electric Switch. William Ely, Providence, R. I. Application filed May 24, 1897.

In an electric switch having a base, a rotatable shaft arranged parallel with the base, and circuit terminals arranged at opposite sides of the shaft, the combination with the parts of a connecting member carried on one side of the shaft, an actuating member loosely mounted upon the shaft for movement independent of the connecting member, and provided with parallel arms at opposite sides of the connecting member, and with a cross member and handle at its outer end, and a cross member at its inner end which latter is adapted to forcibly impart the initial releasing movement to the contact member from its frictional contact with the circuit terminals, and springs connecting the connecting member and the actuating member.



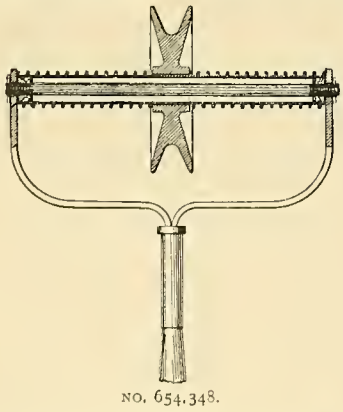
NO. 654,130.

654,277. Electric Arc Lamp. Henri Pieper, Fils, Liege, Belgium. Application filed December 28, 1897.

In an electric arc lamp, the combination with a movable upper carbon, a lower carbon, the circuit connections for the carbons, a coil for controlling the movable carbon, of a shunt for the regulating current, a ratchet wheel having finely divided teeth, and connected with the movable carbon, a pawl controlled by the oppositely acting forces of a spring and the coil for releasing, feeding back and relocking the ratchet wheel, and means whereby the break of the shunt has the effect of modifying the force of the coil.

654,299. Starting Mechanism for Alternating-current Motors. James J. Wood, Fort Wayne, Ind. Application filed March 30, 1900.

In combination, a main switch, a commutator, a common lever for operating the switch and the commutator, means whereby the initial movement of the lever renders it operative to close the main switch, and the continued movement thereof closes the main switch, and means whereby a backward movement of the lever renders it inoperative to close the main switch until after it has been returned to its zero or off position.



NO. 654,348.

654,310. Junction or Connection Box. Rudolf Hundhausen, Wilmersdorf, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed November 18, 1899.

The combination with a box containing supply terminals and having a cover, of a switch for controlling the continuity of the main conductors, and interlocking means interposed between the switch and cover, controlled by the switch and adapted by co-operation with the switch to prevent the cover from being opened when the switch is closed.

654,320. Electric Heater. Robert R. Morison, San Francisco, Cal. Application filed November 15, 1899.

An electrical heater comprising an open center stand or support, a shallow pan within the opening of the stand or support, ribs by which the pan is suspended in the lower portion of the open center and out of direct contact with the stand, a second pan fitting within the first-named one, means interposed between the pans for electrically heating them, and means for controlling the electrical current.

654,325. Automatic Switch for Electric Car-lighting Apparatus. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, New York, N. Y. Application filed March 12, 1900.

The combination with the armature shaft of a dynamo, of an oscillating switch lever mounted on the shaft and capable of sliding lengthwise thereof, a centrifugal governor mounted on the dynamo shaft and connected with the switch lever, and a frictional checking device arranged to retard the oscillating movements of the switch lever.

654,326. Voice-concealing Attachment for Telephones. Henry P. Roberts, Boston, Mass., assignor to Everett D. Godfrey, Taunton, Mass. Application filed January 15, 1900.

A voice-concealing attachment for telephones comprising a body attachable to the transmitter mouthpiece and containing two chambers of non-vibrant material opening into each other substantially in alinement and in alinement with the mouthpiece when the body is attached to it.

654,341. Damping Device for Recording Instruments. William H. Bristol, Hoboken, N. J., and Franklin D. Bristol, Naugatuck, Conn., assignors to the Bristol company, Waterbury, Conn., and New York, N. Y. Application filed May 24, 1900.

In an indicating or recording instrument, the combination with an operative part movable in parallel planes, of a damping device comprising a box horizontally placed and having a shelf therein, a dasher provided with one or more vanes placed between the shelf and the walls of the box to form narrow passages with the box and shelf, and a connection between the operative part and the dasher.

654,348. Trolley Harp. Edward G. Johnson, Brigantine, N. J., assignor to the Edison-Johnson Electrical Manufacturing company of New York. Application filed February 16, 1900.

The combination of a trolley harp, the shaft journaled thereon, the trolley wheel mounted to turn loosely on the shaft and also capable of sliding thereon, and springs bearing against opposite sides of the trolley wheel and against fixed abutments. (See cut.)

654,355. Electric Gas Lighter. John Y. Parke, Philadelphia, Pa. Application filed May 9, 1899.

In an electric gas-lighting device, the combination with a burner having a fixed electrode secured near its tip, of a movable electrode adapted to oscillate with the gas valve as the valve is turned, an arm secured to the movable electrode about midway of its length extending in the path of the burner pipe, the arm being constructed and arranged so as to contact with the burner pipe, and to guide the movable electrode on the return movement in front of and out of electrical contact with the fixed electrode.

NO. 654 557.

654,367. System of Distribution. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Original application filed September 10, 1897. Divided and this application filed May 18, 1899.

The combination with constant-potential mains, of a circuit connected across the same and including in series therewith the secondary of a constant-current transformer, the primary of which is also connected across the mains. (See cut.)

654,390. Induction Coil. Reginald A. Fessenden, Allegheny, Pa. Application filed December 1, 1899.

An induction coil having in combination a divided annular core, and primary and secondary coils surrounding the core and so arranged that at least a part of each coil surrounds the core on both sides of the gap between the ends of the core.

654,391. Locking Device for Armature Oil Guards. Alfred J. Gairing, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed December 28, 1899.

A locking device consisting of an oblique pin having an extended arm having a head therefore, and a perforation in the arm, substantially as described.

654,410. Apparatus for Controlling Electric Motors. Frank A. Merrick and Emmett W. Stull, Johnstown, Pa., assignors to the Lorain Steel company of Pennsylvania. Application filed November 22, 1899.

The combination with four electric motors, of two controller drums, each of which has contacts and connections for changing one pair of the motors from series to parallel, the drums being electrically connected in series with each other.

654,433. Incandescent-lamp Socket. William B. Bragdon, Cumberland Mills, Me., assignor to S. D. Warren & Co., Boston, Mass. Application filed October 31, 1899.

An incandescent-lamp socket consisting of a case provided with a hood, the case having openings in its walls below the hood, terminals in the case, electric conductors leading into the case through the openings, and each provided with continuous insulation from a point above the socket to a point within the case, and a projection upon the hood having openings to receive and separate the conductors. (See cut.)

654,448. Trolley Base. Henry S. Goughnour, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed September 23, 1899.

In a trolley, the combination with a pivoted trolley arm or pole, and a member to which it is pivoted, of a torsion spring having an arm extending from one end of its coil and bearing upwardly against the arm or pole, an arm extending from the opposite end of its coil and bearing downwardly against the member, and an adjusting wedge seated between the member and the last-named arm.

654,463. Electric Furnace. Henri Leleux, Paris, France, assignor to La Compagnie Electro-métallurgique des Procédés Gin & Leleux, Paris, France. Application filed July 7, 1899.

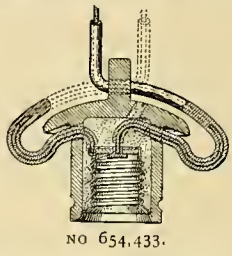
An electric furnace provided with a vertically arranged electrode formed by one or more cores of carbon of high conductivity, each core being surrounded by an agglomerated mass of carbon having a less high conductivity, each of these cores having its two inner faces provided with an elastic pad in order to provide a large surface of contact between the electrode and the plates connected to the lead, the plates being secured against the pad by means of wedges and keys in order to obtain a permanent tightening whatever may be the temperature of the electrode.

654,498. Electric Metering System. Frederic E. Town, Glencarlyn, Va. Application filed May 11, 1900.

The combination of a meter; an electric circuit; a make-and-break device for the circuit operated by the meter; an electrically actuated recording device in the circuit; and means for closing and opening the circuit, whereby the recording device may be brought into or thrown out of operation, as desired.

654,519. Secondary Battery. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed October 2, 1899.

A secondary battery electrode, comprising in combination a conducting support, a coating of active material surrounding it, and a collar formed of non-corrodible material surrounding the support, and arranged to project a distance into the active coating and a distance above it, substantially as set forth.



NO 654,433.

654,520. Secondary Battery. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed October 2, 1899.

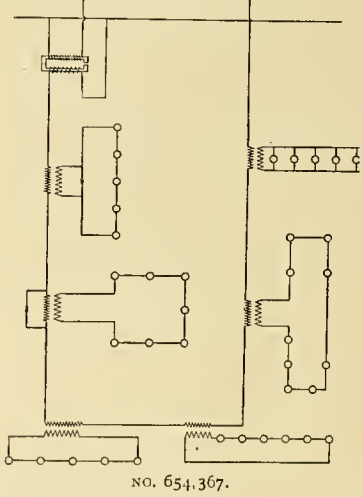
In a secondary battery, the combination of a perforated conducting casing for containing the active material, and a connecting strip or bar having an opening with a thin vertically extending flange or neck around the opening receiving the upper end of such casing, and adapted to afford a convenient means for effecting a fused joint between the parts, substantially as set forth.

654,531. Electric Bell. Charles H. Furgason, Binghamton, N. Y., assignor of one-half to Eric Peterson, Binghamton, N. Y. Application filed October 2, 1899.

In an electrical bell, a backing plate, an L-shaped frame having one arm secured to the plate and the other arm thereof extending at right angles to the face of the plate, magnets carried by the latter arm of the frame, an armature pivoted in an opening in the other arm under spring tension, a post extending in a plane substantially parallel with the armature and carrying a bell or gong, and a clapper carried by and forming an extension of the armature.

654,551. Means for Regulating Electric Motors. Robert Lundell, New York, N. Y. Application filed May 19, 1900.

The combination of a pair of current mains of constant electromotive force, one or more motors having armature circuits capable of being coupled in series parallel; a source of variable electromotive force adapted to vary the field strength and speed of the motor or motors independent of their armature currents, with a controlling switch having circuit connections between the current mains, the motor or motors and the source of variable electromotive force.



NO. 654,367.

654,557. Secondary Battery. Donato Tommasi, Paris, France. Application filed July 8, 1899.

An electrode for electric accumulators comprising a spirally wound resilient metallic strip or support for the active material, having the active material supported by and retained between the convolutions thereof, one end of the strip being freely movable, whereby the strip may accommodate itself to the expansions or contractions of the active material in charging and discharging, and means for supporting the coiled strip in a vessel in such a way as to permit it to expand and contract. (See cut.)

654,574. Trolley Track for Electric Railways. Victor Koch, Scranton, Pa. Application filed February 24, 1900.

A trolley track consisting of a crossing constructed from a circular plate integrally made with projections thereon corresponding to the ends of the rails of the trolley track, and adapted to be joined therewith for the purpose of completing the electrical circuit through the track.

Western Electrician.

EVERY SATURDAY.

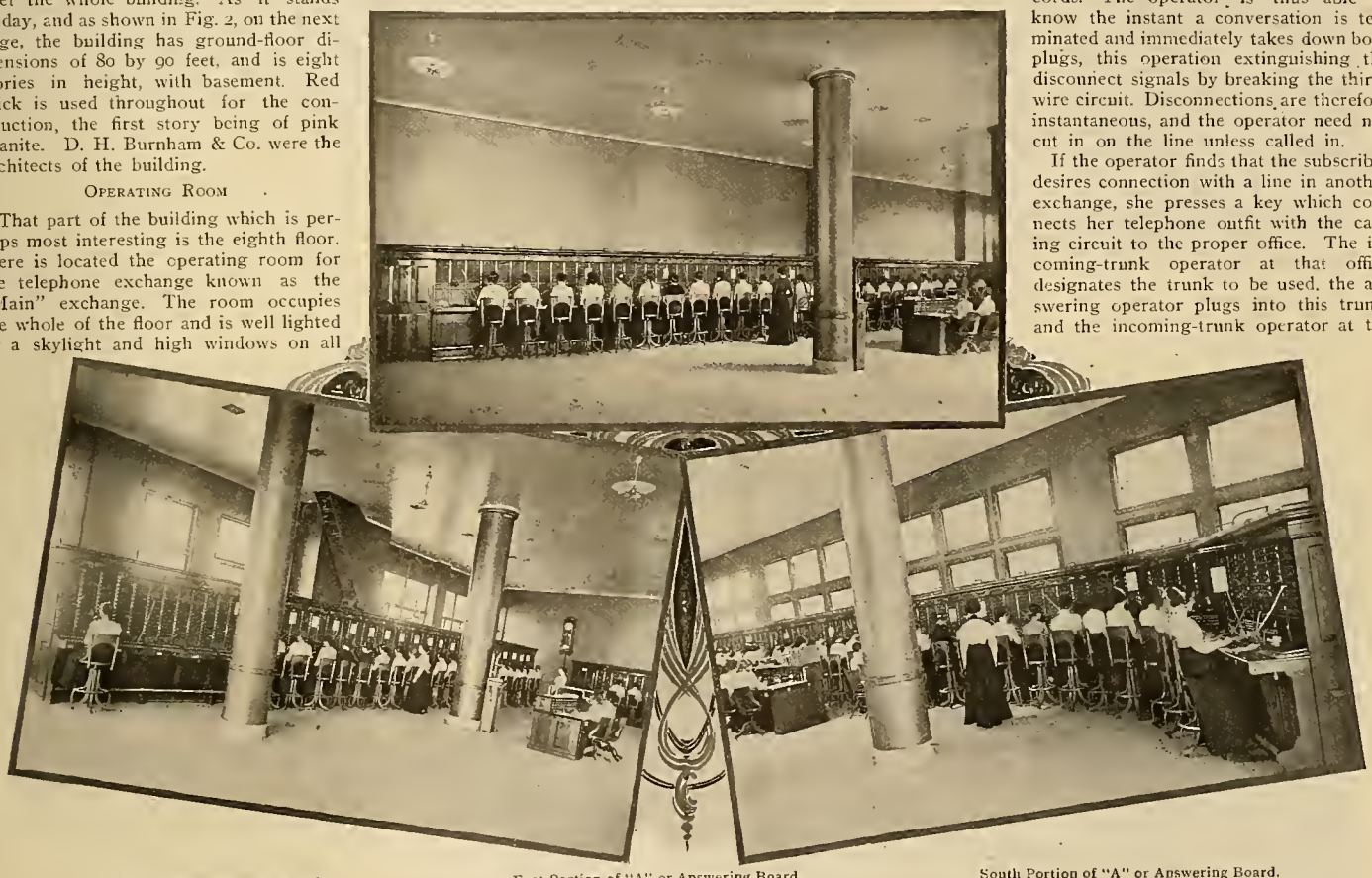
Vol. XXVII. CHICAGO, AUGUST 11, 1900. No. 6

Main Offices and Exchange of the Chicago Telephone Company.

When the old magneto or drop-signal system of multiple switchboard at the Main exchange of the Chicago Telephone company was superseded on July 21st by a new and more modern common-battery relay board, the improvements and extensive alterations which have been making to the whole building of the Chicago Telephone company at 203 Washington street for over a year were practically completed. The old Chicago Telephone building was a seven-story structure, with a 90-foot frontage on Franklin street and a 40-foot frontage on Washington. A 40-foot lot, adjoining the property on the east, was acquired and an eight-story addition erected, the eighth floor being extended over the whole building. As it stands to-day, and as shown in Fig. 2, on the next page, the building has ground-floor dimensions of 80 by 90 feet, and is eight stories in height, with basement. Red brick is used throughout for the construction, the first story being of pink granite. D. H. Burnham & Co. were the architects of the building.

Operating Room

That part of the building which is perhaps most interesting is the eighth floor. Here is located the operating room for the telephone exchange known as the "Main" exchange. The room occupies the whole of the floor and is well lighted by a skylight and high windows on all but the east side. In dimensions the room has a length along Franklin street of 86 feet 5½ inches and a width of 77 feet five inches. It has a high, vaulted ceiling. The switchboard occupies three sides of the room, the arrangement being indicated in the diagram, Fig. 3. A light well passes down through the center of the room to provide light for the floors and halls below. In Fig. 1 are shown three views of the board. The left-hand view is of the "B" or incoming-trunk board, situated on the north side of the room. The other two views show the parts of the "A" or answering board along the east and south walls respectively.



"B" or Incoming-trunk Board. East Portion of "A" or Answering Board. South Portion of "A" or Answering Board.

FIG. 1. MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.—MAIN OPERATING SWITCHBOARD.

The switchboard is of the common-battery relay multiple type, such as is now the standard of the American Bell Telephone company's licensees. This board has a present capacity on the multiple section for 5,400 lines, with space for extension to accommodate 7,500 lines. Such extensions can be made from time to time by adding other sections of switchboard and additional multiple jacks to the present sections. In Fig. 3 the sections of the board already installed are indicated by full lines, the broken lines indicating space reserved for future extensions.

"A" Board.

The A board is divided up into 20 sections, there being three operators' positions to each section. Each section consists of seven panels. One panel contains 700 multiple jacks, and the seven panels in one section thus contain multiple jacks for all the subscribers connected to the board, who, at present, number about 4,300. Each operator can thus plug into a multiple jack on any Main subscriber's circuit, the greatest distance she has to reach to either side being 3½ panels. On this A board, below the multiple jacks, are placed the answering jacks for Main subscribers, the number to each operator being apportioned according to the number of calls. The first six positions of the board are given up to measured-service lines, and each operator has about 160 answering jacks to attend to. The other positions on the board are devoted to unlimited-service lines, and as the calls over these lines are more numerous, no operator has more than 80 lines to answer, the average number being between 60 and 70.

The operation of the A or answering board is, briefly, as follows: When a subscriber removes his telephone receiver from its hook, battery current flows through the circuit and operates the line relay at the exchange, this in turn operating, through a local-battery circuit, the line-lamp signal immediately adjacent to the answering jack before the operator in the switchboard. The operator plugs into the answering jack with her answering plug, which operation closes a circuit in a third wire in the cord circuit through a cut-off relay, the armature of which, when actuated, cuts out the line relay, thus extinguishing the lamp. After ascertaining the number desired by cutting in in the usual way, the operator completes the connection, if the line called for is in the same exchange, by inserting the plug in the proper jack in the multiple within her reach. The cam lever for that pair of connecting cords is then moved in the proper direction for ringing over the line called for. This completes the work so far as the switchboard operator is concerned, assuming that the called-for subscriber responds.

When the subscribers are through talking and hang up their receivers they break the continuity of the battery circuit through their instruments. This allows the disconnect relays in the cord circuit to release their armatures and break a shunt across the disconnect lamp signals, thus lighting these signals through the third wire. A disconnect signal is shown for each line, located on the board immediately in front of the corresponding pair of cords. The operator is thus able to know the instant a conversation is terminated and immediately takes down both plugs, this operation extinguishing the disconnect signals by breaking the third-wire circuit. Disconnections are therefore instantaneous, and the operator need not cut in on the line unless called in.

If the operator finds that the subscriber desires connection with a line in another exchange, she presses a key which connects her telephone outfit with the calling circuit to the proper office. The incoming-trunk operator at that office designates the trunk to be used, the answering operator plugs into this trunk, and the incoming-trunk operator at the same time completes the connection with the called-for subscriber, and rings his bell.

"B" Board.

In the B or incoming-trunk board there are 13 sections, each section consisting of five panels, and having two operators' positions. As there are no answering jacks on this board, the panels are entirely given up to multiple jacks, each panel containing 1,100 of these, with room for an additional 400, when needed. The B board takes care of all the foreign calls or those coming in from other exchanges. Each plug on the board represents the terminal of a trunk from a distant office.

The operation of the B board is as follows: The incoming-trunk operator has connected to her head telephone the calling circuit from the distant office, the trunk lines from which she is handling, and receives the orders of the operators at that office. When a call comes in for a Main subscriber, she immediately tests the called-for line by tapping the tip of her plug on the rim of the multiple spring jack. If the line is busy, a battery click is heard

in the telephone; the operator then inserts the plug into the "busy-back" jack, which sends back over the trunk line an interrupted buzz, thus giving immediate notice to the calling subscriber, as well as the operator at the distant exchange, that the line called for is in use. If it is not in use the incoming-trunk operator immediately inserts the plug and presses the ringing key. This key is dissimilar in construction to those used at the A board, and has connected with it no means of listening in on the circuit. It is virtually a push-button, normally flush with the top of the operator's table. When it is depressed, however, it is latched and held in that position, sending out over the called-for line an intermittent, alternating current, which operates the subscriber's bell. His bell continues to ring intermittently until his receiver is removed from the hook, when a battery circuit is completed, which

FIG. 2. CHICAGO TELEPHONE BUILDING.

actuates an armature, whose function is to trip the ringing key and immediately cut off the generator circuit automatically. Upon completion of a conversation, a disconnect signal in front of the B operator lights up, either by disconnecting the trunk line at the distant office or by the act of the subscriber in hanging up his telephone. The operator then immediately takes down the connection.

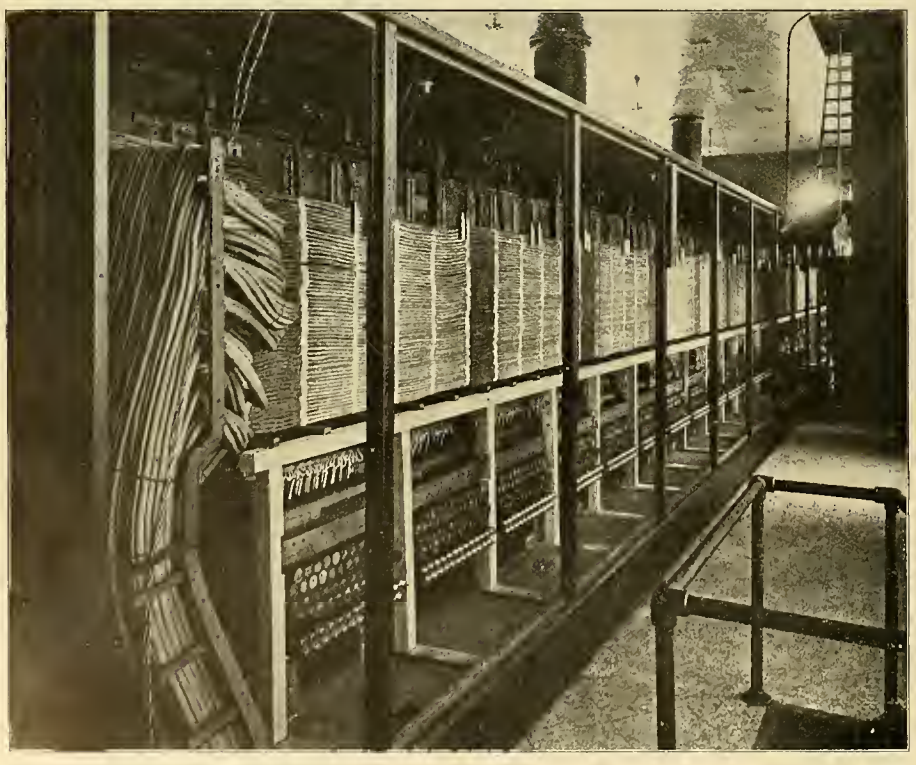


FIG. 6. MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.—BACK OF "B" BOARD.

Operators

The exchange is divided up into divisions, the operators in each of which are in charge of a division chief operator. These chief operators are provided with desks and special apparatus, by which they are enabled to connect with any operator's circuit, and in this manner supervise her work by noting in what manner she replies to the subscriber and gives orders over trunk lines. In addition, supervisory operators are employed, whose duty it is to police the line of operators and see that calls are properly answered and lines disconnected when conversations are over.

There are 61 operators engaged at the A board and 26 at the B board during the daytime. The total number of operators employed at the exchange is 221. The time of service for the day operators is eight hours. The girls go to work in five sections, the first shift beginning at seven o'clock and stopping at four, the last shift working from 9 a. m. to 6 p. m. Each operator has a recess of 15 minutes during the forenoon and also during the afternoon and a half hour at noon. The evening operators (four shifts) work from 4½ to five hours, their periods running between the hours of 4 and 10 p. m. The night operators serve from 10 p. m. to 8 a. m., with two hours off during the night. To make its telephone service more efficient and pleasing to the subscriber, the management is particular when engaging operators to secure only those who have pleasant and agreeable voices. When answering calls the operators are required to speak with a rising inflection, as it is more agreeable to ear of the subscriber.

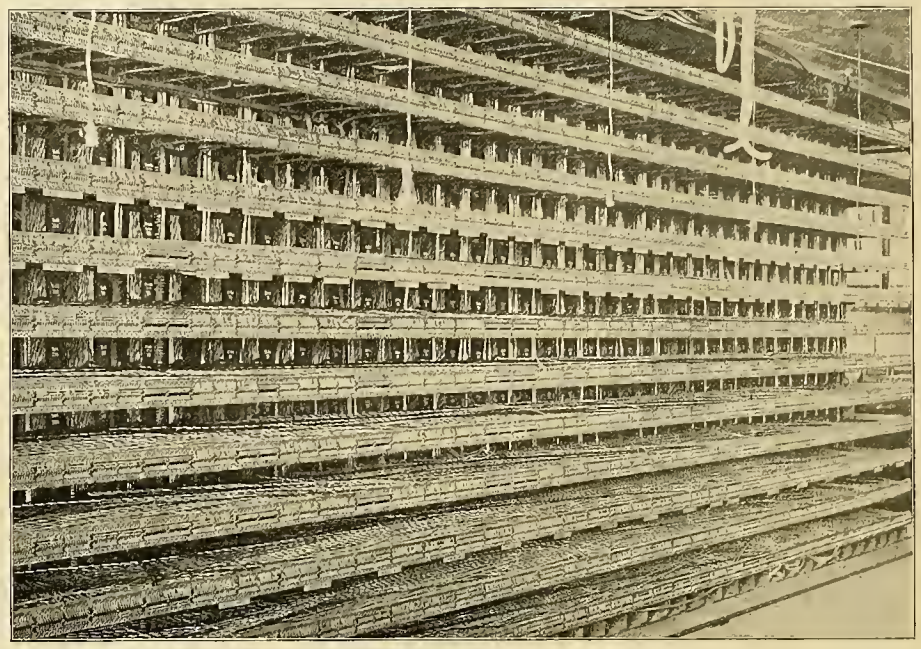


FIG. 4 MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.— CABLE SIDE OF MAIN DISTRIBUTING FRAME

Cable Run.

An important feature of the exchange is the cable run from the street to the switchboards. Coming in through conduits on Washington and Franklin streets are 54 200-pair cables, containing 21,600 wires. Seventeen of these cables come from Washington street, and the others are carried through a tunnel under Franklin street from a point a block and a half south of the building, where the cables branch to different streets. These cables proceed up vertical ducts, laid along the east wall of the building. Fig. 13, on page 85, shows the cables as they turn upward, those coming from Washington street being seen in the foreground.

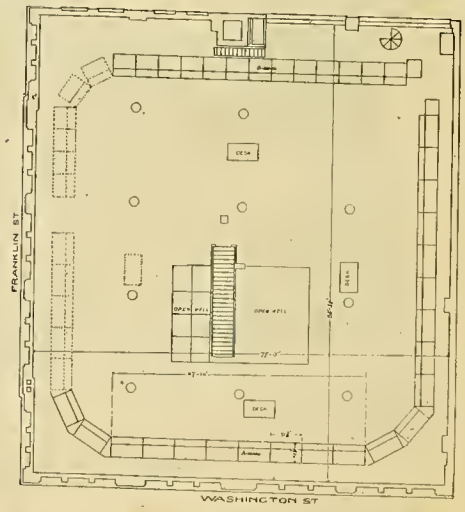


FIG. 3 MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.—FLOOR PLAN OF OPERATING ROOM.

At the fifth floor the cables run into pot heads, in a rack, and then are divided up into 20-pair cables and taken to the main distributing board on the sixth floor, immediately above. At that point they are connected with the usual clips on the horizontal or cable side of the board, and by jumper wires to the proper point on the vertical or protector side of the board. The lines then proceed in 20-pair cables to the intermediate distributing board, located on the seventh floor, vertically above the main distributing board. On the intermediate distributing board branches are taken off to the answering jacks, to the line-signal and cut-off relays and to the multiple jacks. All the switchboard cable wiring is exposed to view between the intermediate distributing board and the operating boards, and is laid upon special wire racks or chutes provided for the purpose. The entire wiring is done in the neatest and most systematic manner.

In Fig. 4 is given a view of the cable side of the main distributing frame. The horizontal racks shown carry the wires as they are distributed from

the 20-pair cables to the contact clips on the front, from which the jumpers lead to the opposite or arrester side of the frame. Fig. 5 shows a portion of the intermediate distributing frame. On the right may be seen a portion of the line and cut-off relays, while on the left is the line side of the intermediate frame, the multiple side being immediately back of it. This intermediate distributing frame gives great flexibility to the system and allows the throwing of any subscriber's line to any position on the operating board.

The lines leading from this frame pass to the floor above and enter the A and B boards at the north-

FIG. 5. MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.—INTERMEDIATE DISTRIBUTING FRAME.

east corner of the room. The back of the B board is pictured in Fig. 6. At the left are seen the 20-pair cables rising from the intermediate frame below. These pass along the board, connections being made to the multiple jacks at each section. Below the cables are resistance coils and relays for lamp signals. At the top of the board are placed an induction coil for each operator, retardation coils, condensers and relays for night signals.

There are 18,000 wires running to the switchboard itself. The total amount of wire used in the switchboard is estimated to have a combined length of 12,000 miles. Other figures concerning the board are interesting. There have been 194,460 spring jacks used in its construction, with 7,910 relays and 7,447 lamps. The number of soldered-wire terminals in the multiple jacks is 1,161,400, while the total number of soldered connections in the entire board is estimated to be 2,000,000.

As stated above, there are about 4,300 subscribers connected to the Main exchange. This, however, represents only about one-third of the telephones in the downtown district, which is now covered by has been a growth in the downtown district of 10,500 telephones, the great majority of which are long-distance instruments, and connected by metallic lines.

Fuse Case and Storage Battery.

The main distributing board described above is located in the wire chief's room, on the sixth floor. In this room are also located the fuse case and storage battery shown in Fig. 7. Current from the battery is used for all purposes in the operation of the switchboard, such as energizing the relays, lighting the signal lamps, etc., and it passes first through the fuses in the fuse case. The fuses are mounted on white-marble panels. Each line on the A and B boards has a one-ampere fuse in its talking circuit, and there are also one-ampere fuses for each operator's transmitter, supervisory fuses, etc. Incandescent lamps are provided at the right of the fuse board as resistance on ringing circuits. The small incandescent signal lamps on the switchboard are 24-volt lamps and furnish a light of about one-half candlepower. The pilot lamps, which are single lamps placed in front of each operator to attract attention to the smaller lamps, are also of the 24-volt type, with about two candlepower. On the shelves, in the supervisory circuits, are 12-volt lamps.

The storage battery consists of 11 Chloride accumulator cells of the type G-25, manufactured by the Electric Storage Battery company. The cells give 240 amperes on a normal rate of discharge and have a maximum discharge of 336 amperes. The capacity of the battery is 1,920 ampere-hours when discharging at the normal rate. Commonly, 10 cells are used, but when the voltage gets too low the eleventh cell is thrown into circuit. The large switch at the end of the fuse case is used for this purpose. On the instrument panel are recording ammeters for the charge and discharge circuits, a voltmeter for all 11, or only 10 cells, and a voltmeter, with switch, for reading the voltage of any individual cell. The voltage of the battery is confined within the limits of 27.5 and 20.5 volts. When the potential reaches either of these limits an alarm sounds and colored signal lamps are lighted. The generator switchboard in the basement is also provided with similar alarm devices, so that the attendant in charge may keep the voltage within the proper limits. As stated above, the battery current is used for all operations of the switchboard, and when the voltage is too high it is equalized with suitable resistances.

Operators' Quarters.

The old switchboard, which was abandoned when the new one was put in service last month, is located on the west side of the seventh floor. When this is removed the entire floor, with the exception of the intermediate distributing room, will be given up to quarters for the operators. The east portion of the floor is already used as a locker and lunch room. In the latter department are provided tables, dishes, a gas stove, ice box, etc., furnished by the company, and the room is in charge of a capable matron. Fig. 8 is a view of the lunch room at the noon hour. Handsome parlors, reading room, toilet and lounging rooms will be fitted up

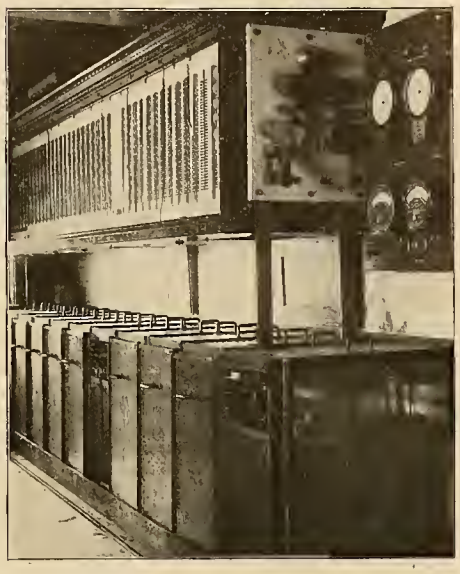


FIG. 7. MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.—FUSE CASE AND STORAGE BATTERY.

manager's office, the traffic department, and the wire chief's and main distributing room, already spoken of. On the fifth floor is the auditor's department and the toll room, where about 60 people are employed. The Chicago Telephone company, in addition to the 12 exchanges which it operates in the city of Chicago, has a network of toll lines in the immediate vicinity, which comprises some 140 cities and villages. The territory which the company operates embraces the counties of Cook, Lake, McHenry, Kane, Du Page, Kendall, Will and Grundy in Illinois, and Lake and Porter counties in Indiana, covering 5,234 square miles and over 2,000,000 population. About 7,500 miles of toll lines are comprised in this system, the principal exchanges being located at Joliet, Evanston, Aurora, Elgin, Oak Park and Waukegan. The lines also touch Lake Geneva and Kenosha, in Wisconsin. Beyond this territory toll-line connections are made with the lines of the Central Union and Wisconsin Telephone companies.

In his annual report to the stockholders for the year ended December 31, 1899, President John M. Clark showed that the company was operating 70 exchanges and 101 toll stations, the total number of exchange telephones in use being 27,663. There were 104 miles of underground conduit, 527 miles of duct, 41,757 miles of wire under ground, 14,445 miles of wire in aerial cables and 18,692 miles of wire on poles, giving a total mileage of wire operated by the company of 74,894 miles. The company employs 2,500 people, the number of operators being 850.

Trunk Lines.

The system of trunk lines connecting the Chicago exchanges is very complete. Each exchange has di-

Fig. 8. Operators' Lunch Room.

Fig. 10. Contract Department.

MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.

Main, Central, Harrison and Monroe exchanges, the total number of telephone operated from these exchanges being about 13,000. Over 9,700 of these telephones are in the district which was covered by Main office prior to the establishment of the Central and Monroe exchanges. The old Main office multiple switchboard, which has now been discarded, was installed in 1888, at which time 2,500 lines were operated in it. Since that year, therefore, there

in the old switchboard room, and everything possible will be done to make the room cheerful and useful. At present the operators' lounging room and parlor are on the sixth floor, but when the new quarters are fitted up these rooms will be utilized for offices.

Toll System.

On the sixth floor are located the city

rect trunk lines with every one of the other exchanges, so that no trunking is done through a third exchange, except in case of emergency. These trunk lines make up a vast network of wires binding all the Chicago local exchanges into one complete system, and so systematic and thorough is the working of the trunk lines that a subscriber experiences no appreciable delay when his call is for a number in a branch office other than the one in

which his line is answered. The following table gives the number of trunk lines connecting Main and the other exchanges, the total number of lines both in and out of the exchange being 781.

Between	In.	Out.
Main and Central	106	92
Main and Harrison	86	83
Main and Monroe	39	34
Main and North	42	24
Main and West	29	32
Main and South	29	29
Main and Canal	21	21
Main and Yards	18	17
Main and Oakland	26	30
Main and Wentworth	10	10
Main and Lake View	10	13

Office Floors.

Passing down to the fourth floor of the building one finds the engineering department, which com-

FIG. 9. MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.—PRESIDENT'S OFFICE AND DIRECTORS' ROOM.

prises the chief engineer's office, drafting room and testing room, where testing of cables, etc., is carried on. The press agents' office and general offices of the American District Telegraph system are also on this floor. On the third floor are the president's office and directors' room, shown in Fig. 9, and offices of the general manager and general superintendent. The second floor contains the superintendent's office, the order and record department and the underground, maintenance and construction departments. The contract department (Fig. 10), the secretary and treasurer's office, cashier and collection departments are located on the ground floor, where they are most accessible to the general public.

Power Plant.

The basement contains, besides the power plant for the building, a locker room and two toilet and wash rooms. Figs. 11 and 12 are views of the engine room. Here are located three direct-connected units for the furnishing of power and light for the building. The engines are of the Ball compound condensing upright type and are rated at 100 horsepower each. Each engine is equipped with an oiling system, by means of which oil is drawn from a reservoir for lubrication purposes, is collected in a tank at the base of the engine, is then forced by air pressure to a filter, whence it is again forced to the oil reservoir, to be used over. The generators are Western Electric multipolar direct-current machines, giving 310 amperes at 230 volts, with a speed of 275 revolutions a minute.

The main switchboard, shown at the left of Fig. 12, consists of 10 panels of white marble. The first three panels are generator panels and are each provided with ammeter, voltmeter, circuit-breaker, three-blade switch and field rheostat. On the bottom of the third panel is a switch in the power circuit of the testing laboratory on the fourth floor. The fourth panel contains a Thomson recording wattmeter for connection on the telephone company's power circuits. The switchboard is also connected with the mains of the Chicago Edison company, so that either Edison current or the company's own current can be used. At present Edison current is being used entirely. For the measurement of this current two wattmeters on the lighting circuit and one on the power circuit are provided on the fourth panel. The fifth panel is a compensator panel, for use with the company's own plant. The remaining five panels control the lighting circuits. These circuits are 10 in number, each of the eight floors and basement constituting a circuit, while the tenth circuit runs to the company's warehouse, located apart from the building. Each panel is provided with a recording wattmeter, circuit-breaker and switch, and the sixth panel also contains a ground detector. The building is lighted by about 1,800 16-candlepower incandescent lamps and six 110-volt enclosed arc lamps. The feeder circuit from the Edison mains to the switchboard has a size of 500,000 circular mils.

In the foreground of Fig. 11 are seen two sets of machines on built-up foundations. The two machines at the left are compensating machines, for taking care of the unbalanced load on the three-wire lighting system when the station plant is operated. Each machine consists of a Western Electric 8½-horsepower motor-generator, operating on 220 volts and generating 110 volts. The two machines at the right are charging sets for charging the storage battery on the sixth floor. The sets are identical, the motors consisting of 10-horsepower, 220-volt machines, while the generators deliver a current of 250 amperes at 24 volts.

At the extreme right of the illustration on a ledge are two telephone-ringing dynamotors. These combination machines operate on a 220-volt circuit and furnish alternating current for intermittently ringing the subscribers' lines and supply the "busy-back" signaling current, the pulsating direct current for party-line service, and also a "howler" current, which is used to vibrate rapidly a subscriber's receiver diaphragm when the receiver is left hanging, thus producing a "howling" sound and attracting the subscriber's attention.

Next beyond the ringing generator is the storage-battery charging board. It is provided with high and low-voltage alarms and bells, a recording wattmeter, voltmeters and the necessary switches for the charging sets. The lower center panel controls the ringing generators and is provided with switches, so that any of the currents from the machines may be sent out over lines to other exchanges.

Other machinery in the engine room comprises the following: An Ingersoll-Sergeant compressor, driven by a Western Electric 25-horsepower motor, supplies compressed air for a pneumatic-tube system used in cleaning out holes about the telephone switchboard, for compression tanks in the elevator system and for the ejector used in the Shone drainage system. A 15-horsepower bipolar motor operates a 12 by 8-inch duplex pressure pump for pumping water to a compression tank on the roof for the hydraulic-elevator system. A 20-horsepower General Electric motor drives a triplex Gould pump for the same purpose. Another triplex pump used for feeding the boilers is driven by a three-horsepower motor. These pump motors are controlled by starting rheostats, switches and speed regulators placed on a board on the east side of the room. Other boards contain gauges indicating pressure and height of water in the elevator tank, and also air-pressure recording gauges for boiler and air pressures, and recording voltmeters.

In the boiler room, Fig. 13, leading from the engine room, are three 110-horsepower Babcock & Wilcox boilers, fitted with Babcock & Wilcox automatic stokers and chain grates. They are used in the winter or in case of emergency. Sheet-iron coal bunkers, with capacity for three carloads of coal, are located at the north end of the room and next to the alley. The coal is dumped into a bucket, and by means of a block and tackle and an overhead track is conveyed to the hoppers of the boilers. An ash hoist is also provided. All the coal is weighed, as well as the ashes, so an accurate account can be kept of the operating expenses of the plant. At the right of the illustration are shown the 200-pair telephone cables referred to previously. A sheet-iron door is provided on rollers, so that the cables are well protected. Other boiler

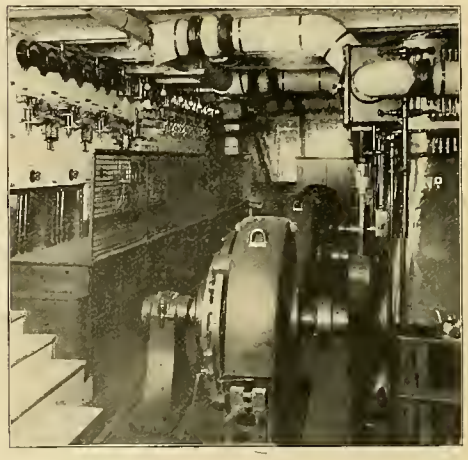


FIG. 12. MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.—MAIN SWITCHBOARD AND GENERATORS IN ENGINE ROOM.

and engine-room equipment includes three injectors for emergency use, an open feed-water heater, a Jewell filter for drinking water, a Worthington 12 by 8½ by 10-inch duplex pump for fire and emergency use, and two Westinghouse nine-inch air compressors.

Ventilating Apparatus.

A very complete heating and ventilating system is installed throughout the building. The heating is done by the Sturtevant system, the fresh air being forced through heating coils in the basement by steel-plate fans. There are three of these fans installed, each being driven by a Sturtevant motor. One of the fans furnishes ventilation for the operating room on the eighth floor and, as it is very essential for the maintenance of the switchboard and also for the benefit of the operators that the air be clean and rid of impurities, it is first washed, then dried and forced into the room. The air is also heated in cold weather and cooled in summer. The washing is accomplished by forcing the air

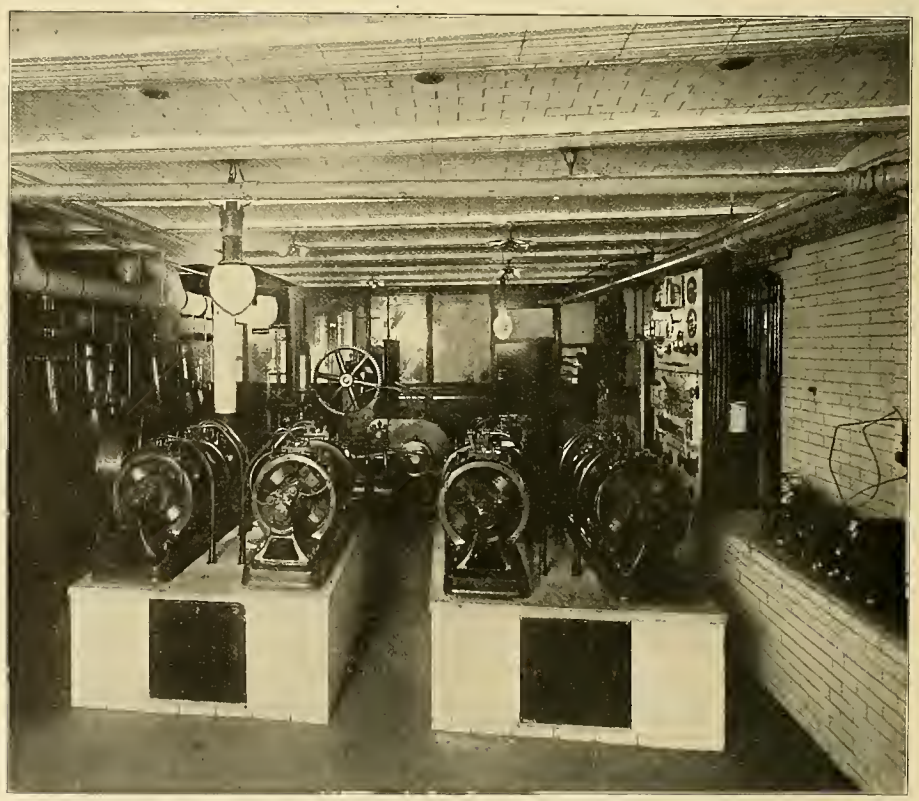


FIG. 11 MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY —ENGINE ROOM.

through fine sprays of running water and then circulating it through tubes with spiral projections, to free it of moisture. In the hottest weather ice is used in the washing chamber, and a temperature is maintained at least 10 degrees below the outside atmosphere.

An artesian well, 350 feet deep, furnishes the water for the building. The pump chamber is 150 feet deep and the pump is driven by a 15-horsepower General Electric motor. If the well water is insufficient, city water is used to supply the demand. Fig. 14 is a view in the ventilating room of the basement. In the pit in the foreground is a jet condenser connected to the returns of the heating system and also to the boilers. It is driven by a 7½-horsepower General Electric motor. The spray pump beyond is operated by a three-horsepower motor. At the left is a board containing the necessary starting rheostats, speed regulators, switches, etc., for the pump and fan motors.

Hot water is furnished in every room of the building, it being heated by exhaust or live steam in the basement. Two Hale hydraulic elevators are used, the cylinders being 14½ and 16 inches in diameter, respectively.

OFFICERS.

The Chicago Telephone company is capitalized at present at $6,500,000, but the capital stock will probably reach $7,000,000 by October 10th. The following-named gentlemen are officers of the company: President, John M. Clark; first vice-president, Byron L. Smith; secretary and treasurer, Charles E. Mosley; auditor, George W. Hutchinson; directors, J. Russell Jones, John M. Clark, Robert T. Lincoln, Arthur D. Wheeler, Byron L. Smith, Albert A. Sprague, C. E. Perkins, William A. Jackson, John E. Hudson, Joseph P. Davis and Chauncey Keep. Angus S. Hibbard is general manager of the company, A. V. Abbott is chief engineer, and F .M. Buck is contract agent. A successor to the late general superintendent, J. E. Zeublin, has not been appointed yet. In the preparation of this article assistance was rendered by G. S. Iredell, private secretary to the general manager.

Fig. 13. Boiler Room Showing 200-pair Telephone Cables.

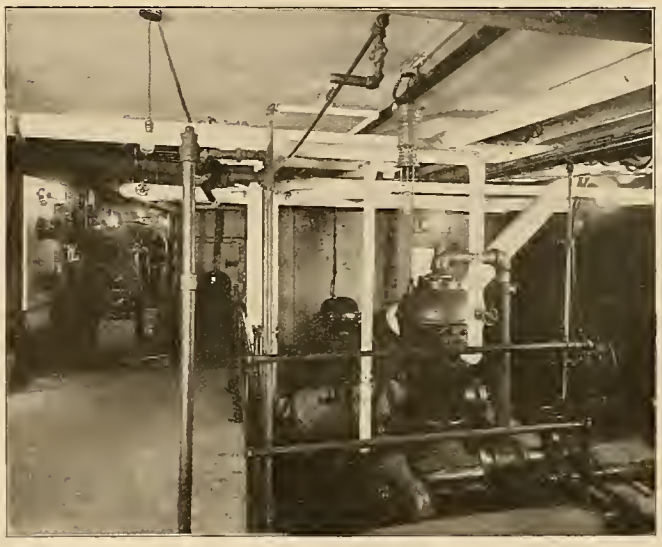


Fig. 14. Ventilating Apparatus.

MAIN OFFICES AND EXCHANGE OF THE CHICAGO TELEPHONE COMPANY.

Tesla Apparatus Tried on Tuberculosis.

Although technical information has not been given out concerning it, the report is that Tesla oscillators, or something of the kind, are being tried by Dr. Croft C. Carroll of 21 East Twenty-fourth street, New York, and the result on two notably bad cases of tuberculosis is said to have been remarkably beneficial. Dr. Carroll is using the apparatus in his public clinic. Dr. John B. Rich, president of the American Microscopical society, is quoted as declaring it the most wonderful demonstration of positive beneficial results that he had ever seen in the treatment of germ diseases. One of the most notable cases cured was that of Dr. E. P. Iliff of Newark, N. J., a specialist in lung diseases, who contracted tuberculosis from one of his patients. He was given up for lost by his brother physicians, and in ten days after being treated was out attending to his practice. Rev. S. W. Switzer, of the Baptist tabernacle, Harrison, N. J., was very low with consumption, but was so helped that he was back on duty in less than three weeks. The principle of the apparatus is said to be the driving through the affected parts of a sufficient quantity of electricity to kill the germs, which are then eliminated from the system by nature.

New Power Plant for the Ottawa Electric Company.

The Ottawa Electric company, the greater portion of whose plant was destroyed in the conflagration of April last, has completed arrangements for reconstruction on a larger scale than ever, and for the installation of a plant for light and power which will be up-to-date in every particular. The hydraulic and electrical equipment will be of the highest grade manufactured.

While the ruins of the late fire were still smoking, the officers of the company were busily employed in providing temporary arrangement which would enable it to supply its customers with light and power until the destroyed plant could be replaced, which would naturally take considerable time on account of the impossibility to obtain electrical apparatus from manufacturers on short notice, and the magnitude of the undertaking. Electrical machinery was obtained from every available source in Canada and the United States, either by purchase or loan. The use of waterwheels was secured in different places, and temporary buildings were erected. With this mixed apparatus, however, the company has experienced the greatest difficulties in maintaining an efficient and full service.

In less than two weeks after the fire, a definite plan of reconstruction had been drawn up and approved by the directors. A new power house will be erected on the site of the old station, which was used for street lighting. A very large amount of waterpower will be developed at this point. The building, which will be about 150 feet long and 46 feet wide, will consist of a steel frame, with walls filled in with brick, and a metal roof. It will be absolutely fireproof, even to the window frames and sashes, and will also be provided with devices for flooding the roof and the walls with water on the outside, to protect them from the effects of heat, due to fires in the neighborhood. The floor will be of concrete, built up from the solid-rock foundations, for the machinery. On the south side of the building pits for the waterwheels will be built, and behind these a flume, of ample dimensions, will carry the water to the wheels. All these will be of steel-frame construction, embedded in concrete, forming walls of great strength and permanency. This is intended to be the main distributing station, and the stone power house, which escaped destruction in the fire, will be remodeled and operated in conjunction with the main station.

In the new building there will be three sets of waterwheels installed, and a place provided for a fourth set, for future requirements. Each set will consist of three 39-inch Victor wheels, mounted on one horizontal shaft. Each set will develop 1,150 horsepower. These wheels have been contracted for with the Stilwell-Bierce and Smith-Vaile company of Dayton, Ohio. The speed will be governed by Lombard governors. This station will be equipped with three, and later four, alternating-current generators, each of 966-horsepower capacity, and two exciter generators, driven by separate turbines, each capable of exciting the fields of all the generators in the station. There will be a direct-current generator of 500 horsepower, especially constructed to supply, in conjunction with the company's storage-battery plant, the 500-volt and 250-volt motors throughout the city. The arc-lighting plant will consist of six arc generators, with a capacity of 150 arc lights each, directly driven in pairs by induction motors of 250 horsepower each. This manner of driving will permit of the street-lighting load being thrown on any generator or on any waterwheel unit, either in the main or in the auxiliary station, thus providing every possible guarantee for an uninterrupted service.

The arc lamps to be used with the system are the direct-current, enclosed-arc, long-burning lamps. The main generators will be directly coupled to the waterwheel shafts, no belting being used, thus securing high efficiency and good regulation. The contracts also include two more generators of 966 horsepower, to be used in the remodeling of the auxiliary station. The main station will contain the switchboard, which will necessarily be an elaborate affair. It will be entirely fireproof, and so constructed that no interruption of service may take place from accidents at the switchboard.

The whole equipment has been carefully designed in accordance with the best modern practice, and it is said that when completed it will be equal to any plant of its size in America. The alternating-current generators, being of the two-phase type, will enable the company to furnish, in addition to its present services, current for alternating-current or induction motors for all power purposes. The contract for the arc-lighting generators has been awarded to the Western Electric company of Chicago, and the contract for the large generators, induction motors and all the other electrical apparatus has been signed with the Westinghouse Electric and Manufacturing company of Pittsburg, Pa.

Telegraph and Cable Lines to Alaska.

General A. W. Greely, chief of the United States army signal service, has gone to Alaska to plan telegraph and cable lines between the United States and Alaska. It is the first project of the kind in which the United States government has engaged, and it would not do so now were not the necessity of military communication becoming very urgent. General Greely, in an interview while in Chicago en route for Alaska, is reported as saying just before he left:

"It is a military wire primarily, necessitated by military conditions, and it will give telegraphic communication between St. Michael's, the military headquarters and all the government forts and stations up the great Yukon valley. Incidentally, it will be extremely valuable to commerce, and will connect the mines with the outside world.

"Two hundred miles of the line will be cable laid down in the ocean. Starting from St. Michael's, the cable will run to Cape Nome, and from that gold-bearing beach across the bight to Unalakilk. Thence the telegraph will proceed, climbing the mountains into the Yukon basin and following up the river to the international boundary line, a distance of another 1,400 miles.

"Some time ago I perfected arrangements with the dominion government, and already the Canadian engineers are building their line from Dawson in the Klondike in a northwesterly direction to meet ours at the boundary. The two governments have joined hands to carry the wires through the heart of the northern wilderness.

"Ultimately it is proposed to complete the circuit by constructing a line from Dawson across country to come out at our own Port Vardez, on the southern coast of the peninsula. The Canadians will eventually carry the line up the Yukon and down into British Columbia, joining it with the wires of the Canadian Pacific Railway."

The Mount Lassen Power company of San Francisco has been incorporated, with the following-named directors: A. Hochheimer of Willows, C. L. Morrill, A. F. Johns and F. Smith of San Francisco; R. M. Saeltzer and H. L. Shannon of Redding, and Park Henshaw of Chico. The company, which is capitalized at $1,000,000, is that which recently purchased Harry Shannon's power-plant site on Mill Creek, near Shingletown. The plant which it is proposed to install is to be an adjunct to that which is planned on the McCloud River, by the McCloud Electric Power company.

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CONVENTIONS AND EXPOSITIONS.

Ohio Electric Light association, Toledo, O., August 14th to 16th.

Inter Ocean Automobile Meet, Chicago, Ill., September 18th to 22d.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

Electrical manufacturers will have no lack of opportunity to display their products at expositions in American cities within the next year or two. The Buffalo and St. Louis exhibitions are in prospect and have been widely heralded. Attention is also called to the exposition to be held at Charleston, S. C., from December 1, 1901, to May 1, 1902, which will be given under the name of the Interstate and West Indian Exposition. The promoters of this show say that it offers an exceptional opportunity for electrical manufacturers to place their various productions before the people of the South. The primary purpose of this exposition is to show to the country and to the world at large the developments of the South during the last quarter of the nineteenth century. It also is the intention of the promoters to make a feature of the exhibits from the West Indies, Mexico and the South American countries, and to show fully the industries, resources and the great possibilities of trade with those countries. One of the greatest attractions of the proposed exposition, it is said, will be the electrical exhibit. It is contemplated to have every department of the electrical industry represented with a large showing of automobiles.

Mr. M. J. Francisco of Rutland, Vt., is an untiring champion of the rights of private proprietorship as opposed to municipal ownership. He commenced to investigate the subject, especially in relation to electric-light plants, as far back as 1885, and he has published a number of articles and pamphlets on the question. His latest contribution to the discussion, "Municipalities vs. Private Corporations," has just been issued from the press in the shape of a book of 172 pages, giving "tables of costs of lights furnished by private companies and municipal plants, a list of municipal plants sold or abandoned, experience of municipalities and legal and editorial opinions." Mr. Francisco is a zealous advocate of private ownership, and his book can hardly be said to be a dispassionate one. Nevertheless, it presents in compact shape a mass of material and statistics hearing on the subject, and central-station men, in particular, will find it of considerable interest. Mr. Francisco takes pains to state that the reports regarding municipal plants are made from city records signed by responsible officials, and this fact adds to the value of the book. The author has, in this particular work, added little that is new to the discussion, but he has made a valuable compilation of facts which he assures us to be reliable.

As compared with steam-railroad practice, electric-railway companies know but little of the performance of the braking appliances in use to-day; and the report of the street-car brake tests of the New York State Board of Railroad Commissioners, summarized in last week's issue of this journal, is a welcome addition to the knowledge on the subject. The report of these tests may be a surprise in many respects. One of the noticeable features is the comparatively good standing of the much-maligned common hand-brake, although it is not by any means so good as to leave nothing to be desired. It is gratifying to note that the improved brakes that stand toward the top of the list in the report on emergency stops are also among the simplest in construction. One thing that has prevented the abandonment of the common hand-brake more than any other is the reluctance of managers to adopt something which was not reliable except when kept in perfect condition, and which involved considerable expense for installation and maintenance. Many improved brakes have been tried and thrown out because of the bad habits of either sticking and blocking the road or of failing in some important emergency. Managers naturally felt that they preferred something a little slower in operation but surer in action.

In view of the growing importance of the export trade of American electrical manufacturers it is well to consider carefully the advisability of fostering and extending this trade by the efforts of a much larger number of foreign traveling salesmen than are now employed by American houses. This question is one not to be lightly disposed of, of course, for the plan involves the expenditure of much money, patience and effort; but for several reasons it gives promise of abundant success. There is no better or more readily adaptable salesman in the world than the American "drummer," and if his energy should be directed more largely to the development of trade abroad, satisfactory results would probably follow.

Up to the present time German manufacturers have paid more attention to the development of foreign trade by means of commercial travelers than those of any other country, and in consequence they are getting a large share of foreign orders that might be secured, perhaps, by American manufacturers if the proper steps were taken. The following are among the more important factors favoring German competition: Zeal in seeking orders; readiness to conform to the wishes of customers in questions of quality, dimensions, appearance and packing; offering quotations in the currency of the country, the seller taking the risk of exchange; quoting for delivery, at the place of consumption, all charges, including duty, paid; systematic inquiry concerning the commercial standing of all likely buyers, so that credits may be given with fair security; rapidity and certainty in date of delivery, and, finally, lowness of quotations.

It may take some time to form a numerous class of American commercial travelers having the necessary qualifications for promoting business in foreign centers, and meanwhile the demands of the comparatively few capable men are so high that firms are seldom inclined to accept them. This difficulty might, it is suggested, be met, to a certain extent, by combinations among houses engaged in different lines of business, but desirous of pushing their trade in the same foreign markets. With the view of assisting such combinations, American chambers of commerce might undertake on a small scale a sort of registry office for commercial travelers, noting their qualifications. German travelers are generally the representatives of several houses in kindred, though different, lines, and thus they secure satisfactory remuneration without too heavy a tax being imposed on their principals.

One would think that with the high price and steady demand for rubber the cultivation of rubber trees ought to be one of the most profitable of agricultural pursuits in tropical and sub-tropical countries. But Mr. O. F. Cook, of the United States Department of Agriculture, who, it is to be presumed, knows what he is talking about, thinks that there is much risk in investing large sums in rubber plantations, even though it is possible that the present high prices for the commodity may be doubled. The risk, according to Mr. Cook, consists in the possibility that a substitute for rubber may be discovered or that new processes may entirely change the rubber industry.

After reviewing the conditions existing in rubber-producing countries, Mr. Cook says: "Whatever the ultimate conclusions from these investigations and discoveries, the great diversity of opinion among students of the subject seems to indicate that we know extremely little about the constitution of the latest or the best methods of extracting rubber, and we may still be far from the place where the invention of processes or appliances of permanent utility is to be expected. Proper manipulation may enable the extraction of rubber from juices not now utilized, so that a new process, as well as a new plant, might at any time revolutionize the whole subject of rubber culture. But while such a revolution would not destroy, it might gradually lessen the value of producing trees, and by taking off the margin of profits completely ruin the prospects and credit of enterprises based entirely on rubber. A realization of this fact, added to a knowledge of former failures, may account for the continued wariness of large investors, in spite of the inviting estimates so freely circulated. The probability is thus increased that the future of rubber, as a distinctly cultural industry, will continue to lie in the direction of its development as contributory to the rise of mixed farming in the tropics rather than in the organization of capital for the exploitation of a single product."

In the meantime, however, rubber continues to rule high in price, as electrical manufacturers know to their cost. Many substitutes for it have been proposed, but have proved unsatisfactory under test. It is altogether likely that rubber will be in active demand for many years. Under these circumstances it does seem that the Agricultural Department expert is unduly apprehensive. Cheaper rubber would be a boon to the telephone and other electrical industries, and it is a pity that capitalists cannot be encouraged to furnish it.

Electricity Versus Gas for Train Lighting.

By Alton D. Adams.

Railway trains seem to be about the last important structures, where power is available, that have not generally adopted the electric light. This fact is not only to the disadvantage of the public, as to quality of service, but also to that of railway companies in the matter of operating expense. Three methods of lighting railway cars are in use, those with oil and gas, very generally, and the electric in a few cases. This condition as to the illumination of railway trains is just about that which existed in large office, mercantile and factory buildings some 15 years ago. Since that time there has been a wide and rapid change to electric light in a large part of such buildings, and the process is still going on. While the superior qualities of electric light have been factors in its application, the actual saving in the cost of operation, over other forms of illumination, has had much to do with its very general adoption in large buildings having power plants. It seems that the advantages of electric lighting that have enabled it to displace oil and gas lamps in large buildings must ultimately bring about a like result on railway trains. So far as the public is concerned, the superior quality of electric illumination is sufficient to give it a decided preference, and its greater safety and economy should appeal to railway managers.

Oil is so generally conceded to be an inferior agent for illumination, and its use in railway cars has proved so destructive to life and property, through fire, at times of accident, that a comparison between gas and electric lighting should determine the most desirable method. On the score of safety from fire, gas represents a great advance over the oil lamp, since in case of accident to a car the gas does not spread flames as quickly and the supply is more easily shut off.

Electric lighting on railway trains represents a greater advance over gas, as to immunity from fire, than does gas over the oil lamp. When a railway car, lighted by gas, is overturned, it is highly probable that the gas flames will set it on fire. If an electrically lighted car is subjected to like usage, it is most probable that it will not be set on fire. To simply overturn an electrically lighted car would have no tendency to start a fire from the lamps, and even were the car broken or crushed so as to destroy the insulation on parts of the wires, the usual result would be to blow a fuse and a fire would not probably result once in 100 times. In those cases where the electric current is derived from machinery located at some one point in a train, a derailment would be apt to break the electrical connections between cars and thus shut off the supply.

Turning from the rather remote case of accidents to the ever-present costs of operation, the electric light can be shown to be decidedly cheaper than that from gas on railway trains. Some idea of the relative costs of the gas and electric-lighting systems may be gained from the materials consumed for a given lighting effect by each. The costs of operation for electric train lighting vary somewhat according to the system used. Storage batteries are the most expensive means for train lighting, not so much on account of the losses of energy in the batteries, which amount to about 15 per cent. of the energy sent into them, as from the items of interest, depreciation, labor and repairs. If electric lighting is to be generally adopted on steam-railway trains, it seems clear that the energy must be generated by dynamos on board, as this plan is at once the simplest and cheapest. With electric current generated by dynamos on the train, conditions approach very close to those that obtain in the ordinary isolated plant.

One of the most important points to be decided for electric-generating plants on railway trains is the method of driving the dynamo. Three plans for dynamo driving present themselves. Dynamos may be driven by steam from the locomotive boiler, used in a special engine; a gasoline or oil engine may be operated for the dynamo, or it may take its power from the car axle.

Two material objections exist to the supply of power for the dynamo from the locomotive boiler; one, that the available capacity of the boiler for hauling the train is thereby reduced, and the other and more serious objection that the dynamo can only be operated while the locomotive is connected with the train. That the reduction in the capacity of boiler available for train hauling is a small matter, may be seen from the requirements of power for lighting purposes. Allowing 30 incandescent lamps per car, each lamp consuming 50 watts, a train of 10 coaches would consume 15 kilowatts, or 20 electrical horsepower, with all lamps lighted. A good engine and dynamo, with capacity for this load, will show a combined efficiency of 80 per cent., as to the indicated power of the engine cylinder, and a simple engine for the purpose should not consume more than 30 pounds of steam per indicated horsepower-hour at full load. The maximum demand for steam on the locomotive boiler should not, therefore, exceed $(20 \div 0.80)\ 30 = 750$ pounds per hour for electric lighting under the conditions stated. So small a per cent. of the locomotive capacity devoted to lighting purposes would not be objectionable in many cases, but might not be admissible in others. From the standpoint of lighting requirements, the necessity for locomotive connection before the dynamo can be operated is certainly objectionable, and turns attention to a system that is free from this defect.

The use of a special steam boiler on the baggage car for the purpose of electric lighting does not seem desirable, but a gasoline or oil engine may well be employed instead of a steam engine for dynamo driving. Petroleum engines, in the sizes suited for driving dynamos on railway trains, and working at from one-half to full load, may be expected to develop an indicated horsepower-hour on 0.8 pound of petroleum, or 0.6 pound of gasoline. Because of the explosive nature of gasoline vapor, the petroleum is perhaps more desirable for use on railway trains. Allowing the petroleum engine and its driven dynamo to have a combined mechanical and electrical efficiency of 80 per cent., one pound of petroleum is consumed for each electrical horsepower hour delivered at the dynamo terminals. Each electrical horsepower of 746 watts is sufficient to operate 15 50-watt incandescent lamps, so that the 300 lamps assumed to be necessary for a train of 10 coaches would require $300 \div 15 = 20$ pounds of petroleum per hour of operation at full load. This includes no wiring or battery loss. A petroleum engine and dynamo in the baggage car would enable electric lamps to be operated in any part of the train, as soon as it was made up, without regard to the presence of the locomotive.

Another method of driving dynamos on railway trains is that by which they are attached to the car axle. This plan combines the disadvantage incident to the reduced capacity of the locomotive for traction purposes, with the further one that when the train stops or has its speed reduced below a certain rate the dynamo is put out of action. In order to compensate for variations in the train speed, within certain limits, the dynamo must be of a special type, more expensive than the usual form. It seems doubtful whether any material advantage exists with a special dynamo driven by the car axle, over one with an independent engine, supplied with steam from the locomotive boiler. In order to render satisfactory lighting service, a storage battery is absolutely necessary on railway cars, where the dynamo is driven by the car axle, as the lamps must not go out when the train slows up or stops. With either a steam or petroleum engine to furnish power for the dynamo, a battery is only necessary if electric light must be had on the individual cars before they are connected with the baggage car. More battery capacity must obviously be had with a dynamo driven by the car axle than when an independent steam or petroleum engine is employed. In either case, however, the capacity of batteries is trifling compared with that necessary to light cars without the aid of a dynamo on the train. On the basis of the above figures, there must be $30 \div 0.8 = 37.5$ pounds of steam taken from a locomotive boiler for each electrical horsepower-hour delivered at the dynamo terminals. Assuming a loss of 10 per cent., which is ample, in the car wiring, and in the auxiliary batteries, the delivery of one electrical horsepower-hour at the car lamps requires $37.5 \div 0.9 = 41.6$ pounds of steam from the locomotive boiler for the dynamo engine.

If the dynamo for train lighting is driven from the car axle, it seems certain that its requirement as to increase of steam in the locomotive cylinders will be at least the amount just stated. If the locomotive boiler evaporates seven pounds of water per pound of coal burned, one electrical horsepower-hour, delivered at lamp terminals, requires the consumption of $41.6 \div 7 = 6$ pounds of coal. Allowing the same loss of 10 per cent. in wiring and batteries, when a petroleum engine is used, each electrical horsepower delivered to the lamps requires 1.1 pounds of petroleum in the engine. As incandescent lamps of the 50-watt, or other usual size, yield one-third of a candlepower per watt, six pounds of coal or 1.1 pounds of petroleum furnish, through the agency of engine and dynamo, $746 \div 3 = 248$ candlepower-hours. One thousand cubic feet of oil gas for car lighting can be produced from about 99 pounds of petroleum and 96 pounds of coal. This oil gas yields about 12 candlepower hours per cubic foot, in open-flame burners, or 12,000 candle hours for the 1,000 cubic feet. As the petroleum consumed to produce this 1,000 cubic feet of oil gas is 90 times as much as that necessary to supply one electrical horsepower-hour to incandescent lamps, and the consumed coal is 16 times as great in amount, the petroleum and coal would generate $248 \times 106 = 26{,}288$ candlepower-hours at electric lamps. This is more than twice the amount of light derived from this fuel when employed to generate oil gas.

The plant for oil-gas production and the car equipments for its use cost probably somewhat less than do engines, dynamos, batteries and wiring for equivalent illumination, but the large saving in materials consumed, by the electric system, much more than offsets the greater first cost.

Owing to the increasing number of poles on the streets at Aurora, Ill., a meeting was called last month to consider the question of the consolidation of pole lines of non-competing companies as far as possible. Representatives of the city and the electric companies were present. The result of the meeting was satisfactory and the work of weeding out poles will begin.

Electrolysis Investigation at Providence.

A. A. Knudson of New York city has recently been investigating the electrical condition of the water system at Providence, R. I., for that city with a view to determining the danger from electrolysis. From a reading of the report it appears that conditions exist which are very favorable to electrolysis in a number of cases. The bad conditions were in most cases fully accounted for by the poor shape the track bonding was in. In a number of cases five or more volts difference of potential was found between the tracks. In some places extra high readings were definitely accounted for by discovery of broken bonding. In regard to "perfect bonding" Mr. Knudson says:

"A perfect rail bond should continually equal the conductivity of the rail itself. Some bond makers claim a conductivity of 100 per cent. of continuous rail. The 'cast-weld' is one of these. Others claim 80 to 90 per cent. The actual efficiency of bonds tested will be understood when it is stated that through one lineal foot on an ordinary-sized rail it is seldom that one millivolt difference of potential can be obtained, or 0.001 volt; whereas, in many of these tests, in which the joint is included in the lineal foot, the difference of potential is more than one volt, and in two instances it rises to six and nine volts. One-tenth volt is considered excessive and indicates that the bond is losing its electrical contact with the rails.

"It is even more important that the contact between return track feeders and rails should be perfect. Only one such point was examined, at the junction of Plainfield street and Hartford avenue; this showed differences of potential between the feeders and rails as follows: First rail, 0.3 volt; second rail, 0.2 volt; third rail, 0.2 volt. Wherever these differences of potential occur, the tendency is to an increased diversion of current into the ground and water mains."

In regard to the actual condition of the pipes, as found by excavation, the following extract from the report gives a fair idea:

"At the 11 excavations made the water mains were carefully examined for evidence of electrolysis, and tests for current flow through them were made at each place. Most of them were in soil which was sandy, and in some cases hardly damp, although there had been recent rain; this condition of soil is not such as to favor the flow of current from the mains owing to its high electrical resistance, and thereby to cause electrolytic action at such points.

"In some cases, however, where the soil was more favorable, and the current flow in the main found excessive, electrolysis pittings have been found, but not of an immediately serious nature so far as could be seen, as in all except one case the action was found on the bell end of the joint, where the metal is heavier than at other portions. The exception mentioned was at the excavation on Hartford avenue, near the junction of Plainfield street and Manton avenue, where the effects of electrolysis were found at the spigot side of a joint, the current of the pipe flowing in the reverse direction in relation to the joint. This is a condition which should cause concern and warrant early attention, for, although the damage is not serious, as found at this point, there may be many other joints in this main located where more favorable conditions prevail and cause electrolysis to be more active and damaging."

Another Cable to Europe Opened.

On August 3d the Commercial Cable company put in operation its new cable from New York to the Azores, where connection is made with the Europe and Azores company's line to Lisbon, Portugal. This is the first direct line from the United States to Portugal. The Europe and Azores company's cable makes connection at Lisbon with the Portuguese land line, the Eastern Telegraph company's cables to Spain, the Mediterranean ports, all Africa, India, China, Japan, Australia and the Philippines, and with the Western Telegraph company's cables to Brazil, Argentina and other parts of South America. The new route via the Azores is the most direct, shortest and quickest to all of these countries. The rates from Europe will be exactly the same as those in force by the existing cables of the North Atlantic cable companies. The completion of this new ocean circuit is the most important development in ocean cable extensions in many years. President McKinley exchanged felicitations with the king of Portugal and with American residents in the Azores at the time of the opening.

Charged Barbed Wire on Fence Top.

A dispatch from Wheeling, W. Va., says: "The National Steel company, which has repeatedly refused to sign the Amalgamated association scale or to negotiate except for a straight reduction, has begun building a ten-foot tight-board fence around the 120 acres occupied by its plant at Mingo Junction. The fence is of two-inch planks, with foot-square cedar posts. On top will be placed four strands of barbed wire, two wires to be constantly charged with a killing current of electricity. Workmen expect an effort to start the plant with non-union labor as soon as the fence is completed."

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

Arthur Adams, an employe of the Little Wolf River Telephone company, at Fond du Lac, Wis., has been elected superintendent of construction for the Waushara County Telephone company.

The Wisconsin Telephone company is putting in a new switchboard for its North Side exchange at La Crosse, Wis.

A stock company has been formed by business men at Baldwin, Wis., to establish a local exchange.

The Southern Electric Telephone company has installed a new switchboard in the Redwood Falls, Minn., office.

G. O. Miller, a merchant of White Rock, Minn., has constructed a telephone line to Cannon Falls, Minn., by way of Spring Garden. There are 15 farmers along the line, who can now order their goods from the store without leaving their homes.

The Wausau Telephone company is building a line from Wausau, Wis., to Sunset, via Nutterville.

The Duluth and Iron Range Railway company is building a long-distance telephone line between the towns on the Iron Range and Duluth, Minn.

The receiver of the North Dakota Telephone and Electrical company of Jamestown, N. D., finds that the company is in good shape. Its debts amount to $1,700, with property worth many times that figure, and of the $1,700 there is $1,200 which was to be settled in stock, leaving a net debt of but $500. The line is about 150 miles long.

Work has been begun improving the system of the Mutual Telephone company at Des Moines, Iowa. The directors of the company favor a complete reorganization of the company and changing it from a mutual to a stock company, in order to get in additional capital.

The Hawkeye Telephone company will extend its lines from Panora, Iowa, along the Jefferson road.

Citizens of Windham want the Johnson County Telephone company of Iowa City, Iowa, to extend toll wires there.

The Farmers' Mutual Telephone company of Liberty township, near Sigourney, Iowa, has formed an organization and will construct a farmers' system.

Efforts are being made in the council of Marquette, Mich., to allow the Marquette County Telephone company to have 12 years in which to put its wires underground. The Michigan Bell company has been in possession of the field that much longer than its young rival. The Michigan company is willing to put its wires underground at once.

The Mississippi Valley Telephone company has been granted a franchise for a local system at Wapello, Iowa.

The Iowa Telephone company is rebuilding its line between Davenport, Iowa, and Walcott.

The Elwood Telephone company of Sac City, Iowa, has completed a line to Lytton, Iowa, where connection is made with the Rockwell City company.

The Central Telephone company of Rockwell City, Iowa, has arranged for all-night service hereafter.

The Home Telephone company of Oskaloosa, Iowa, has connected with Sharon.

The Spokane and British Columbia Telephone company, which has been refused admittance to Spokane, Wash., may cross the mountains and connect with Seattle or Tacoma. As the company has valuable toll connections with mining camps north of Spokane, it would divert considerable business. Inasmuch as Seattle has been in the throes of a contest with the local company, the Spokane company would hardly have any trouble in securing a local franchise.

A telephone line is projected from Faribault, Minn., to Shieldsville, Minn.

A local company at Republic, Wash., has been organized to build a line to Keller, 50 miles, and thence to Daisy.

The Iowa Telephone company has installed a system, with 18 connections, at Clarinda, Iowa.

The telephone operatives of the Sunset Telephone company at Tacoma, Wash., have petitioned the company for an increase in wages corresponding with the increase tendered the striking operatives at Seattle.

The local exchange at Beresford, S. D., is nearly completed.

The Farmers' and Merchants' Mutual Telephone company has been formed by residents of Delphos, Iowa, and Allendale, Mo.

The Home Telephone company of Marion, Iowa, is about to lay 800 feet of new cable and to add another section to the switchboard.

The Sunset Telephone company of Olympia, Wash., is about to add a section to its switchboard.

R.

A dispatch from Springfield, Mass., says that the Automatic Telephone company of that city wants a long-distance connection with the Massachusetts Telephone company, which was recently granted permission to put its line through the city. The long-distance line is being built from Boston to New York and points West. By the terms of the franchise given to the Massachusetts company by the Springfield City Council that company cannot establish a local business in Springfield, but the combination of interests would give the Springfield company the benefit of projected connections, which the big rival of the Bell concern is to make as rapidly as possible in that section.

Interstate Telephone Association.

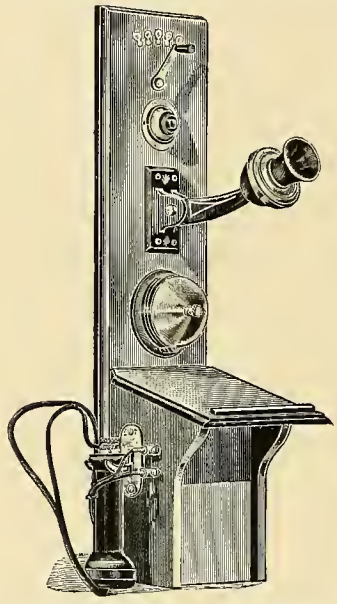
The Interstate Telephone association, of which Charles R. Duffin is president and Henry A. Coit secretary, met in Terre Haute, Ind., on August 4th. The association is composed of Independent exchanges in Eastern Illinois and Western Indiana, and there are several hundred towns connected in the association's district. A basis was arranged at the meeting for pro-rata charges for long-distance service where more than one company's lines are used.

Representatives were present from Danville, Casey, Hume, Oakland, Ridge Farm, Chrisman, Mattoon and Marshall, in Illinois, and Terre Haute, Rockville, Clinton and Greencastle, in Indiana. The Kinloch Long-distance company of St. Louis is now building a long-distance line from St. Louis to Indianapolis, which will pass through Terre Haute, and from Indianapolis to Cleveland another company is building a line.

When the circuit is completed it will reach Boston, Philadelphia and New York. The Independent companies now have service west from St. Louis to Kansas City. The Citizens' Telephone company, which is constructing an independent plant in Terre Haute, expects to be ready for service in a month or two.

An Improved Inter-communicating Telephone.

In the accompanying illustration is shown a new form of warehouse or intercommunicating telephone, which is said to have some new and highly



IMPROVED INTER-COMMUNICATING TELEPHONE.

commendable features. This style of instrument can be equipped with an intercommunicating switch of any number of points, up to 20, the lever being secured with a lock nut, making a quick and reliable contact. The transmitter is of the long-distance type, the cup and arm being cast in one piece with concealed cord. It is said to be very simple in construction, very sensitive and a splendid talker. The hook is new, having rubbing and positive contacts, and the receiver is of the double-pole style.

The switch points, lever, push-button, mouthpiece, bell and hook are all heavily nickeled, and mounted on a neat, quartered-oak back-board. The whole presents an attractive appearance, and constitutes an instrument that is guaranteed by the manufacturers to give the user the best of satisfaction. This telephone is made by Thomas, Wilcox & Dietz of Cleveland, Ohio, who are making a specialty of intercommunicating telephones, in both wall and desk styles.

Trouble at Seattle.

The Sunset Telephone company has been having considerable trouble with its Seattle, Wash., exchange. First the operators struck for shorter hours and more pay. The company would not compromise and began to replace the strikers with inexperienced help, whereat the service became very poor, or worse than nothing. Then the business men waxed wroth over the matter, and after several indignation meetings the Seattle Chamber of Commerce demanded that the experienced girls be reinstated. The company offered to take back all but the leaders of the strike, but the business men insisted on all being taken back. Upon the company refusing this, subscribers began to order out their telephones, and it is said four-fifths of the instruments have been ordered out.

A telephone line is being constructed from Denton to Queen Anne, Md.

Notes from Ohio.

The United States Telephone company is constructing a long-distance line to Wapakoneta to Celina, which will give that town direct connections with Cleveland.

An independent line is being constructed from Bucyrus, Ohio, to Plankton. The material is all on the ground for the work.

The suit of L. C. Edgar against the United States Telephone company for $3,000 damages in the courts at Bowling Green has been settled. It is understood that the company has agreed to pay something like $500. Mr. Edgar was injured while riding in a buggy, by being caught in one of the company's wires, which, in some way, was left hanging too low.

The Columbiana County Telephone company is negotiating for the purchase of the Phœnix line, and it is thought the deal will soon be closed. Communication with Steubenville and Pittsburg will be established by September 1st.

The Independent Telephone company will ask for a franchise at Springfield within a short time. It is very likely that there will be a hot contest in that city.

Captain Gilmore of the United States Telephone company has just completed a new exchange for the Portsmouth (Ohio) Telephone company, and it is now in good working order.

The Star Telephone company of Ashland, Ohio, has arranged to build a line to connect with the People's Telephone company at Shelby. Work on the construction will begin within a very short time.

Harry Wolf has resigned his position as inspector of the Central Union company at Gallipolis, and is succeeded by Harry Howe.

The Columbiana County Telephone company has given a mortgage to the Euclid Avenue Trust and Savings company of Cleveland for $300,000, the trust company acting as trustee. The mortgage is given to cover an authorized issue of the same amount of gold bonds.

The coroner of Crawford County has rendered a verdict to the effect that J. E. Zeublin, who stepped off a Pennsylvania train near Bucyrus and was killed, committed suicide. The verdict seems to have been arrived at mainly through the fact that he had not been in the best of health for some time and because he had made a remark or two to his wife that might be construed to mean something of the kind after such an accident had happened. His friends in this state do not believe he intentionally took his own life, however. They say his financial affairs are in good condition, and that he had one of the happiest homes in Chicago. His health was not alarmingly bad, and there was nothing to cause him to brood over it to such an extent that he would want to cut his life short at a time when he could enjoy it most. Many persons have censured the Pullman company for having allowed the vestibule door to be unlocked so that anyone could open it, as Mr. Zeublin did.

O. M. C.

National Telephone and Telegraph Company.

A Philadelphia dispatch in the Boston News Bureau reads as follows:

"It is said that the permanent officers of the National Telephone and Telegraph company will be announced about the middle of August. The statement is denied here that the officials of the Massachusetts Telephone company of Boston Knickerbocker Telephone company of New York and the Boston and New York Telephone company will have any connection whatever with the new company, nor will the properties controlled by the Independent telephone companies comprise any part of the National company's assets.

"The scope of the National is far greater than can be imagined, and it is believed here that the assets of the company will finally consist exclusively of properties working under contracts with the American Bell Telephone company and the telegraph and cable properties now owned by the Western Union Telegraph company, Commercial Cable company, German Cable company, Postal Telegraph company, Hayti Cable company, the Inter-Ocean Telegraph and Cable company and the Mexican and South American Cable company. The company will be largely interested in the new Pacific cable system, and will extend its ownership of cables to other companies."

Rats and Ferrets as Accessories in Conduit Wiring.

In Waterloo, Iowa, the work of laying conduit for the Cedar Valley telephone system has been going on recently, and ferrets have been used for pulling threads through the conduit ducts. A rat is put in the duct and after he has about 15 feet start a ferret is let in after him. The ferret is hitched to a spool of thread and draws the thread after it as it chases the rat to the other end of the duct. With the thread a stronger string is pulled through and finally a pulling-in wire. The scheme is said to be a great success.

The Columbiana County Telephone company of East Palestine, Ohio, has increased its capital stock from $200,000 to $300,000.

Rochester Strike Trouble Renewed.

Trouble over the strike of the linemen of the Bell Telephone company at Rochester, N. Y., has again broken out, and the company has asked the city for police protection. A few days ago it was thought that the strike had been settled, as an agreement which was satisfactory to the representatives of the local strikers had been submitted to them by the company. The company's communication was sent to Buffalo, and the Buffalo strikers saw fit to reject it. Then no agreement could be reached in Rochester. The strikers' representatives had agreed that there should be no trouble, and the promise was kept until just recently. But attacks again have been made upon non-union men and several of them have been badly beaten. Now the company has decided that the time for concessions has passed, and after a conference a new policy was decided upon, and the company announces that there will be no recession from the stand taken. From now on it is announced that every effort will be made to protect men working for the company and that all unlawful attempts at interference by strikers or sympathizers will be resented and the guilty persons will be prosecuted. The several cases now pending in the Police Court against strikers charged with rioting will be vigorously pushed.

EXTENSIONS AND IMPROVEMENTS.

The Washington County, Md., commissioners, on July 31st granted the Pennsylvania Telephone company a right-of-way through the western section of the county. A new telephone line will be built through Maryland from Pennsylvania to West Virginia.

The Smithfield Telehone company of Smithfield, N. C., has sold out to the Home Telephone company. It is stated that about $500 will be spent by the new company in general improvements, also that a number of outside towns will be connected with Smithfield.

The Pittsburg (Kan.) Telephone company expects to be in operation August 15th, with about 250 subscribers. It is building lines to Fort Scott and Weir City, and through Fort Scott will get connection with Kansas City over the Kansas Telephone company's lines.

The long-distance telephone line from Richmond, Va., to Louisa Court House was completed and tested on July 31st. The service between Richmond and Gordonsville opened for regular service on August 1st. The long-distance telephone company of Virginia expects, in the early future, to complete its connections to Staunton, and from there to the principal points in the Shenandoah Valley, and also in the southwestern part of the state.

NEW COMPANIES.

A new company, the Williamston (N. C.) Telephone company, has been incorporated, with a capital stock of $900.

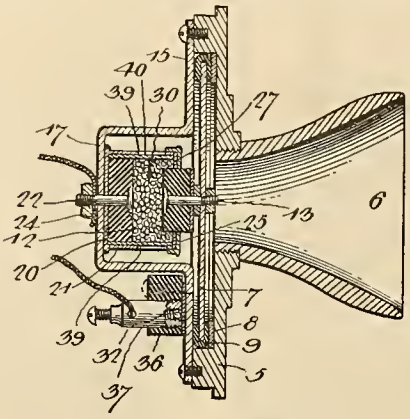
The Greensboro (N. C.) Telephone Exchange has been incorporated, with a capital stock of $50,000. The incorporators are T. J., V. C. and C. M. McAdoo and R. M. King.

The Glenn Springs (S. C.) Telephone company, with $500 capital, has been granted a charter. The officers are: A. O. Simpson, president and treasurer; A. Z. Cates, vice-president, and R. C. Sampson, secretary.

A company has been organized to connect the sea islands, off the coast of South Carolina, with Charleston. The capital is $10,000 and the company is known as the Sea Island Telephone company, with headquarters at Charleston.

The West Telephone Transmitter.

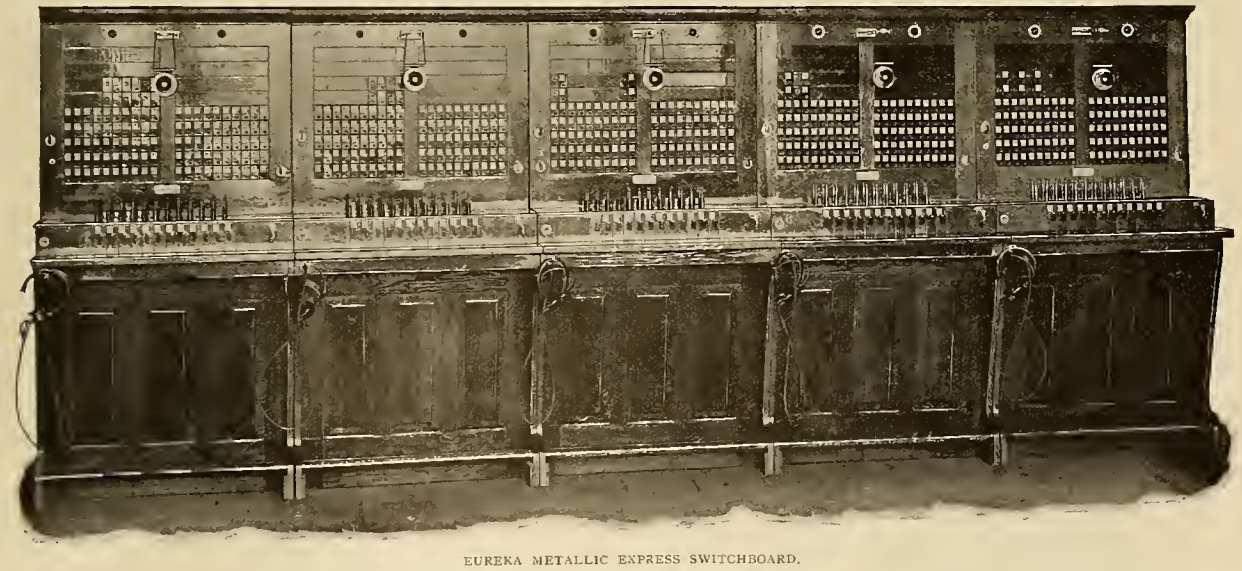
James L. West of Omaha patented on July 17th a form of telephone transmitter that may be of interest. The construction is made plain by an inspection of the accompanying diagram. It is a granular-carbon transmitter, in which the carbon (30) is held between the carbon electrodes (20) and (27). The diaphragm (7) is held in place by spring fingers (not shown in the cut) fastened to the rear face of the plate (5), so that the diaphragm is free to vibrate. To show the condition of the carbon, the openings (39) in box (21) are mica windows, which are transparent.



WEST TELEPHONE TRANSMITTER.

Eureka Metallic Express Switchboard.

The accompanying picture illustrates one of the latest productions of the Eureka metallic express switchboard, equipped for a capacity of 1,000 lines, with 500 lines installed, and with pilot, flashlight supervisory visual signals. The Eureka Electric company of Chicago, the manufacturer, has quite lately placed several of these installations, and its large boards are said to be giving the same general satisfaction as all of its smaller boards have in the past. This company is now entering the field on large boards, and is able to furnish systems for central-energy work, either for local battery or centralized battery, with pilot-lamp visual signals operating in the transfer as well as in the line drops.



EUREKA METALLIC EXPRESS SWITCHBOARD.

The Eureka switchboard, according to the manufacturer, is the fastest operating board ever produced.

The Eureka company is distributing circulars and catalogue matter, describing its high-grade line of telephones and switchboards, particularly its new transmitter and other specialties that it has entered in its line of apparatus within the last six months.

The Shock that Hurt Him Most.

From Waynesburg, Pa., comes a tale of disaster that carries with it both a practical lesson as to the need of efficient lightning arresters on telephone lines and an illustration of the fact that it isn't always the electric shock that hurts the most, after all. It seems that the Rev. J. F. Garvin was using the telephone in his home, "when," to quote the language of a press dispatch, "such a strong current of natural electricity came in over the wire that he was badly shocked. Not being able to drop the instrument, and realizing his danger, he jerked the box loose from the wall. The chief damage was to his ankle, where the box struck with force in falling."

GENERAL TELEPHONE NEWS.

The Bisbee Telephone company is again seeking a franchise from the city of Macon, Ga.

The Denison (Texas) and Preston Telephone company has completed the extension of its line to Woodville.

At Salisbury, N. C., recently, nearly the entire telephone system was burned out during an electric storm. The damage has been repaired.

In Egypt the telephone operators are all men, and they are required to be expert linguists, speaking English, French, Italian, modern Greek and Arabic.

The Pacific States Telephone company made a net gain of 812 subscribers in July. The total number connected is 77,302, which includes 19,332 in San Francisco.

The work on the private telephone line, to be built by the sanitary district along the drainage canal, from Lockport to Chicago, for use in regulating the canal flow, has been begun.

The Erie telephone system made a net gain of 2,121 subscribers in July. The total number connected July 31st was 128,576, while the number waiting connection was 4,405.

The New Concord Telephone company of Muskingum county, Ohio, with $10,000 capital, has been incorporated by L. J. Graham, A. M. Shipley, S. W. Loviner, T. J. Rader and John B. Bain.

A new toll-line company has been formed at McKinney, Tex., to build a line from Bates, Denton County, through several villages to McKinney. Work has already commenced. J. B. Roy of Bates is manager. The directors are Capt. W. A. Rhea, J. H. L. C. English, H. T. Robertson and Jake Bryan.

The Santa Fe Railroad company has established a private telephone system connecting the block-signal stations on its eastern, middle and Chicago divisions. Careful experiments will be made to see if the telephone is practical for the transmission of train orders.

There have been several changes in the New York and Pennsylvania Telephone company recently. W. J. Garvey has been promoted from local and district manager at Binghamton, N. Y., to district superintendent at Elmira, N. Y. E. B. Rogers, formerly district manager, becomes assistant general manager. The local manager at Binghamton to succeed Mr. Garvey is Clayton Sexsmith, formerly chief inspector at that place.

The American Telephone and Telegraph company, formerly the "Bell," continues the practice of issuing a monthly statement of the instrument output, and the showing for the month to July 30th is one of the best recently submitted. It shows a gross increase of 17,000 instruments and a net gain of 5,000. For June the statement showed a gross decrease, compared with the corresponding month of 1899, amounting to 6,000 instruments and a net decrease of 16,000. May's comparisons, in lesser degree, reflected similar conditions. For the month ended July 20th and seven months to that date the comparisons show:

Month July 20th.	1899-1900.	1898-99.	1897-98.
Shipments	65,463	48,873	21,551
Returned	30,093	18,028	10,011
Net output	35,370	30,845	11,540
Since December 20th.			
Shipments	411,609	389,899	187,884
Returned	162,753	109,765	83,306
Net output	248,856	280,134	104,578
Instruments in use	1,829,227	1,404,980	1,025,599

Western Electric Company's Exhibit at Paris Exposition.

The American exhibit of the Western Electric company at the Paris Exposition is in the Electrical Palace, on the ground floor, facing the main aisle, which runs the full length of the building, and occupies a space 60 by 30 feet. It has exhibits in three classes of group five, namely: Class 23, for the production and mechanical utilization of electricity; class 25, electric lighting, and class 26, telegraphy and telephony. The principal exhibit is in the last-named class. The whole exhibit is very interesting and instructive, not only on account of first-class apparatus being shown, but because everything is in practical operation.

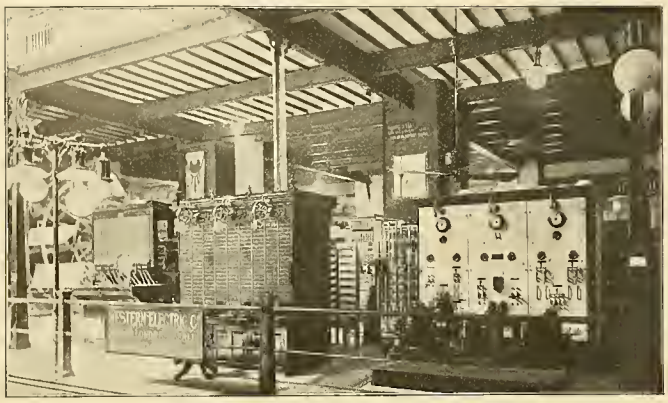


Fig. 1. Common-battery Telephone Exchange.

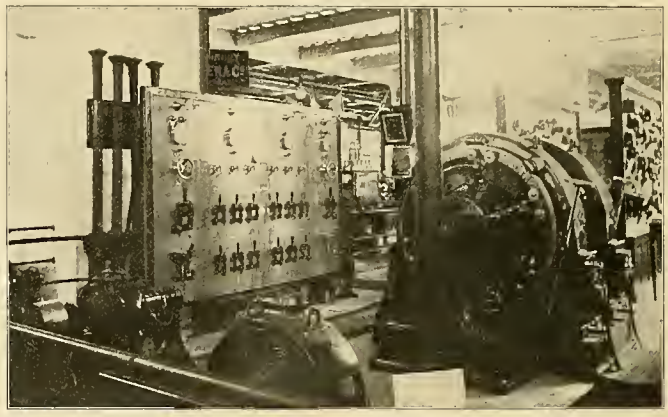


Fig. 3. Twin Motor-generator and Switchboard.

WESTERN ELECTRIC COMPANY'S EXHIBIT AT PARIS EXPOSITION.

The principal features may be classified as follows: A complete telephone exchange in operation; a complete line of telephone instruments; a complete line of telegraph and testing instruments; a complete line of fire-alarm apparatus; street-railway supplies for overhead-trolley construction; an electric-lighting and power-distribution plant in operation; enclosed-arc lamps for direct and alternating currents; fan motors; models of the Chicago and New York factories; samples of electric-light and telephone cables and cable-terminal boxes.

The telephone exchange illustrates the common-battery system, and has a capacity of 18,000 lines. Only 20 lines are in permanent operation, however. These lines are connected with various American exhibitors in groups four and five, and, by means of three trunk lines, connecting with the central exchange of Paris, service is given not only to all parts of Paris, but to American exhibitors at Vincennes. As Vincennes is about six miles from Champs de Mars, and as many of the exhibitors have exhibits at both places, this service is a great convenience.

The complete exchange is shown in Fig. 1, with the exception of the battery plant. The power plant for the telephone exchange is installed in duplicate and consists of one charging generator, direct-driven by a 220-volt motor, and one charging generator, direct-driven by a 440-volt motor, each generator having a capacity of 40 amperes at 30 volts at 1,150 revolutions a minute. There are also two ringing dynamotors, one operating from the power mains at 220 volts primary, and the other operating from the battery at 24 volts primary. The dynamotors are supplied with busy-back and tone-test attachments.

In the morning it is necessary to use the battery alone for operating the exchange, as power is not available from the 220-volt mains before 10:30 a. m. The switchboard for controlling the charging generators, ringing dynamotors and battery is made of white Italian marble, on which are mounted all-copper switches, with connections on rear of board.

The battery plant, which is located at the rear of the power switchboard, consists of 11 cells, installed in a large mahogany case with glass windows, made to correspond with the woodwork of the telephone switchboard and power-board. The telephone instruments comprising wall, desk and table sets for common-battery and magneto systems are artistically arranged on two "cloisons," erected at the rear of the storage-battery case. There are also shown two types of portable telephone sets, especially adapted for campaign service.

Beside the multiple-telephone switchboard, on the opposite side from the power plant in Fig. 1, is shown a telegraph switchboard for 50 lines. This is also shown on the right of Fig. 2. This board is made with glass windows at the side and glass doors at the rear, so that all details of construction are open to inspection. The telegraph and testing instruments are at the rear of the space in a large showcase, the former consisting of quadruplex, as well as private-line instruments. The testing instruments consist of tangent and astatic galvanometers, standard and adjustable rheostats and condensers, combination sets and portable testing sets.

FIG. 2. WESTERN ELECTRIC COMPANY'S EXHIBIT AT PARIS EXPOSITION.—MODELS OF CHICAGO AND NEW YORK FACTORIES.

The fire-alarm apparatus occupies a table and a portion of a large column near the rear of the space. Two types of alarm boxes are shown, the key and the keyless, such as used by the city of Chicago, also a 14-inch mechanical gong for station service and a joker set for the office, with the facile-pen register and repeater. The apparatus is in practical operation.

The electric-lighting and power plant shown in Fig. 3 consists of a six-pole, 75-kilowatt, 110-volt compound generator, directly driven by a 220-volt motor of the same type at 275 revolutoins a minute. Both machines are erected on one subbase, with a common shaft. This rotary transformer furnishes current for the various arc lamps, power motors and fan motors scattered about the space. Current is taken from the exposition mains, through the marble switchboard shown in Fig. 3, transformed, and then distributed through the same board. The switchboard shown is of red Tennessee marble, surrounded by a metal border of oxidized copper. It is open on the rear, so that all connections may be easily inspected. The board is wired for six motor and six lighting circuits.

There are three types of motors shown, the open, the semi-encased and the encased type, ranging in output from three-fourths horsepower to 15 horsepower, and also illustrating the slow, intermediate and moderate-speed motors. With an encased motor of three-horsepower capacity is shown a back-gear attachment, with wall and ceiling carriage. A feature of the back gear is that it may be operated from either side or from the top of the motor. It may also be removed from the motor without dismantling the bearing brackets.

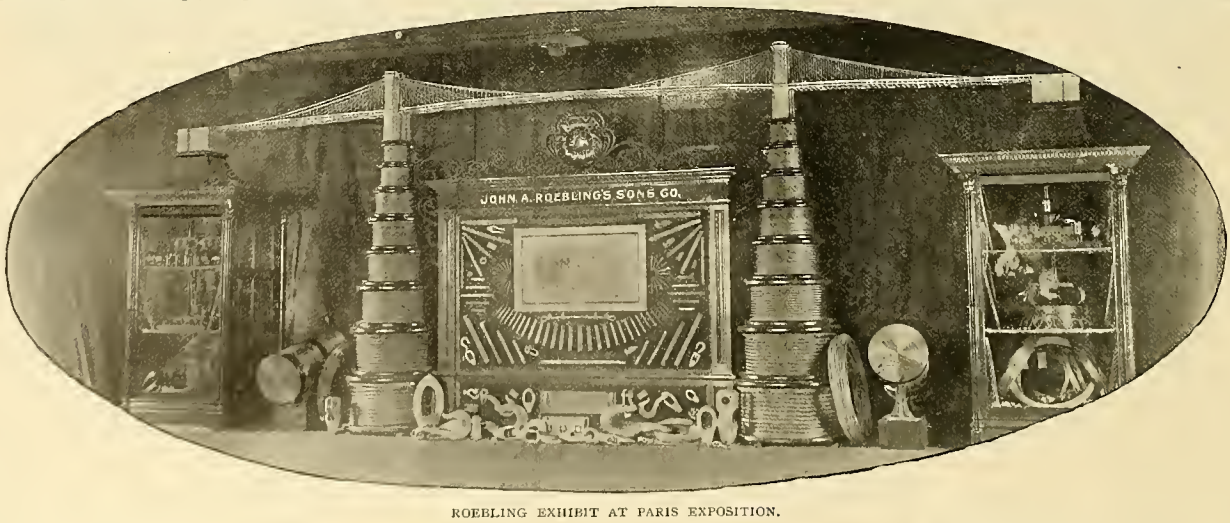
The arc lamps distributed about the space on specially designed posts, each post supporting six lamps, are all of the enclosed-arc type. The Petite lamp, to burn singly, on 110 volts, predominates, but there are also shown the marine Petite, for direct current, the Petite for burning two in series on 220 volts, and the Petite alternating, adapted for from 90 to 115 volts and for either 60 or 125 cycles. Forty-eight lamps, to burn two in series on 220 volts, are distributed through the American section on the ground floor, and are operated by the United States commission as an extra illumination of this section.

Several types of fan motors are distributed about the space. The fans, like the other apparatus, are in constant operation. An interesting feature of the exhibit is the plaster models of the Chicago and New York factories, shown in Fig. 2.

The series arc-lighting business of the company is illustrated in an armature only. The armature is of the standard ironclad type, used with a 150-light machine. It attracts a great deal of attention, as its construction is entirely different from anything used in European practice. Among the miscellaneous exhibits which may be mentioned are samples of telephone and electric-light cables, junction boxes for telephone cables, tools for cable splicing, pictures of direct-driven generators and motor-driven booster sets.

Roebling Exhibit at Paris Exposition.

The John A. Roebling's Sons company of Trenton, N. J., has divided its exhibit at the Paris Exposition into two parts. One of these is to be found in the Electrical Palace and consists, essentially, of electrical wires and cables. The other part of the exhibit, shown in the accompanying illustration, is in the Mining and Metallurgical building. It is located in the United States section of this building and occupies a conspicuous space. The display is devoted to wire rope and wire, and consists of a



ROEBLING EXHIBIT AT PARIS EXPOSITION.

number of reels of wire roping, with two cabinets of samples of wire and rope used for a great variety of purposes. These are all attractive features of the exhibit, but the most conspicuous item is a splendid model of the Brooklyn bridge, worked out in fine detail, and standing above a central board on which are displayed various pieces of rope and fittings. William S. Rogers is in charge of both exhibits.

Electric-power Bills in London.

[From the London correspondent of the Western Electrician.]

The electric-power bills, which were recently discussed and passed by a committee of the House of Commons, as reported in the Western Electrician a week or two ago, have been the subject of much interest for some time. In the spring of last year members of the electrical and mechanical engineering profession were startled to learn that a bill providing for the supply of electricity over an area of 2,000 square miles in the Midlands, had been, after curt debate, refused a second reading by the House of Commons. Their surprise was not lessened when they learned that the opposition had been organized by the Association of Municipal Corporations, a body which is practically a trade union of the officials of municipal corporations, on the ground that municipal rights and privileges were being intrenched upon, though, in fact, out of the 2,000 square miles which it was proposed to serve, the area actually being supplied with electricity by municipal enterprise was 4½ miles, and the gross total of consumers was 1,500.

Two things, however, were forced into prominence by the defeat of the bill. On the one hand, the public began to appreciate what the engineers have long known—that England was disgracefully backward in the development of electrical science; that in electro-chemical industries, in the transmission of electric power, and in the manufacture of electric machinery the country was a decade behind Germany, Switzerland and the United States. On the other hand, it was clear that the municipal corporation dog intended to lie in his manger, whatever might happen to the mechanical industries of the country, unless he could be turned out by main force.

A determined effort had therefore to be made to dislodge him. Accordingly, the engineers and electricians set vigorously to work to revive their schemes and to educate their public. The present session saw not one, but four proposals, lodged for electric-power distribution. All four were alike, in the fact that they proposed to manufacture electricity on a vast scale, at a point where cheap coal was available, and to distribute it thence over a considerable area, at a price which local producers of retail quantities could not hope to rival. Speaking broadly, it was proposed to conduct only a wholesale business and to sell their electricity in bulk to local distributors, whether corporations or companies. The bills were opposed by the Association of Municipal Corporations, but fortunately, the debate found the members of the House of Commons better informed of the rights and wrongs of the question than they had been a year before, and the bills were read and passed without a division.

According to the bills, the maximum price to be charged per Board of Trade unit, even to the smallest consumer, is six cents; to any consumer, except the smallest, four cents. In practice, it is not believed that the average charge will exceed two cents. At present the authorized maximum in the two or three fragments of the area where alone a public supply is available is 16 cents. The average charge is believed to be about 10 cents.

Lineman at Niagara Falls Killed by Shock.

Charles G. Fleck, a lineman employed by the Buffalo and Niagara Falls Electric Light and Power company, in Niagara Falls, was killed on a cross-arm in that city Wednesday, August 1st. Fleck, in company with a fellow lineman, went down Main street to repair a transformer on a pole. His companion had twice been up the pole to ascertain the trouble and cautioned him to be careful. He advised Fleck to go back 125 feet and throw a switch, turning off the current, but Fleck thought this unnecessary. He ascended the pole and, standing on a telephone cable, reached out to the transformer. Almost instantly he sank back and became limp. His companion realized he had received a shock, and caught him and held him fast until help came to take him down. When lowered he was lifeless. The back of his hand had touched a live wire. The fuses were not blown in the station. The coroner, who investigated the case, rendered a verdict of accidental death. The funeral of the dead lineman was held Sunday afternoon, August 5th, and was very largely attended.

The contract for the erection of a power house and complete station equipment and pole lines for the Consumers' Light, Heat and Ice company of Newport News, Va., has just been awarded to G. A. Williams & Co. of Jersey City, N. J. The electrical equipment consists of two Westinghouse two-phase 2,200-volt engine-type generators and exciters, one of 175 kilowatts and one of 125 kilowatts, and a Westinghouse standard switchboard, with plunger-type switches. The contract also calls for a large number of Manhattan series arc lamps.

Combination of the Stanley and Northern Electrical Companies.

It is now definitely announced that a combination has been effected between the Stanley Electrical Manufacturing company of Pittsfield, Mass., and the Northern Electrical Manufacturing company of Madison, Wis. The first-named company is engaged in the manufacture of the S. K. C. alternating-current apparatus, and the latter company manufactures a full line of direct-current apparatus. The exact nature of the agreement has not been definitely announced, but it is believed that each company will manufacture and place upon the market both direct and alternating-current machinery and apparatus. The eastern business is to be handled by the Stanley company, from New York, and the western business will be handled by the Northern company from Chicago. The Northern company has for some time past been at work upon the extensive enlargement of its plant at Madison, probably having in view extensions in its lines of apparatus. The Stanley company has in process of erection an entirely new and modern plant, which it expects to occupy within a few months. These companies intend to make their apparatus full and complete in all lines of both kinds, including the largest sizes of direct-current machinery, suitable for large power-transmission plants and street-railway work.

It will be remembered that the Stanley company was recently bought by the Roeblings and Dr. F. A. Perrine. The latter-named gentleman is now president and general manager of the company. The Northern company is owned by ex-Senator W. F. Vilas and A. O. Fox of Madison, Wis. Mr. Vilas is president and Mr. Fox is the business manager and treasurer. These companies have each strong financial resources; they have been conservatively handled, and are said to be making money. Both concerns have established a first-class reputation for their apparatus. Those who are in a position to know something about the inside seem to think that the new arrangement will add substantially to the already growing business of each company and that the combination will be a strong one.

Boston Electric Light Company's Annual Report.

Boston, August 1.—The annual report of the Boston Electric Light company for the fiscal year which ended June 30th was made public to-day. It makes the following excellent comparative showing:

	1900.	1899.
Gross income	$990,797	$910,892
Operating expenses	531,327	604,972
Profits	459,469	305,919
Interest charges	91,958	53,522
Net for stock	367,511	252,397
Dividends	184,724	143,908
Surplus	*182,787	108,489

*Increased to $436,082 by including $253,294 premium on stock sold.

The president's report, among other interesting information, makes the following statements:

"We have during the past year completed the transfer of all business from the open-arc to the enclosed-arc system. This system is giving satisfaction to the city officials, and is being inquired for by cities all over the country, and spoken of in the highest terms by visiting committees from various sections, who have been here to inspect this system. All the iron lamp-posts owned by the city of Boston have been removed. The locations have been granted to this comany, and in place thereof we have substituted about 2,650 of the approved insulated Gilbert lamp-posts.

"At the present time we are doing all our business from our new station in South Boston, with the exception of our business in East Boston, which is being run from the company's local plant there, and will so continue until the completion of the tunnel to East Boston, now being constructed by the city. When completed, we are expecting to procure permission from the Transit Commission to run our ducts through it and supply current from our large generating plant, when we will discontinue the East Boston station, thereby effecting a further saving. We have installed four 3,000-horsepower engines, to which are now being added two more of the same type and style.

"Our expectations of economy by use of the enclosed series arc lamps and the new generating system have been more than realized. The reduction in the percentage of cost for the production of the current was more than we anticipated, in consequence of which we felt no hesitation in returning during the past year to the old rate of two per cent. quarterly dividends, instead of 1½ per cent., as previously paid.

"The company has three pieces of real estate which are no longer needed for the uses of the business, and which, at a conservative valuation, are worth $600,000 or $700,000."

It is understood that at the next annual meeting the stockholders will be asked to authorize the sale of this real estate, the proceeds to be devoted to betterments in the company's property. B.

American Battery Compound.

The widespread use of the zinc-carbon couple for battery cells makes a few words on its installation and maintenance of interest to those who use open-circuit batteries. Sal-ammoniac has long been the only chemical that was found to give even fair results in these cells, yet the insoluble crystals deposited on the elements by the solution, when spent, have always been a source of serious loss, while the creeping salts often did great damage to the surroundings and corroded the terminals of the cells.

Prior to the invention of the American battery compound, says its manufacturer, nothing commercially practical had been discovered to supersede the use of sal-ammoniac in zinc-carbon cells. This American compound is offered to the public as a chemical compound that is far superior to sal-ammoniac; it is said that with its use no creeping salts are produced and that its phenomenally long life reduces the cost of maintenance and inspection to a minimum.

The slow polarizing properties of the compound, it is claimed, make it a superior battery salt for telephone work as well as any service requiring a small quantity of current for an extended period. On long-distance instruments that are in constant use, batteries charged with it are asserted to be nearly equal to the Fuller cell for constancy, while they excel it for long life and cleanliness. The adoption of this compound will enable exchange managers to increase the efficiency of their plants by decreasing the cost of inspection and battery materials.

The solution in batteries charged with American compound has no tendency to creep or crystallize out on the edges of the cells or the elements where they enter the liquid, and thus the terminals of the cells are not destroyed by corrosion, and there is no danger or damage to the surrounding of the cells. This permits of the cells being placed anywhere with perfect safety.

The accompanying illustration shows the neat cardboard box containing the compound. This package (4 by 2 by 1½ inches, actual size) contains one full charge of battery compound for the standard size of salammoniac cell, and, it is said, will energize it for from two to three times as long as a similar charge of salammoniac. The compound, so it is claimed, does not undergo any chemical change in any climate nor does it deteriorate with age; hence any quantity can be carried in stock. It is packed in cases containing 50, 100 or 150 charges, as desired, and is manufactured by the American Battery Compound company, 31-33 South Canal street, Chicago.

Storage-battery Charging Boards.

The General Electrical Repair company has recently installed three storage-battery charging plants for the Helios-Upton company at No. 222 East Fullerton avenue, Chicago. The first plant was completed on April 23d. It consists of 32 charging circuits, connected to a slate switchboard, on which are mounted 32 35-ampere, double-pole snap switches, 32 Edison main-line cut-outs and 32 spring jacks. The spring jacks are arranged on two slate shelves, with 16 spring jacks on a shelf. The shelves are attached to the face of the board by means of brackets mounted on the switchboard.

The storage-battery cells are arranged on 16 benches. Each bench is 2½ feet high by two feet wide and 28 feet long, made of Georgia pine and treated with insulating paint. From the bottom of the bench legs protrudes a three-eighths-inch dowel pin of hardwood, which centers in a large porcelain insulator laid in the floor. This prevents any possibility of a ground connection with the batteries. Each bench has a capacity of 80 cells, or two charging circuits.

The positive wire of each circuit is arranged at a uniform end of the bench and marked + and numbered. A No. 12 iron wire, wound around a 2½-inch by 4½-foot iron pipe, insulated with asbestos, serves as resistance to vary the strength of current when charging. These coils are mounted perpendicularly on an angle-iron frame arranged along the wall. They are separated four inches. An aluminum yoke spans two coils and serves as a sliding contact, to vary the resistance.

The second plant was completed in May, with a similar arrangement of circuits, but using 35-ampere, double-pole, single-throw knife switches instead of snap switches and cut-outs. This plant has 36 charging circuits, with 35 amperes capacity per circuit.

The third plant was installed in June, of much greater capacity and of an entirely different plan. In the former installation the ordinary hard-rubber or glass cells was used, but in this plant the Helios-Upton company designed a cell of much greater dimensions and one that would enable it to charge any number of plates in one cell. A wooden tank of Georgia pine, 13 feet long, 12 inches deep and 10 inches wide, boiled in paraffin and lined with one-eighth sheet-lead, forms the cell, in which are placed any number of plates desired. The plates are con-

nected in multiple with the cell, and 40 cells connected in series. There are four of these circuits having a capacity of 200 amperes per circuit. The circuits are brought to a marble switchboard, and each is connected to a 200-ampere knife switch and spring jack. The General Electrical Repair company also installed 160 incandescent and 10 arc lights.

Massachusetts Electric Companies.

The Massachusetts Electric Companies, the big shore-line street-railway corporation, held a special meeting of stockholders recently and ratified the purchase of the South Shore and Boston railway, which is a consolidation of five roads, and represents 75 miles of track, and also voted to acquire, by purchase, the Lowell and Suburban railways, previously held on lease. It was decided to pay the semi-annual dividend in July and January instead of June and December, as heretofore. The annual meeting will be held November 7th. President Gordon Abbott, in his address to the stockholders, presented figures showing results attained since the company organized, or for nine months to June 30, 1900. The trustees at the outset received all, or a controlling interest in 31 companies. Twenty of these companies have been merged, leaving 15, the shares of which are held or proposed to be purchased by the trustees.

Excluding the Lowell and Suburban, and the South Shore and Boston, and also the New Bedford, Middleboro and Brockton, which company had not been acquired by the trustees at this time last year, the results of the operation of the companies are as follows:

	1900.	1899.	Changes.	
Gross earnings.....	$3,102,518	$2,809,464	Inc.	$293,054
Operating expenses... ..	2,132,679	2,087,898	Inc.	44,781

The increase in gross earnings amounted to 10.43 per cent., the increase in operating expenses amounted to to 2.14 per cent., and the ratio of expenses to earnings amounted to 68.75 per cent.

For the same period of nine months the net divisible income, after deducting all interest and other charges, has increased by $207,893.

CORRESPONDENCE.

London Letter.

London, July 24.—There has been greater delay than was anticipated in admitting the public to the Central London railway, which the Prince of Wales opened on June 27th. Everything is promised to be in full working order, however, by this day week, possibly a day earlier. Things are better managed in the United States.

A friend, who is an officer on H. M. S. Diadem, one of the warships taking part in the naval maneuvers, writes your correspondent that the wireless-telegraphy instruments on board kept up an incessant crackling, caused by the sparks from the coil. He says: "We were in constant communication with the flagship of Admiral Rawson, many miles astern and out of sight. At 15 miles messages were read easily, at 25 they were still intelligible, but after that they failed."

West London will soon be in possession of an electric tramway, the comfort and luxuriousness of which will far exceed anything that has gone before. The London United Tramways company secured the passage through the House of Lords last week of a bill which will enable it to operate some 40 miles of tramway. The chief generating station is in the rear of the company's headquarters at Chiswick, and there will be smaller power stations at other points. A number of cars have already been delivered, and they are superior to anything of the kind in London. They are beautifully upholstered and will accommodate 70 passengers, 30 inside and 40 outside, and will be electrically lighted.

The question of rapid transit in London was discussed at a meeting of the London Reform Union last Wednesday. A resolution was passed deploring the lack of harmony between the central and the local authorities in regard to an adequate system of electric traction.

Electric motors was the subject of a paper recently brought before the Municipal Electrical association. The contribution deals chiefly with the troubles experienced in the maintenance of motors, and is of interest to all actual or possible users of electricity for motive-power purposes. It is pointed out that electric motors have been very much improved of late years, and it may be added that an electric motor may now be obtained which is a thoroughly mechanical, efficient and reliable piece of machinery, capable of adaptation to nearly every class of work. There has been occasionally an impression that electric motors are expensive in upkeep, but the author endeavors to show that the blame is to be attached elsewhere. It is with the starting arrangements that the fault usually lies. One very frequent use for an electric motor is for crane or hoist work. In many cases the motor must be operated from any floor. To do this the starting resistance first adopted at Bradford, at which place the hiring and maintenance of electric motors has been dealt with on a considerable scale, was usually connected to a chain or rope extending through the different floors of the building. It was found that leaden plates placed at various depths in jars of acid, the rate of falling of which plates was controlled by oil or glycerine dash-pots, to prevent the current rising rapidly before the motor attained its normal speed, did not answer well. The action of the dash-pots was affected by temperature, in cold weather sometimes sticking together, and in warm weather falling too rapidly, the result being collapse of the main fuses and sometimes damage to the motor. Air dash-pots were next tried, but for some reason never on the liquid resistance, but on the ordinary wire resistance, with contacts. The trouble with the latter was, as might be expected, with the contacts. As the result of a number of experiments, it was found that the series motor was the correct one for such work. A motor is required which can be permanently geared to the elevator and will operate a heavy load at a low speed and a small load at a higher speed. Such requirements are to be found in the series type of motor which starts easily with a reasonable current and will rapidly attain a fair speed. This construction will obviate most of the starting difficulties for this class of work, and fuses will be less liable to fail or starting resistances and armatures to be damaged.

The officials of the Paris Metropolitan railway made up their minds to open the new line on Thursday. The inauguration had been so often postponed that the public would not believe that the trains were at last running, and only one man took a ticket for the first train. The motive power is electricity and there is an agreeable absence of smoke and dust.

W. H. B.

New York Notes.

New York, Aug. 4.—The new electric automobile service in Central Park, the advent of which was noted in these columns last week, is apparently filling a long-felt public demand. On Wednesday three automobile coaches were put in service by the Central Park Carriage Service, which has charge of the new route, and were found to be entirely inadequate to the traffic. A coach left Seventy-second street and Fifth avenue every 45 minutes, and there were three times as many people to ride as there were seats every time a coach came around. The management had to send down a lot of horse-drawn vehicles to make up the deficiency. The route is from Seventy-second street and Fifth avenue through Central Park over to Riverside drive and up the drive to Claremont. The fare is 25 cents one way.

The application of the New York and Brooklyn Union Transportation company and the New York, Brooklyn and Jersey City Rapid Transit company for permission to construct a tunnel under the East River was again up before the State Railroad Commission at its session in the Fifth Avenue Hotel Wednesday. No decision was reached, owing to the request of Albert B. Boardman, counsel of the Rapid Transit Commission, for time to enable Alexander A. Orr, president of the commission, to prepare an affidavit setting forth the plans of the commission with reference to a tunnel to Brooklyn to be built by the city. Mr. Boardman argued against the granting of the application because the Rapid Transit Commission had not yet determined what to do. George Wilson, managing director of the Eastern Contracting company of Dublin, Ireland, made a statement concerning the financing of the scheme. The Eastern Contracting company is back of the New York corporations making the application. Mr. Wilson said it was capitalized for $9,000,000. One of its directors was Lord Aldenham, of the London banking house of Gibbs & Co., and a director in the Bank of England. Mr. Wilson's estimate of the cost, including terminals, was $30,000,000—$20,000,000 for the Brooklyn side and $10,000,000 for the New York side. He thought the tunnel should be completed in five years.

The application of the New York Electric Vehicle and Transportation company, which controls the Fifth Avenue stage line, for permission to change its motive power and to extend its route was granted by the State Railroad Commission Thursday, nobody objecting. The extensions asked for are from Eighty-ninth street and Fifth avenue, up Fifth avenue to Mount Morris Park, west around the park by One-hundred-and-twentieth and One-hundred-and-twenty-fourth streets to Fifth avenue again and up to One-hundred-and-thirty-fifth street; from Eighty-ninth street and Fifth avenue to One-hundred-and-tenth street, to Cathedral parkway, to Riverside drive, and from Fifty-seventh street and Fifth avenue west to Broadway and up Broadway, crossing the Grand circle, to West Seventy-second street, to Riverside drive, to One-hundred-and-twenty-fourth street.

Some of the daily papers have attempted to make out that another strike was imminent on the Brooklyn Rapid Transit lines, but investigation among the officers and men has failed to unearth any foundation for these stories.

The Brooklyn Rapid Transit company has made a new rule whereby only one transfer will be given to a fare—that is, transfers will be given only on payment of a cash fare. Conductors will also have to ring up fares as soon as passengers enter a car.

M. L. G.

Northwestern Notations.

Minneapolis, August 4.—An electric railway is projected to run from Alden, Iowa, to Britt, a distance of 60 miles.

The cylinder head of the electric-light engine at Sigourney, Iowa, blew out and crippled the system until a new head could be put in.

C. E. Hawkins was arrested in Minneapolis on a charge of violating the state law compelling the registration of all electricians. The defense attacked the constitutionality of the law.

The Dubuque (Iowa) Street Railway company will ask that its charter be changed, and that the provision enabling the city to purchase the system at the end of 15 years be annulled. The company claims that this section prevents the sale of its bonds for the improvement of the road or the extension of its lines.

The Street Railway company of Des Moines, Iowa, plans to work on its proposed extension from Valley Junction, Iowa, through Commerce to Winterset and Greenfield, next season, if the steel market is favorable.

The Washington Water Power company of Spokane, Wash., has installed new machinery, doubling the capacity of its lighting plant.

Geneva township, Minn., voted $5,500 bonds to aid the Albert Lea and Geneva electric railway, and Geneva, Minn., voted $2,500 bonds for a similar purpose.

Repairs are being made to the electric-light plant at Appleton, Wis., as fast as possible, and the new generators will soon be installed, and a new power station erected.

The Gas and Electric company of Fargo, N. D., proposes to exclude the Fargo Edison company from the streets of Fargo. Under the franchise granted in 1881 the former claims an exclusive and indefinite tenure. The company will endeavor to show that the council, in granting the franchise, under which the Fargo Edison company works, exceeded its authority.

The Cass Land company will establish an electric-light and water system for Cass Lake, Minn.

The Boston and Great Falls Electric Light and Power company has refused to grant lower rates to the city of Great Falls, Mont. The Tribune, of Great Falls, thereupon applied for a franchise for an electric-light plant, and proposes to give lower rates.

The council of East Grand Forks, Minn., has awarded contracts for materials for a new electric-light system.

Business men of Centerville, Iowa, will work to secure electric street-car service for the city.

The electric-light plant of Casselton, N. D., is carrying all the work that it is capable of, and the demand for light is not filled. The system will probably be extended.

The city of Stillwater, Minn., proposes to revoke the franchise of the Twin City Rapid Transit company, because the company has failed to have a line to South Stillwater, as promised, and also because the principal office of the company has not been located in Stillwater.

The village of Thief River Falls, Minn., may put in an electric-light plant.

A local paper at Madelia, Minn., urges installing an electric-light plant.

The Fargo Edison company of Fargo, N. D., has let the contract for an extension to its power house.

The council of Fergus Falls, Minn., will avoid the necessity of shutting down the electric-light plant during the repairs to be made. The old flume will be kept intact and another built beside it.

The Commercial Club of Cedar Rapids, Iowa, will agitate for a competing street-railway system. It condemns the present company for niggardness in being unwilling to assist public enterprises in the slightest.

Wedge & Sons of Mantorville, Minn., contemplate putting in an electric-light plant, in connection with their mill.

The Electric company of Owatonna, Minn., has contracted with the city to furnish street lighting for 10 years. The contract is to be void if the company fails to put in a gas and heating plant in connection.

Shakopee, Minn., is taking bids, until August 6th, for the installation of an electric-lighting plant.

The Adel Mill company of Adel, Iowa, has been granted a franchise to put in an electric-light system, in connection with its mill.

The Hubinger light and street-railway system at Keokuk, Iowa, will be improved and extended. Over $35,000 will be expended at once. The system has just been bonded for $250,000, through which mortgages for $100,000 have been released.

The Cambridge Milling company and the Electric Light and Power company of Cambridge, Minn., have consolidated.

The electric-light and gas plant at Aberdeen, S. D., was wrecked by fire. J. S. Bartholomew of Grand Forks, N. D., is the owner. He will rebuild.

The changes being made in the power station

of the Fargo Edison company of Fargo, N. D., will increase the capacity ot the plant about 30 per cent.

The Western Union has begun putting its wires underground at La Crosse, Wis. The Burlington and Postal have also begun burying their wires.

Contractor Porritt has begun work on the new electric-light and power plant for Hillsboro, N. D.

The American District Telegraph company has filed articles of incorporation in Spokane, Wash., and proposes to furnish messenger service, under the auspices of the Western Union. The office will be a branch of the same company, with headquarters at Minneapolis. The incorporation at Spokane provides for doing business in the states of Washington, Idaho, Oregon and Montana.

The power is installed for the projected electric road from the Leola and Surprise mines to Fairfax, Wash. The power will be secured from the Carbon River. Construction will be begun on the line, which will be a narrow-gauge system.

The Republic Gold Mining company has been granted a franchise at Republic, Wash., for an electric street-railway, light and power system. A survey has been made for a tramway up the Granite Creek gulch, back of town, to all the mines in the northern district. From this line there will be branches through the cross streets of the city.

The Robinson & Cary company of St. Paul has been awarded a contract at Chaska, Minn., to furnish and install an electric-lighting system for $7,594.

Work is being pushed installing the new electric-lighting system at Omro, Wis.

The Winona (Minn.) Railway and Light company has adopted the system of cast-welded joints for its rails. The arrangements have been completed and work will be pushed at once on the extension of the line across the lake.

The new Apple River power plant is not yet in condition to furnish power for the St. Paul street-lighting system, owing to a delay in the arrival of certain machinery. The right-of-way for the pole line from Apple River Falls to St. Paul has been secured, after prolonged negotiations. Some of the farmers, whose lands are crossed, asked exorbitant prices for the privilege, and several changes of route have been made in consequence.

A. L. Hutchinson of Weyauwega, Wis., is a moving spirit in a projected electric-railway system to run from Berlin, Wis., to Waupaca, New London, Wautoma and Weyauwega. A survey is being completed, and it is expected to start construction by September 1st.

The defense of C. E. Hawkins of Minneapolis, on a charge of violating the state electrical law, has been upheld, and the law declared unconstitutional. The defense held it to be class legislation, as it exempted interstate telephone and telegraph companies and their employes. The law seems to be poorly drawn, the title and body of the act differing as to its intent, and other errors also exist.

C. H. and J. F. Causy of Helena, Mont., have been granted a franchise for an electric-light system at Fort Benton, Mont.

The Gas and Electric Light company of Mankato, Minn., will erect a new power station for its lighting plant and will install new electrical machinery.

The Edison Electric company of Des Moines, Iowa, has asked the city to enter into a contract for lighting the city for 10 years, at $65 per annum for moonlight-schedule lamps and $75 a year for all-night lamps. It asks for an advance of $20 per lamp in the event of the wires being placed underground. R.

New England News.

Boston, August 4.—The executive board of the Boston Elevated Railway company has decided to increase the equipment for its elevated lines from 60 cars, the number originally ordered as an initial outfit, to 100 cars, and contracts therefor will be placed at once. All of the elevated structure between the Roxbury and Charlestown terminals has been set up now, and the work of preparation for rail laying is in progress. The outlines of the big buildings at the terminals are beginning to rise and take shape above the foundations also, and work on the Lincoln wharf power house progresses with due celerity. One of the elevated stations is nearing completion, at City Square, Charlestown, and is typical of the depots to be constructed at other points on the line. The Atlantic avenue loop remains to be put up and changes in grade at the entrances to the subway will be in order also before the end of the year.

The General Electric company has entered suit here in the United States Circuit Court against Fred S. Burke of Salem, Mass., of the Crown Woven Wire Brush company, for alleged infringement of patent on an electrical brush. Damages are set at $100,000, and an accounting is requested.

The Massachusetts Board of Railroad Commissioners has approved the joint petition of the Amesbury and Hampton Street Railway company, a Massachusetts corporation, and the Exeter, Hampton and Amesbury Street Railway company, a New Hampshire corporation, for a lease of the first-named company by the Exeter, Hampton and Amesbury Railway company.

The railroad commissioners have also approved the modified plans for the Boston elevated-railroad stations, and contracts will be awarded about the middle of August. With the exception of the station at City Square, Charlestown, all stations will be awarded under one contract. President W. A. Bancroft has given orders to push the work on the structure with all possible haste, as the elevated road between Dudley street, Roxbury, and Sullivan Square, Charlestown, must be in operation, under statutory requirements, on January 1, 1901. There is little doubt but that cars will be running between these points on January 1st, but the stations may be incomplete.

Authority has been granted by the board to the Citizens' electric street railway of Newburyport to issue additional capital stock to the amount of $190,000 for the purpose of providing means for the payment of the property and franchises of the Newburyport and Amesbury Horse Railway company.

Plans are in preparation for the construction of a new street-railway line from the terminus of the South Shore and Boston road at Assinippi in Hanover to Scituate Harbor, a distance of 12 miles. The new company, to be known as the Norwell, Scituate and Cohasset Street Railway company, will have a capital of $30,000. C. H. Killam of Hanover, G. J. Morse of Hyde Park, G. F. Welch of Scituate, A. F. Turner of Scituate, H. T. Fogg of Norwell, Albertis Williams of Scituate and G. S. Forbush of Brookline are the directors of the company, which is considered the beginning of a plan to skirt the whole South Shore with an electric railway, from Nantasket to Brant Rock and Plymouth.

At a stockholders' meeting of the Vermont and Boston Telegraph company, held at White River Junction, Va., on July 25th, the following-named directors were elected: T. F. Eckert, C. A. Tinker, T. F. Clark, A. R. Brewer, New York; Thomas Roche, H. C. Sherman, Boston; R. J. Kimball, W. Randolph, G. W. Smith, H. E. Tinker, White River Junction. The board organized as follows: President, T. T. Eckert; vice-president, A. R. Brewer; secretary and treasurer, M. T. Wilbur; executive committee, C. A. Tinker, T. F. Clark.

H. M. Heath of Augusta, Amos F. Gerald of Fairfield, A. H. Shaw of Bath, E. J. Lawrence of Fairfield, M. I. Mason of Brunswick, Theodore L. Peters, E. Burton Hatch and J. Hugh Peters of New York city are petitioners at Augusta, Me., to construct and operate the Lewiston, Winthrop and Augusta street railway. The length of the road will be about 27 miles, the amount of capital stock $160,000, and the number of shares will consist of 1,600. B.

From the Buckeye State.

Columbus, Ohio, August 4.—The Board of Public Works has rejected the second proposition made to the city of Columbus by the Columbus Railway company. Like the first one, it contained no agreement to reduce fares, and this is what the board wants. The company officials had Attorney Henry J. Booth to print a long article in the local papers, comparing Columbus railways with those of other cities, in this and foreign countries, tending to show that its patrons got more for their money than those of roads in other places. This was answered the next day by the Rev. Dr. Gladden, in a very carefully prepared letter, in which he showed the loopholes in Mr. Booth's argument, and told why the Columbus road may be able to operate with a three-cent fare and still pay the stockholders a good dividend. It is very probable that this company will have to come to lower fares before the franchises are renewed, and from present prospects, it will have to come quick. It is reported that a party of Toledo men are preparing to ask for a franchise on the streets of Columbus, and will agree to operate their lines on a three-cent fare, with transfers on tickets, and pay a certain per cent. of the gross receipts to the city as rental for the privilege. There is little doubt but that a proposition from outside parties will be considered, if the local company does not come up with a more liberal proposition than it has yet made. So far as its right to the streets is concerned, it has conceded it has none by trying to get new franchises for all its lines; so it remains with the city whether the road shall have another franchise or not. The fight is a very interesting one, and bids fair to be long-continued, unless outsiders force an issue.

The Dayton and Germantown Traction company has filed papers with the secretary of state, notifying him that the capital stock has been increased from $10,000 to $450,000. This looks as if the company meant business. J. O. Arnold is president of the company, and T. C. Lindsey, secretary, and the office is at 27 South Main street, Dayton.

The Cincinnati Street Railway company has notified the secretary of state that $2,000,000 has been added to its capital stock, making its present capitalization $20,000,000. This company is making many improvements and putting its road in excellent shape.

The Dayton, New Carlisle and St. Paris Traction company has been incorporated, with a capital stock of $1,350,000. It is proposed to build a line of road from Dayton through Montgomery, Miami, Clark and Champaign counties, to St. Paris. It will touch New Carlisle in Champaign County. The company has authority to furnish electricity for light and power also. The incorporators are B. H. Rannels, H. S. Forgy, Charles E. Layton, H. N. Reynolds and John A. Brake.

Another new road for southwestern Ohio is the Miamisburg and Germantown Traction company, which was incorporated a few days ago, with a capital of $50,000. Those interested, as shown by the papers filed with the secretary of state, are William A. Mays, C. W. Dodds, S. H. Mays, A. F. Guinner and Albert J. Dwyer. The intention of the company is to build and operate an electric line between Miamisburg and Germantown.

The section of country about Dayton is one of the best supplied with electric roads in the state, and it seems as if the people are not satisfied yet. Within the past few weeks several new companies have been incorporated, and all of them mean business. So far as can be ascertained, there will not be a figurehead among them.

The Ohio River Electric Railway and Power company has filed a mortgage to the Union Surety and Guaranty company for $315,000 in Meigs County.

The power house of the Mansfield Street Railway company at Mansfield is being enlarged to meet the requirements of the road when the line between Shelby and Mansfield is completed. Work is progressing nicely on the new line.

There is a plan on foot to build an electric line from Springfield to Clifton. Harry Frey of Springfield is the moving spirit in the enterprise, and will push matters to an issue. The Clark County commissioners have agreed to grant a franchise when the requisite number of persons along the line have given their consent. The line is to be completed by July 1, 1902.

Mayor R. W. Nelson of Newport, Ky., has purchased the waterworks and light plant at Georgetown, that state, for which he is to pay $30,000.

The telephone, telegraph, electric-light and street-railway people of Sandusky have combined to fight the ordinance taxing all the poles within the city limits $1 per year. They will likely carry the matter into court and secure a decision upon the question as to whether a Town Council has the authority to impose such a tax.

The Village Council of Mechanicsburg has refused to grant the Urbana, Mechanicsburg and Columbus Electric Railway company a franchise through the village, and as a result the people of the town are up in arms. It is likely that body will have to change its verdict if its members are to live in peace hereafter.

Word has come from Akron that a number of Cleveland and Akron capitalists, headed by Will Christy, president of the Southern Ohio Traction company and vice-president of the Northern Ohio Traction company, have arranged to build a line from Springfield to Columbus, a distance of 42 miles. The Southern Ohio Traction company now has in operation a line from Cincinnati to Dayton, and the officers expect to gain control of another independent line between Dayton and Springfield. These, with the proposed new line, will give them a through line from Cincinnati to Columbus. Northern connections may then follow.

The Ohio Valley Electric Light and Railway company has leased Pastime Park, at Ironton, and will convert it into a baseball park.

Work is progressing rapidly on the new electric line between Oberlin and Wellington. It is thought it will be completed before extremely cold weather interferes.

John H. Walters of Johnstown, Pa., has just returned from a business trip to Huntsville, Ala. He states that a new light plant, in which he is interested, has been completed, and is now in running order.

J. F. Doman, formerly of Norwalk, has brought suit for $20,000 damages against the Sandusky, Milan and Norwalk Electric Railroad and Traction company. He claims that while helping a man off one of defendant's cars he fell and broke his leg. It would seem singular that the man would bring such a suit, as he does not claim that the car was in motion, but that the street lights were out in Norwalk, where the accident took place.

The Urbana, Mechanicsburg and Columbus Electric Railway company has applied to the Board of Public Works of the city of Columbus for a franchise in the city. Former Adjutant-general H. A. Axline of Columbus is the president of the company.

Those who are on the inside claim that the state board of public works has about decided that the berm-banks of the Miami and Erie Canal cannot be leased for electric-road purposes because of the contract with Thomas N. Fordyce, who will operate canal boats with motors on the banks. It will be necessary for him to have a track and one track is all there is room for.

A company is being formed at Akron, Ohio, for the manufacture of electric police-patrol wagons and vehicles to be used by fire departments. It will be incorporated within a short time, with a capital of $200,000. It is said that a number of other companies in the same line of business will be combined with it. It will be known as the Akron Automobile Police Patrol company.

The Triumph Electric company of Cincinnati will furnish two 200-kilowatt generators for the Dayton Electric Light and Power company of Dayton, Ohio, and one belted generator of the same capacity for a company at Dayton, Ky.

The new light plant at Piqua, Ohio, was put in operation Friday. O. M. C.

The Niagara Falls Street Railway company of Niagara Falls, N. Y., which has a franchise but no road, has sold its franchise to the Niagara Gorge Railroad company.

PERSONAL.

H. W. Baer has succeeded Mr. Beam as manager of the Berlin, Pa., electric-light plant

Carlyle C. Davis has been appointed manager of the United Electric Gas and Power company at Santa Barbara, Cal.

C. F. Hewitt of Elmira, N. Y., has been appointed superintendent of the Home Electric Light and Power company of Elkhart, Ind.

F. E. Boardman, superintendent of the Knoxville (Tenn.) Electric Light and Power company, was fatally injured by a fall on August 2d.

Frank P. Ross, manager of the Central Union Telephone company at Columbus, Ohio, has resigned, on account of ill health, and W. W. Johnson of Youngstown has taken his place.

ELECTRIC LIGHTING.

An electric-light plant will be built at the state hospital, Massillon, Ohio.

Cass Lake, Minn., has granted H. Hartley a franchise for an electric-light plant.

The Lewiston (Idaho) Water and Light company plans to spend $20,000 improving its plant.

The Roseburg (Ore.) Water and Light company has been organized with a capital stock of $100,000.

The City Council of Cleburne, Texas, has granted a franchise for an electric-light plant to E. Ellis of Dallas.

The power house of the East Side Electric company at Detroit, Mich., has been visited by a $20,000 fire.

The Carolina Light and Power company of Aiken, S. C., has increased its capital stock from $20,000 to $50,000.

The voters of Chambersburg, Pa., decided to issue $13,000 bonds for improving the town's electric-light plant.

The Shenandoah (Iowa) Electric Light and Power company is enlarging its building preparatory to adding new machinery.

A new electric-light and power plant will, it is reported, be built by the Hot Springs (Ark.) Street Railway company.

The National Cash Register company is preparing plans for a complete new electric-light plant at its works, Dayton, Ohio.

Dothan, Ala., will receive bids for a municipal electric-light plant to operate 25 arc and 1,000 16-candlepower incandescent lamps.

The Columbia City (Ind.) Heat and Power company was incorporated for $10,000 by S. J. Peabody, J. A. Ruch and A. A. Adams.

The waterworks board at Evansville, Ind., has rejected all bids received for building an electric-light plant and will readvertise the work.

J. B. Nelson, Baldwin block, Indianapolis, has been engaged to prepare plans for the new municipal electric-light plant in Lawrenceburg, Ind.

The Board of Public Service at Cincinnati, Ohio, has ordered plans prepared for a new power house at the city infirmary to cost about $10,000.

Bids are asked for the installation of an electric-light plant in the State Insane Asylum at Jackson, La. G. A. B. Hays, M. D., is superintendent.

The village board of Ilion, N. Y., has decided to place on the market $50,000 four per cent. bonds for the purpose of erecting an electric-light plant.

The board of awards at Baltimore, Md., has rejected the bids recently received for lighting the city, and will alter the specifications and readvertise.

The Cattaraugus Electric Light and Power company of New Albion, N. Y., has been incorporated for $12,000 by A. J. Setter, C. Centre and F. Crawford.

The committee on lights at Grand Island, Neb., has recommended an appropriation of $5,000 for putting an electric-light plant in the waterworks pumping station.

Bids will be received until August 27th by the board of trustees of the Toledo (Ohio) State Hospital for installing an electric-light plant. Charles Foster is president of the board.

At a meeting of the stockholders of the Laclede Power company of St. Louis it was voted to increase the capital stock of the company to $800,000. The company will erect its own power plant.

The Electric Light and Power company of South Boston, Va., of which J. A. Mebane is electrical engineer, wants bids on generators to 500 kilowatts' capacity and 600 horsepower in waterwheels.

The Baltimore and Ohio Railroad company, within the next two months, will remove all its electric machinery in Cumberland, Md., and replace it with larger generators, etc. The number of lights in the shops and roundhouse will be considerably increased. The Queen City Hotel, which has lately reverted back to the Baltimore and Ohio company, will be lighted from the new electric plant, and the use of gas discontinued.

ELECTRIC RAILWAYS.

L. Soule of Chicago is one of the promoters of an electric railway from Alden, Iowa, to Britt.

The Pensacola (Fla.) Electric and Terminal railway will make an addition to its power plant.

The Bradford (Pa.) Traction company has filed articles of incorporation with $1,000,000 capital.

Surveyors have been at work upon the route of a trolley road from Elkton, Md., to Chesapeake City.

D. Lesley and A. W. Moon of Indianapolis have secured a franchise for an electric line at Seymour, Ind.

W. L. Covill of Biloxi, Miss., is making a survey for the proposed electric line in that town and suburbs.

The Village Board of Mazomanie, Wis., has decided to rebuild the city light plant recently destroyed by fire.

The Miamisburg and Germantown Traction company of Miamisburg, Ohio, has been incorporated with $50,000 capital stock.

The power station of the Northern Ohio Traction company at Akron has been destroyed by fire, causing a loss given at $30,000.

The City Council of Dublin, Ga., contemplates increasing the capacity of the electric-light plant. R. N. Ellis is superintendent.

The council of Oklahoma City, Okla., has granted a street-railway franchise to the Oklahoma City Land and Electric Railway company.

The Springfield street railway of Springfield, Mass., proposes to increase its capital stock to provide for improvements and extensions.

At Selma, Ala., F. M. Abbott has purchased the Selma City and Suburban Railroad and will rebuild the line for the use of electric motors.

The Grand Rapids (Mich.) Consolidated Street Railway has had plans prepared for a large new power house by J. H. Vail of Philadelphia.

A charter has been granted to the Northeastern Street Railway company of Allegheny, Pa., with $24,000 capital. E. J. McIlvane is president.

A. L. Hutchinson of Weyauwega, Wis., is chief promoter of an interurban line between Berlin, Wanpaca, New London, Wautoma and Weyauwega. It is said surveys will be made this month.

The franchises have been obtained for the Taylor-Smith-Sawyer electric line from New Lothrop to Saginaw, Mich. It is also proposed to ask for a franchise in Montrose and run the line through that town.

The interurban electric road between Rockford, Ill., and Janesville, Wis., is under construction. The principal office will be in Rockford, and the new line will be called the Rockford, Beloit and Janesville electric railroad. H. H. Clough is president of the new company.

The Washington Co-operative Mining Syndicate, Fidelity building, Tacoma, Wash., announces that W. J. Wood, M. E., has completed a second survey from Fairfax to the Surprise and Clipper mines for an electric road, and it is now ready to make a definite location of the route.

The Bank street electric line of Richmond, Va., will be dismantled in a few days. This is the first line on which an electric car was successfully run by the trolley system. The line is now worn out, and by connecting the Church Hill loop with the Main street line, the old line is no longer necessary.

The Hartford Street Railway company has been experimenting with eavetroughs on its open cars for the protection of passengers in wet weather. The results are reported to be very satisfactory, both to conductors and passengers, as there is no dripping on the running board, and the ends of the seats do not become so wet.

The first step in the construction of an electric trolley line from Norfolk, Va., to Gilmerton, on the Dismal Swamp, was taken August 2d, when a deed of trust from the River Front Railway company to the Colonial Trust company of Pennsylvania, constituting a first mortgage on the company's property to secure $2,000,000 of five per cent. 30-year gold bonds, was recorded. The property and franchises conveyed under the terms of the deed are the main line of the Norfolk and Western railway; second, what is known as the navy-yard branch of the Portsmouth Street Railway company, extending from Green street and Gosport road, and third, the Gilmerton branch of the Front River Railway company.

TELEGRAPH.

The Emden-New York cable, which Germany is laying via the Azores, will cost, altogether, very nearly $5,000,000, and have a length of 4,984 miles. From Emden to Borkum the cable is partly on land and from the island of Borkum it is all sea. It is hoped to have the cable in service this fall.

The American District Telegraph company has incorporated in the state of Washington, with Spokane as the principal place of business and $100,000 capital stock. The trustees named are A. D. Campbell and Thomas P. McKinney of Spokane. The other incorporators are Isaac McMichael, Sidney B. McMichael and Jacob Levinn, eastern capitalists.

Before the cable to the Azores was opened, which somewhat shortens the route by which cablegrams are transmitted to the Far East, the route of messages from Washington to Manila was as follows: To New York by land; to Valentia, Ireland, by cable; to Brighton, England, by cable and land; to Havre, France, by cable; to Marseilles by land; to Alexandria, Egypt, by cable; to Suez, Egypt, by land; to Aden, Arabia, by cable; to Bombay, India, by cable; to Madras, by land; to Singapore, Malayan Peninsula, by cable; to Saigon, Cochin China, by cable; to Hongkong, by cable; to Manila, Philippine Islands, by cable—the distance being 14,000 miles and the number of transmissions 14. And for this communication the government pays about $400,000 annually for its own messages.

The British government has asked bids for ocean cable, as follows: For the manufacture and laying in the Pacific ocean of 8,272 nautical miles of telegraph cable between Vancouver and Fanning island, Fanning island and Fiji, Fiji and Norfolk island, Norfolk island and New Zealand, and Norfolk Island and Queensland. The work will be divided into three parts, for any one or more of which contractors may bid. Each contract will include a clause under which the contractor guarantees the good electrical condition of the cable for 30 consecutive days after the completion of the laying. There is also a fourth contract to be let for surveying and sounding the whole route. The bids close September 14th, and specifications and forms of contracts may be obtained from Clark, Forde & Taylor, 4 Great Winchester street, London, E. C.

PUBLICATIONS.

The General Electric company has issued its catalogue of lightning arresters from its press at Schenectady, N. Y., and it is one which does credit to all concerned in its publication.

The McGuire Manufacturing company, Chicago, has issued a beautiful new 11 by 18-inch catalogue of its trucks and other street-railway appliances, in a typographical style strictly modern.

The Consolidated Railway Electric Lighting and Equipment company of 100 Broadway, New York, has issued two interesting pamphlets, one on "Train Lighting from the Car Axle" and the other entitled "A Little Talk With You on the Electric Lighting of Passenger Cars," the latter being a history of the evolution of axle-driven dynamo schemes which led up to the present system.

ELECTRICAL SECURITIES.

The Metropolitan West Side Elevated Railroad company of Chicago declared a semi-annual dividend of 2 per cent. August 5th. The business of the road for the first half of this year has increased 14.8 per cent. over that for the corresponding period last year.

The Appellate Court has handed down a decision confirming the decree of sale and foreclosure in the case of the old Chicago and South Side Rapid Transit company. All the contentions of the former stockholders are denied. The legality of the present organization is confirmed, together with its title to all the property.

Bondholders of the Chicago General Railway company are preparing to foreclose the property. An agreement has been drawn up appointing James P. Black and Lyman M. Paine of Chicago and N. D. Lawson of New York a committee of trustees to act in the interests of the bondholders in foreclosing, and an attempt will be made to obtain the signatures of all the bondholders to this agreement.

MISCELLANEOUS.

During the last six months 9,054 electrical inspections have been made by the city of Chicago and 2,791 pieces of defective work noted.

The Monongahela Consolidated Coal and Coke company will put electric power in its Camden, Streets Run and Dravosburg mines this fall.

The Yerkes electric fountain in Lincoln Park, Chicago, which has been out of repair for some time, is to be fitted up for the G. A. R. encampment here this month.

A new use of the portable electric light is reported from Portugal. It is for fox and badger hunting. When fixed to the collar of a dog that is entering the burrow the light frightens the animal out.

The Genesee Electric company of Rochester is a newly incorporated company. The directors are: F. C. Boland of New York city and Fred C. Cochen and P. H. Flynn of Brooklyn. The capitalization is $50,000.

TRADE NEWS.

MacDonald Bros., manufacturing electricians of Winnipeg, Man., have suffered a complete loss by fire. The loss is given as $10,000.

The Michigan Carbon Works at Delray, near Detroit, were visited by a fire the morning of July 31st. The acid department was completely destroyed, at an estimated loss of $27,000.

The Granite State Electrical Works of Lisbon, N. H., has filed articles of incorporation, with a capitalization of $25,000, to manufacture magnet wire. The incorporators are: Henry C. Libby, Henry H. Atwood, Calvin I. Currier, Jesse W. Richardson and Warren Williams, all of Lisbon.

The following announcement is made by the Electric Storage Battery company of Philadelphia: "The Electric Storage Battery company and the Electric Boat company have filed papers in suits for infringements of patents, in the United States Circuit Court, Southern District of New York, against the Gould Storage Battery company, and in the United States Circuit Court Northern District of Ohio, against Sipe & Sigler, manufacturers of Willard storage batteries."

Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until August 20th, and then opened, for the repair and enlargement of the electric-wiring and lighting system, in the United States Postoffice and Subtreasury building, Boston, Mass., in accordance with the drawings and specifications, copies of which may be had at the discretion of the supervising architect, on application at his office, or at the office of the custodian at Boston, Mass.

The Johnson Electric Service company of Milwaukee has signed articles of incorporation, with a capital of $800,000. The new company will absorb the old Milwaukee company of that name, the Johnson Temperature Regulating company of New York and the Johnson Temperature Controlling company of Chicago. The officers of the reorganized company are: President, William Plankinton; vice-president and treasurer, W. S. Johnson; secretary, J. M. Doesbury. The directors are W. S. Johnson, A. A. L. Smith, Jesse Stone, August Vogel, William Plankinton, and J. M. Doesbury of Milwaukee, and W. D. Bristol and B. T. Voigt of New York.

BUSINESS.

The Western Electric company reports largely increasing sales of the new-type Sunbeam incandescent lamp. A very large order for these lamps has just been received for shipment to South America. Anyone desiring these lamps who has not yet received a copy of the handsome catalogue may obtain one by writing.

The equipment of electric motors and dynamos for the new Russian war vessel Variag, just turned out by the Cramps shipbuilding yards of Philadelphia, and recently accepted by the Russian government, after severe trial tests, was supplied by the General Electric company, some from the Lynn factories and others from the factories at Schenectady, N. Y.

W. N. Matthews & Bro. of St. Louis, general agents for the Stombaugh guy anchor, report splendid business on that specialty. They have received orders in the last week for 1,685 anchors, including one order for 1,000 eight-inch anchors for a new long-distance telephone company. They have recently appointed S. B. Condit, Jr., & Co. agents for the New England states and the Western Electric company agent for the Atlantic states and Canada.

The rapid growth of the export business of the B. F. Sturtevant company of Boston, Mass., manufacturer of blowers, heating and drying apparatus, engines, forges, electrical equipment, etc., is well exemplified by recent foreign orders for forges, which aggregate 200 for Japan, 75 for Russia, 40 for Germany, 32 for Canada, and 24 for Sweden, in addition to large numbers distributed through its London and continental stores. Domestic demands have likewise increased in the same line during the last few months, large forge equipments having been furnished to several ship-building and locomotive shops in the United States. The manual-training, trades and technical schools have also been placing some large orders with this company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 31, 1900.

654,583. Machine for Winding and Insulating Electric Coils. James C. Anderson, Jersey City, N. J. Application filed February 7, 1900.

In a machine for winding fibers, filaments or strands, the combination of a winding spindle, means for feeding the fibers, filaments or strands thereon in layers to form a coil, and means for automatically inserting a sheet material between the layers of the coil.

654,586. Conduit Electric-railway System. Frank M. Ashley, New York, N. Y., assignor to the General Electric company of New York. Application filed February 26, 1898.

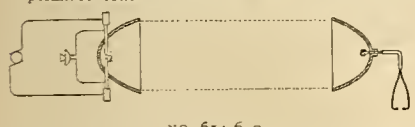
In an electric-railway system, the combination with a conduit, of a hinged cover therefor, sectional working conductors in the conduit, and means for establishing electrical connection between the conductors and the motor of the car when the cover is in its normal position over the conduit.

654,595. Method of Operating Dynamo-electric Machines. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed May 26, 1900.

The method of adjusting the angular position of the rotating member of a synchronous dynamo-electric machine which consists in causing the member to slip until the desired angular position is secured and then checking any further slip.

654,625. Signaling Device. John L. Hall, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed May 10, 1900.

A shutter for a searchlight projector, or other signaling device composed of a plurality of sections of opaque heat-resisting material mounted to shift between the source of light and the mirror, and means operative from the outside of the regulating device to shift the sections, to cut off or permit reflection of the beam.



NO 654,625.

654,630. Radiophony, Hammond V. Hayes and Ernest R. Cram, Cambridge, Mass., assignors to the American Bell Telephone company, Boston, Mass. Application filed June 7, 1897.

The combination with a radiophone receiver, of an electrical circuit containing a source of electric current and a device for developing radiant energy under the action of the source, and means for producing characteristic alterations of the radiant energy, consisting of an auxiliary circuit associated with the first-named circuit and a transmitting apparatus contained therein and adapted to alter the current thereof and thereby correspondingly modify the current supplied to the first-named circuit to the device for developing radiant energy. (See cut.)

654,631. High or Low-water Alarm for Boilers. Eugene D. Hays, Philadelphia, Pa., assignor, by direct and mesne assignments, of two-thirds to John W. Griffenberg, Fred. De Witt Goodwin and William C. Hays, Philadelphia, Pa. Application filed December 15, 1899.

The combination, in a high and low water alarm for boilers or tanks, of a vertical tube or guage glass, a vertical tube extending parallel with the guage glass and connected therewith at the top and bottom, a dependent curved connection having electrical termini inserted therein, electrical contacts, mercury in the curved connection to complete or break an electrical circuit between the termini, thereby giving an alarm, and a stop-cock having couplings thereon to receive the tubes.

654,632. Gear for Motor Cars. Jean J. Heilmann, Paris, France. Application filed December 19, 1899.

A variable speed-driving gear is described consisting of a number of magnetic clutches fixed to gears of different ratios, one or another of the magnetic clutches being thrown in to vary the speed.

654,656. Elevator Controller. Nils O. Lindstrom and Allan Cowperthwait, New York, N. Y., assignors to A. B. See Manufacturing company. Application filed April 11, 1900.

The combination of an elevator car, an actuating electric machine therefor, two controlling switches for the respective directions of rotation of the actuating machine, a fluid-pressure motor for each switch, a valve controlling each motor, a brake for the actuating machine and a fluid-pressure motor operating the brake, and means whereby the operation of either of the valves will control the pressure in the motor operating the brake.

654,658. Electric Railway. Gustav A. Lyncker, Munich, Germany. Application filed April 23, 1900.

In an electric railway, the combination with a plurality of surface contacts, and normally open conductors for supplying current to the contacts, of electromagnets for each conductor, means operated by the electromagnets when energized for closing the respective conductors where normally open, a battery carried by the car, and connections between the battery and the surface contacts and between the latter and the electromagnets, whereby the electromagnet beneath the car and the electromagnet in advance of the car are both simultaneously energized.

654,663. Electric Regulating Device. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed May 21, 1900.

A regulating device consisting of a single primary winding and a plurality of subdivided secondary windings in inductive relation to the primary winding.

654,679. Electric Arc Lamp. Carl Schuster, Pittsburg, Pa., assignor to Pittsburg Electrical and Machine Works, Pittsburg, Pa. Application filed June 13, 1899.

In arc lamps, the combination of an expansive strip forming a part of the circuit and continuously receiving the full force of the current, the strip being returned upon itself; a roller supporting the bend of the strip; a pivoted lever connected to one end of the strip; a pawl connected to the other end of the lever and engaging with a clutch on the upper carbon, and a weight adjustable on the lever serving to regulate the tension of the strip and to assist in regulating the feed of the carbon. (See cut.)

654,693. Electrical Igniter for Hydrocarbon Engines. Hugo Wegelin, Augsburg, Germany. Application filed February 16, 1899.

In combination in an igniting device for gas engines, a contact piece, electric connections controlled thereby, electrodes in the electrical connections and a tappet having an inclined edge adapted to effect early or late separation for early or late ignition according to the relative position of the contact and tapper, one of the parts being adjustable in relation to the other and means for operating the tappet.

654,700. Electric Controller. William Asbury, New York, N. Y. Application filed December 1, 1899.

In an electric controller, the combination with a revoluble shaft, of a cylinder of non-conducting material loosely mounted on the shaft; radial contact blades projecting from the cylinder; conducting bases for the blades; a catch disk secured to one end of the cylinder; contact clips with which the blades contact; a gear wheel fixed to the shaft; a quadrant gear meshing with the gear wheel; stop mechanism co-operating with the catch disk and quadrant gear; means for rotating the shaft and means for causing the rotation of the cylinder by the rotation of the shaft.

654,734. Electric Commutator Cleaner. August H. Jahn, Homestead, Pa. Application filed November 23, 1899.

In a cleaning or grinding device for commutator cylinders, the combination with a supporting frame, of a holder containing a cleaning block and movable toward and away from a commutator cylinder, a pair of levers pivoted in the frame, links connecting the holder with the outer ends of the levers, a solenoid and a core therefor having a slot-and-pin connection with the inner ends of the levers.

654,747. Supervisory Signal for Telephone Switchboards. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed November 13, 1897.

The combination with united telephone lines and a signal associated with each line and controlled by current in the line of a pilot signal and mechanism actuated in the simultaneous operation of the signals adapted to cause the display of the pilot signal.

654,748. Telephone Toll Apparatus. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed November 13, 1897.

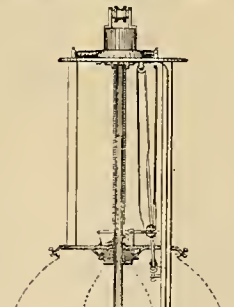
The combination with a telephone line and a coin-collecting or registering appliance at the station thereof, of a supervisory visible signal at a central office associated with the line, and circuit connections changed through the agency of the coin-collecting appliance adapted to operate the supervisory signal, whereby the required act of payment is signaled to the operator without the use of her telephone.

654,749. Signal Appliance for Telephone Switchboards. Frank R. McBerty, Downer's Grove, and James L. McQuarrie, Chicago, Ill., assignors to the Western Electric company, Chicago, Ill. Application filed November 22, 1897.

The combination with telephone lines and plugs and plug circuits for making connection therewith, each telephone line being provided with a switch at its station for changing the resistance of the line circuit in the use of the telephone, of a key in each plug circuit, a general supervisory signal and a source of current, each key being adapted to connect the general signal and source of current temporarily with the corresponding plug circuit to determine the condition of use or disuse of the substation instruments.

654,750. Switchboard for Telephone Lines. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed December 26, 1899.

The combination with a telephone line, a spring jack forming a terminal of the line, and a plug and plug circuit for making connection with the spring jack, of a local circuit terminating in normally separated opposed contacts of the spring jack adapted to be crossed together through the sleeve of the plug, and a magnet in the local circuit, a branch of the local circuit terminating in the contact sleeve of the plug, a secondary supervisory signal in the last-mentioned branch, and a supervisory relay in the plug circuit controlling the signal.



NO. 654,679.

654,752. Speed-governor Attachment for Electrical Apparatus. James H. McGurty, Jersey City, N. J., assignor of forty-nine one-hundredths to Thomas McEwan, Jr., Jersey City, N. J. Application filed April 25, 1900.

The combination with an electrical controller having a rotary controlling shaft, of an air-check device comprising an air cylinder and a reciprocating plunger working therein, the plunger having an operative connection with the rotary controlling shaft, and co-operating means between the plunger and the cylinder for causing the plunger to have an intermittent slow and accelerated inward movement. (See cut on next page.)

654,758. Apparatus for Telephone Switchboards. Joseph J. O'Connell, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed May 12, 1899.

An apparatus for telephone switchboards, consisting of a connecting plug and its cord circuit, a seat wherein the plug is adapted to rest when not in use, switch contacts and means for setting the same controlled by the co-operation of the plug with its seat, an electromagnet having an armature for releasing the switch contacts and means for energizing the magnet.

654,803. Trolley Wheel. Stephen G. Reynolds, Easton, Pa., assignor of one-half to Nat Freeman, Easton, Pa. Application filed December 11, 1899.

A trolley wheel having in combination a peripherally-grooved annular center provided with integral lateral projections, side disks having interlocking indentations or depressions on their inner sides corresponding in number

and position with the projections, whereby the disk and center are locked against relative rotary movement and a pin on which the side disks have their bearings.

654,816. Electrical Transmission of Power. Imle E. Storey, Trenton, N. J. Application filed November 18, 1899.

The combination of a variable-speed dynamo-electric machine, a storage battery and an electric motor in series therewith, an exciting coil on the field magnet of the dynamo, an opposing coil for weakening the field-magnet excitation of the dynamo, and means whereby the voltage generated by the dynamo in excess of that required to charge the battery and drive the motor will cause current to flow through the opposing coil. (See cut.)

654,818. Sparking Igniter for Explosive Engines. Harry C. Thamsen, Hamburg, Pa., assignor of two-thirds to Alexander Murdoch, Hamburg, Pa., and Adam H. Leader, Reading, Pa. Application filed April 17, 1900.

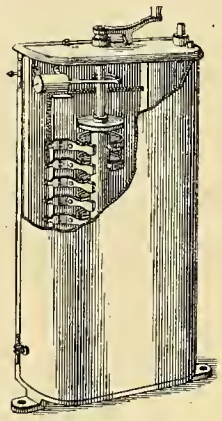
In an electrical igniter a casing having vertical insulated parts passing through the casing, their ends depending below the casing and connected by means of contact plates, an operating rod passing through an insulated opening in the plate, and having a flange adapted to make contact with the upper face of the plate, the upper end of the rod entering the casing and backed by a coiled spring.

654,821. Flash-light System. Martin Wright, San Antonio, Texas. Application filed April 28, 1900.

A flash-light system comprising main-line wires, a plurality of banks of lamps connected across the main line, an electrically operated switch for the circuit of each bank of lamps for cutting the banks of lamps into and out of the main line, an electrically operated switch for opening and closing the circuit of the main line, a battery common to all the switch circuits, and a circuit closer adapted to open and close the circuits of the several switches successively.

654,847. Automatic Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical Manufacturing company of New Jersey. Application filed November 1, 1897.

In an automatic magnetic circuit breaker, the combination of separable co-operative contacts, with mechanism for separating them, a latch for holding the contacts in closed relation, a plurality of electromagnetic actuating devices, each operating independently of the other, and a member operated by each of the electromagnetic actuating devices upon an overload therein to strike the latch and disengage it.



NO. 651,752.

654,848. Automatic Magnetic Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing company of New Jersey. Application filed January 5, 1898.

In an automatic magnetic circuit breaker the combination of a main breaker and supplemental automatic magnetic breaker in shunt therewith adapted to break the circuit after the separation of the contacts of the main breaker.

654,851. Semaphore-operating Mechanism. Judson Shoecraft, Eskridge, Kan., assignor to Charles C. Gardiner, Bradford, Kan. Application filed October 10, 1899.

The combination with a semaphore, of a follower connected therewith and comprising two separable parts movable toward and away from each other, electrically operated means in the path of movement of the parts of the follower for engagement by the parts of the follower, the electrically operated means being adapted to move the follower and to move the semaphore in one direction, electrically operated means for locking the parts of the follower to the moving means and for releasing the parts of the follower from the moving means for subsequently breaking the circuit of the moving means, means for holding the follower intermediate of the limits of its motion, means for releasing the follower to allow it to reach the limit of its continued movement, and means for moving the parts of the follower into engagement with the moving means.

654,871. Electric Cable. John Y. Buchanan, Edinburgh, Scotland. Application filed May 18, 1900.

An electric cable comprising a conductor having alternate coatings of guttapercha and a compound of india-rubber and ozocerite, the innermost and outermost of such coatings being of guttapercha.

654,883. Motor Controller. William B. Elliott and John W. Eskholme, Westfield, N. J., assignors to the C. & C. Electric company of New Jersey. Application filed April 2, 1900.

In combination, a plurality of armature windings, a hand-lever, means operated by the movement of the lever in one direction to connect the windings in series, a series of resistances in the armature circuit, means connected with the lever and adapted on the movement of the lever in one direction to cut out in succession some of the resistances, a switch connected with the lever and operated by a further movement of the lever in the same direction to throw the windings into parallel and at the same time introduce into the circuit a series of substantially compensating resistances, and means connected with the lever and operated by a further movement of the lever in the same direction to cut out in succession some of the latter resistances.

654,924. Switchboard for Telephone Lines. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed December 26, 1899.

The combination with telephone lines and multiple jacks, one for each line on each section of a multiple switchboard, individual calling signals, one for each line, and an answering jack for each line associated with its individual call signal, of an answering plug and a calling plug united in a circuit for connecting lines together, and a source of current in a bridge of the plug circuit, the answering jack and answering plug being adapted to each other to avoid the formation of accidental battery currents in the insertion of the plug; a relay controlling the connection of the plug circuit with the calling plug, and a local circuit closed in registering contacts of the calling plug and a multiple jack when the plug is in its place in the jack for exciting the relay, whereby a call may be answered and a connection completed with the line called for without producing unnecessary variations in the current over the calling line.

654,951. Process of Manufacturing Composition Applicable for Electric Insulation. William J. Cordner, London, England, assignor to Louis D. Brandeis, trustee, Boston, Mass. Application filed October 17, 1899.

A process for the manufacture of a composition consisting of treatment of rhea fiber, in a solution of silicate of soda of a density of 15 to 20 degrees Baume, the drying of the same to extract the moisture, the saturation of the fiber with a heavy hydrocarbon such as resin oil and the like, the removal of superfluous heavy hydrocarbon, the treatment by heat of the saturated fiber to transform it into a heavy hydrocarbon cellulose, the disintegration of the cellulose and the mixture therewith of gums, resins, oxidizable oils and the like to form a composite material.

654,952. Composite Material Applicable for Electric Insulation. William J. Cordner, London, England, assignor to Louis D. Brandeis, trustee, Boston, Mass. Original application filed October 17, 1899. Divided and this application filed February 6, 1900.

A composite material made from a heavy hydrocarbon cellulose derived from rhea fiber, mixed with oils, resins, gums and similar materials.

654,967. Electric Signal and Fire Alarm. David Geywits, Rome, and William Still, Utica, N. Y., assignors to Michael H. Powers, Rome, N. Y. Application filed February 16, 1900.

The combination of a movable contact piece and a clock-work for operating the same, with a series of normally stationary contact members adjustable to pass into or out of the path of the contact piece, a switchboard having a series of conducting members each connected with one of the contact members, and an additional conducting member not so connected, a series of movable circuit closers, such as plugs, adapted for engagement with the conducting members, a series of circuits in which are included the circuit closers and the contact pieces, so that the engagement of the contact piece with one of the contact members will close a circuit through the conducting member connected with the contact member, when the conducting member is engaged by one of the circuit closers, and a permanent electrical connection from the additional conducting member to each of the circuits, so that the circuits may be closed independently of the contact piece and contact members, by an engagement of the circuit closers with the additional conducting member.

654,999. Electric Motor. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed May 7, 1898.

In an electric motor, the combination of a field magnet having one wound and one unwound pole, an armature revolving within the field magnet, and an energizing coil for the field magnet which surrounds the entire upper half of the armature.

655,006. Electric Lock. Theodore P. Pratt, Boston, Mass., assignor to Fred Warren Clark, Boston, Mass. Application filed April 21, 1900.

In an electric lock, the combination of a pivoted bolt head or latch, a latch bar connected with the latch and adapted to be moved to retract the same, two independent knob-operated tumbler dogs arranged in proximity to the latch bar, a dog pivoted to the latch bar and adapted to be moved simultaneously into engagement with one tumbler dog and out of engagement with the other, the bolt having a spring whereby it is normally engaged with one of the tumbler dogs and normally separated from the other, and electrically controlled means for displacing the latch-bar dog from its normal position and moving it into engagement with the tumbler dog from which it is normally separated.

655,014. Trolley. Felix J. Rogers, Crafton, Pa. Application filed January 3, 1900.

In a trolley for electric cars, the combination of a plate rotatably mounted in a trolley stand and provided with eyes, a trolley pole pivotally secured to the plate, a substantially U-shaped spring mounted upon the pivotal pin of the trolley pole with the cross-bar which connects its two members engaging the underneath face of the trolley pole and its ends adjustably secured in the eyes on the plate, a sleeve mounted upon the pole and provided with eyes, an auxiliary trolley pole pivotally secured to the sleeve with a trolley wheel mounted on its upper end, a substantially U-shaped spring having its ends adjustably mounted in the eyes and the cross-bar connecting the two members engaging the underneath face of the auxiliary trolley pole, a keeper mounted on the auxiliary trolley pole, a like keeper mounted on the trolley pole proper, and a yoke or clevis engaging the keepers for limiting the upward movement of the auxiliary trolley pole.

655,032. Rectifying Alternating Currents. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed March 28, 1900.

Means for maintaining synchronism between two electric machines connected in the same alternating-current circuit, comprising a synchronous motor and a source of supply therefor delivering impulses of higher frequency, but constant relation to the currents in the circuit.

655,041. Light Especially Adapted for Electric Headlights for Locomotives. William H. Young and Stephen A. Hayes, Sanford, Fla. Application filed March 14, 1900.

In a headlight or the like, the combination with a source of light, and a lens or glass, of a transparent or translucent body interposed between the source of light and the lens or glass and nearer to the source of light and adapted to protect it from the heat of the light.

655,047. Quick-break Electric Switch. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction company, Utica, N. Y. Application filed March 10, 1899.

In an electric switch the combination with terminals, of main and auxiliary blades adapted to bridge the terminals, a spring having connection with the auxiliary blade and adapted to throw it, means for placing the spring under tension, a latch adapted to hold the auxiliary blade against the action of the spring and means for moving the auxiliary blade bodily from the influence of the latch.

655,057. Thermostat and Alarm Circuit Controlled Thereby. Henry G. Carleton, New York, N. Y., assignor to the Carleton Electric company, New York, N. Y. Application filed September 8, 1899.

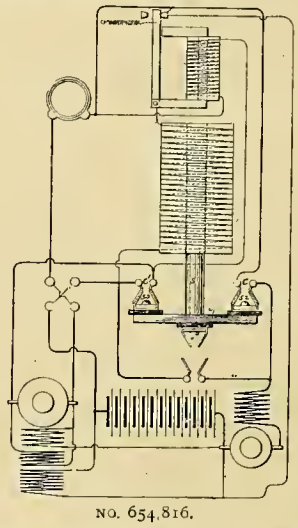
In a fire-alarm apparatus the combination of an electric circuit including a source of electric energy and suitable alarm mechanism, a thermostat comprising two hermetically closed chambers containing a gaseous substance and of unequal thickness, a circuit-closer controlled thereby, and circuit terminals leading from the source of energy to and controlled by the circuit closer.

655,063. Electric Arc Lamp. James E. Davidson, Butte, Mont. Application filed October 17, 1899.

In an arc lamp, a feeding mechanism for the movable carbon having a lazy-tongs interposed between the carbon and its actuating devices, the carbon being sustained by the lazy-tongs in its center line and wholly supported thereby, and the lazy-tongs forming the means for transmitting the motion of the actuating devices to the movable carbon.

655,110. Gas Battery. Andrew Plecher, Savannah, Ga. Application filed November 23, 1899.

A gas battery comprising a cell formed of a porous solid non-conducting body, homogeneously filled with a chemically deposited metal of the platinum group, and having on one side a superficial electrode adapted to be covered by one gas, and on the other side a superficial electrode adapted to be covered by the other gas.



NO. 654,816.

655,111. Electrolytic Apparatus. Andrew Plecher, Savannah, Ga. Application filed January 20, 1900.

An electrolytic apparatus of spheroidal shape consisting of two separate closed cells or chambers forming sections of the spheroid with flat sides juxtaposed and having registering openings for intercommunication, and an encompassing band or jacket completely encircling and holding them together, the cells being provided with electrodes and circuit wires and gas-discharging pipes.

655,113. Electromagnetic Telephone. Andrew Plecher, Savannah, Ga. Application filed February 16, 1900.

A resistance-varying medium for a telephone consisting of a coil of fine bare wire of magnetic metal having separated turns of convolutions interposed in the circuit and arranged to collapse and reduce resistance from magnetic action.

655,144. Electric Signal-registering System. Otto P. Yurgae and Robert H. Yurgae, Milwaukee, Wis., assignors, by direct and mesne assignments, to the Yurgae Signalphone Manufacturing company, Milwaukee, Wis. Application filed May 14, 1900.

The combination of a main-station battery and electric signal register apparatus, call-station instruments in series on a line in circuit with the battery and apparatus, each instrument comprising a number wheel, a spring motor for it, separable conductors intercepting the line and arranged to have one thereof in yielding opposition to the teeth of the wheel, a crank on a motor shaft movable in one direction to contract the motor spring, a device movable with the crank to separate the conductors, coincident with expansion of the spring, an electric telephone apparatus in circuit with the aforesaid conductors, the motor crank serving as a hanger for the receiver element of this apparatus; means for ground circuiting the number wheel with the aforesaid battery, a main-station electric-telephone apparatus, a battery for it, and means for putting this telephone apparatus in and out of circuit with the line of call stations.

655,164. Connection Counter for Telephone Lines. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed November 13, 1897.

The combination with a telephone line, a magnet associated therewith to indicate a call, and means for making connection with the line, of an electrically controlled connection registering appliance associated with the line, a local circuit including the magnet thereof, the local circuit being normally broken at two points, switch contacts controlled by the call-indicating magnet to close one break in the local circuit, and other switch contacts adapted to be brought together in the act of making connection with the line to close another break in the local circuit, whereby the registering appliance is actuated when a call is followed by the establishment of connection with the line.

Western Electrician.
EVERY SATURDAY.
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New Wheel-pit at Niagara.

By Orrin E. Dunlap.

The new wheel-pit at Niagara Falls has reached a depth of 75 feet. Operations are carried on night and day, and there is every reason to believe that the contract will be completed by June, 1901, as expected. Ground was broken in October, 1899, and by the time the work is completed 20 months will have elapsed. It will be recalled that the pit is to be carried to a depth of 180 feet, and, therefore, about 100 feet more are to be excavated before the bottom is reached.

The contract is in the hands of the National Contracting company, and this company has about 400 men on the job. These men work in shifts of equal length, and every facility in the way of machinery is at their command to aid in doing rapid work. When completed, the pit will have a length of 463 feet and one inch between channel cuts. The width between the brick lining will be 16 feet below the turbine deck and 17 feet four inches above the deck. Above the thrust deck the width between face and face of the arris lines of masonry will be 21 feet, the depth having been stated above. In this pit there will be installed 11 units of 5,000 horsepower each, or a total of 55,000 horsepower output capacity, which will exceed the present pit's output capacity by 5,000 horsepower. Six of the 11 units are to be installed as soon as the pit is ready for them. The pit is to be lined throughout with brick, ample drainage facilities being provided to drain the water that is likely to flow from the rock behind the walls. The new pit and the old pit are to be connected by an underground passageway or tunnel, located about 130 feet below the surface. This passageway will be about 200 feet long, six feet wide by eight feet high. It will be lined with brick and lighted by incandescent lamps Its main purpose will be to afford employes facilities for passing from pit to pit without ascending to the surface every time. It will be constructed under the inlet canal.

A. C. Douglass, who has a sub-contract with the National Contracting company for the sinking of a shaft in front of the power station and the extension of the main tunnel, has completed the shaft and has gone 200 feet on the tunnel extension, the total length of which is to be 616½ feet. The method of operation is to remove the upper bench or section first. This tunnel extension is to be built on a curve, the length of which will be 368½ feet, the radius of the curve being 186½ feet. The excavated material is raised to the surface by means of a derrick. About the mouth of the shaft, which is sunk right in the bed of the inlet canal, there are being erected substantial masonry walls, in order that the water of the canal will not enter when it returns to its normal location.

The big cofferdam (Fig. 2) in the inlet canal in front of the wheel-pit location has been completed. This is 550 feet long, and is formed of two rock-filled cribs, between which there is a clay puddle. Excavations for the inlets have been commenced behind the wall of the canal.

There has been erected over the wheel-pit a Lidgerwood patent cableway, which is operated by means of two towers, one at each end of the pit. One of these towers, shown in Fig. 1, is 60 feet high, the other 30 feet. A 2½-inch cable is used The length of cable between towers is 600 feet, and the total length is 840 feet. Fig. 3 is a picture of the new wheel-pit, showing the cableway and the compressor plant in the distance. At each end of the cable an anchorage, amounting to 19 tons, has been provided, by sinking a round oak log 25 feet long and 30 inches in diameter 12 feet in the ground and surrounding it with concrete and loading it with rubble-stone piles. The cableway is capable of lifting a 10-ton load and has the aerial-dumping feature. The buckets used hold two cubic yards and are run close up to the higher tower, where the contents are dumped in Goodwin gravity-dumping cars in which the excavated material is conveyed to the trestle of the Niagara Junction railway, where it is used to form a roadbed, preparatory to double-tracking the line. Fig. 1 shows the high tower and a bucket being dumped. The dumping of the buckets operated on the cableway is brought about by the engineer in charge of this feature of the work, located in a small building near the big tower. The first of these cableways used on heavy construction was employed by George B. Burbank, on the Sodom dam in 1887. Mr. Burbank is consulting engineer of the National Contracting company on the present work, and he is very glad to have the service of the cableway on the Niagara contract.

The blasting in the wheel-pit is done at the off hours, 12 m. to 1 p. m.; 6 to 7 p. m.; 12 to 1 midnight, and 6 to 7 a. m., dynamite in careful quantities being used. It will be seen from the illustration (Fig. 3) that the masonry on one side of the new pit is well under way. It will also be observed that as the work progresses, the castings for various purposes are placed in the walls, a job that requires the greatest nicety of calculation and workmanship. The several castings demanded are for bearings, guide bearings, struts and penstock bearings.

Night and day the scene about the new wheel-pit work is one that commands much attention and gives high ideas as to the future power development. All about, on every side, there is a vast quantity of material that is to be employed in the building and construction operations, and the forces of more

Fig. 1. High Tower of Cableway.

Fig. 3. Wheel-pit Showing Cableway and Masonry Construction.

Fig. 2. Large Cofferdam in Inlet Canal.

NEW WHEEL-PIT AT NIAGARA.

than one plant are crowded to their utmost capacity in order that the Niagara wheel-pit may go on to completion without delay or interruption.

In Fig. 4 is given a view of the new wheel-pit taken at night. The pit itself is lighted by the arc lamps placed along its sides. At the left is seen the present large power house of the Niagara Falls Power company, while the lights at the right are from the compressor plant.

The air-compressor plant that has been erected on the grounds is considered one of the finest ever put up in the United States. In it are 10 100-horsepower boilers, shown in Fig. 5, and four straight-line Ingersoll-Sergeant air compressors, known as "Class A" machines, and indicated in Fig. 6. Double expansion pumps feed into a tubular boiler 72 inches by 16 feet, which serves as the first air receiver. From this runs a 10-inch air main to the center of the pit, where a second tubular boiler has been installed. This is 60 inches by 16 feet, and here the second expansion of air is obtained, dropping all moisture and giving a dry-air service. Five four-inch mains run down into the pit, 90 feet apart. The compressor plant has worked admirably.

While these general statements give a very good idea of the new pit work, still a better conception of the magnitude of the contract may be obtained by taking into consideration the plant that is required to carry on the work and the material that will be consumed in the construction. So far as the plant is concerned, some parts of it have been referred to and described, but, in addition, there are on the ground in operation 10 Sullivan Machine company's channeling machines, which are used in channeling work. This job of channeling is the largest ever done on any single contract in the world, it is said, and the work of the machines may be observed on the sides of the pit, as portrayed in the pit illustration, Fig. 3. There are also six Ingersoll-Sergeant rock drills; three Ingersoll-Sergeant gadding machines, for cutting checks in the rock to receive castings; one Byer's traveling derrick of five tons' capacity, used in placing masonry and delivering concrete; three Goodwin gravity-dumping cars; 40 common dump cars; 10 derricks and hoisting engines; two 30-ton locomotives; 1¼ miles of railroad track; one Wagenhall electric headlight, which is placed about 30 feet up on the high tower and throws its beam along the cableway and down in the pit, to aid the night work.

As to the material that will be handled, there will be 32,000 cubic yards of earth taken from the pit and inlets; 68,000 cubic yards of rock from the pit, and 13,000 cubic yards from the shaft and tunnel extension; 6,000 cubic yards of cut-stone masonry will be placed; 10,000 cubic yards of Portland-cement concrete will be used; 13,000 cubic yards of brick will be laid, which means the placing of 7,500,000 brick, all furnished by the Buffalo Brick association; 1,400,000 pounds of iron and steel castings will be used, and 800,000 feet of hemlock timber, placed in the cofferdams, etc. These are no small quantities.

Walter McCulloh, civil engineer, of Niagara Falls, is the local manager of the work, on behalf of the National Contracting company. He is a gentleman of extended experience and a man of accuracy and push.

On the part of the Niagara Falls Power company, William A. Brackenridge is in charge of the big work. He has had previous experience on the original work at Niagara Falls, and is familiar with all demands of the great contract. It will be remembered that Mr. Brackenridge and Dr. Sellers went to Europe some months ago relative to prospective changes to be made in the turbines to be placed in the new pit. While it is understood that changes will be made, the exact nature of them is not yet made public by the Niagara Falls Power company. It is understood, however, that the ideas suggested by these two prominent and eminent American engineers were accepted and adopted by the designers of the original turbines, and that the new turbines will be built in accordance with the suggestions they have been pleased to make.

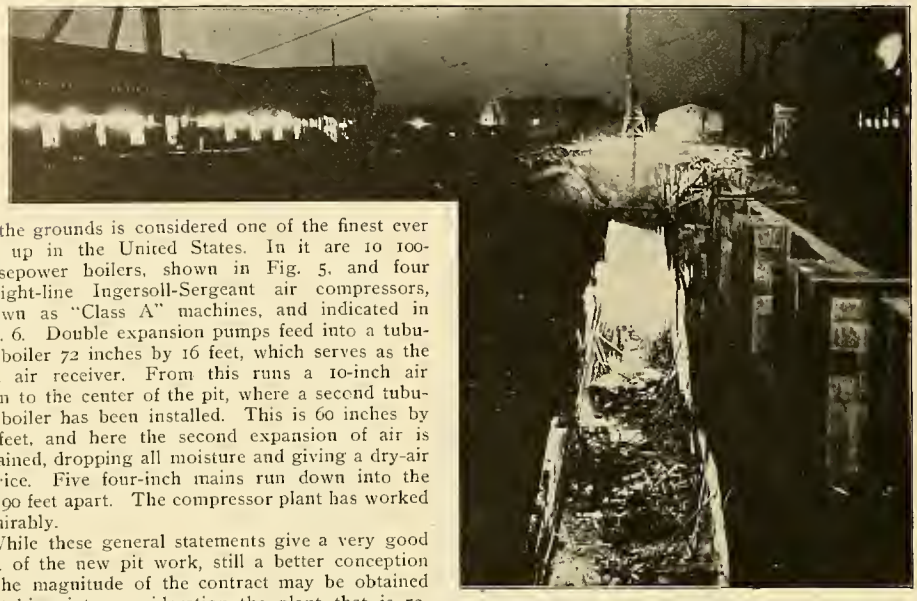


FIG. 4. NEW WHEEL-PIT AT NIAGARA.—NIGHT VIEW IN AND NEAR THE PIT.

Long Cars for Chicago City Railway.

So far the large street-railway companies of Chicago have avoided the use of the long double-truck, closed cars which are becoming so popular all over the country. There has been a feeling that by their use traffic would be much delayed during the rush hours, because of the difficulty with which passengers could get out from the middle of a long car, especially if cross-seats are employed, with the accompanying narrow aisle. The present management of the Chicago City railway, however, has had considerable experience with long cross-seat double-truck cars at St. Louis, and the results there were such that an experiment will be made with them here as soon as a trial order for some of these cars can be filled and put on the road.

Modern Switchboard Practice.

By Frank C. Perkins.

Part I—Polyphase High tension Switchboards.

There has been a continual advance in the construction of switchboards in the last 10 years, particularly in the modern light and power plants. The apparatus for controlling and handling alternating current has undergone important changes, resulting in remarkable perfection and simplicity.

In modern switchboard practice the universal method has been adopted of arranging marble panels side by side and usually supported by a suitable iron frame. In alternating and direct-current work the general arrangement is the same. One panel is installed for each generator and one panel for each one or two feeders, the instruments, switches, etc., for the generator and feeder circuits being mounted on and forming part of these panels. Additional generators and feeders may be provided for at any time by additional panels installed while the plant is in operation, forming a most flexible and uniform practice in switchboard construction.

The panels usually installed are of marble and have a height of about seven feet six inches and a thickness of two inches. For alternating-current work, the marble selected is either blue Vermont, on account of its high-insulation resistance, or the best Italian white marble, highly polished and with one-half-inch beveled edges. A rigid iron framework of angle iron supports the marble and is arranged as a part of each panel. The steel angle-bars are usually 1½ inches by 2¼ inches by one-fourth inch in size and over seven feet high, the marble panels being bolted to the 1½ and 2½-inch faces. Some manufacturers have a clear space of about two feet below the marble, which rests on ornamental iron legs. Others have the angle bars secured to the floor with angle brackets and to the wall with stay rods. The space below the standard panel is frequently used to install extra or special apparatus on slabs of marble, filling the entire space, the legs being in this case removed.

An alternating, three-phase generator switchboard of the first plan, using iron legs and with a space below, is shown in Fig. 1. It was built by the Westinghouse Electric and Manufacturing company, and is a three-phase panel board for polyphase circuits of 1,100 or 2,200 volts. All appliances are mounted directly on the panels and are arranged so that no charged metal parts are exposed on the front of the board. This prevents the liability of any accidental shock. Lamp brackets are mounted on single panels, but it is frequently recommended in large stations, that instead of placing regular illuminating lamps upon the panels, they be installed about the station, giving in this way a distribution of the light and avoiding the glare in the electrician's eyes while reading the instruments. Shaded lamps are often used, which throw the light directly upon the instruments, but when illuminated dials are used, better results are obtained without additional light.

Switches.—Usually switches are provided to substitute any dynamo in the power house for any other dynamo, also, so any of the feeder circuits may be transferred from one machine to another without interrupting the service, or causing any winking of the lights when the change is made.

The main switches are usually of the quick-break type, with marble barriers for high-voltage alternating currents, or sometimes high-potential plunger-type switches are used, which are practically non-combustible, and as no charged metal parts are exposed, they are well protected and still permit examination from the rear of the board without difficulty. This type is shown on the board illustrated (Fig. 1), and where light currents are used, one porcelain cylinder and plunger is provided in each leg of each circuit, while with heavy currents, two cylinders and plungers are used, giving four breaks in series on any one phase. These

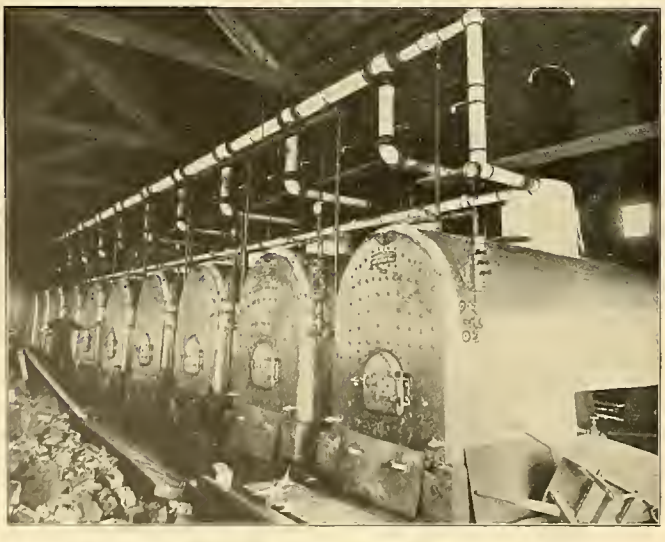


Fig. 5. Boiler Room of Air-compressor Plant.

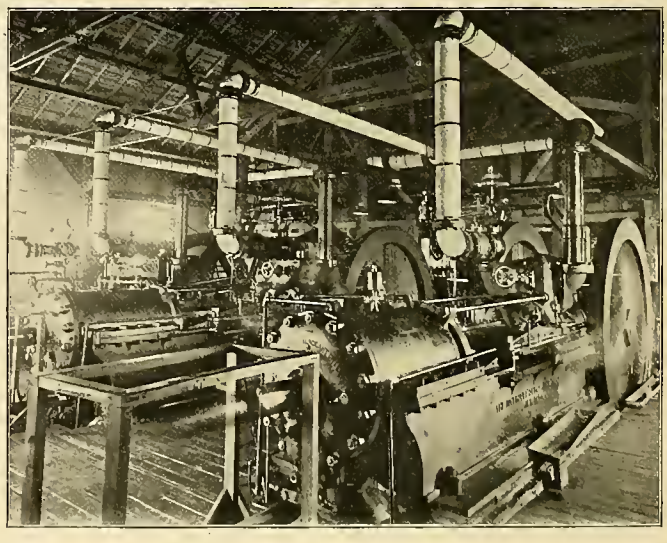


Fig. 6. Air-compressor Plant.

NEW WHEEL-PIT AT NIAGARA.

"single-break" and "double-break" switches have proven very satisfactory and break the circuit very quickly.

While many switches used in the past on high-tension boards have been ineffective when opened on heavy load, the light follower type has proven to be very efficient when circuits are not highly inductive.

For heavy inductive loads, the oil switch is strongly advocated. The switches for generator fields are recommended to be of the carbon-break

FIG. 1. MODERN SWITCHBOARD PRACTICE.—THREE-PHASE WESTINGHOUSE HIGH-TENSION POLYPHASE SWITHBOARD.

construction, which materially reduces the injurious effect of induction when the field circuit is opened, and lengthens the life of the switch. The panels are frequently fitted with synchronizing and voltmeter switches of the plug or other type.

Fuses.—The question of the use of fuses on the panels is a very important one, and is treated somewhat differently by different manufacturers. In Fig. 1 it will be noted the fuse holders are mounted at the bottom of the panel and the vent is so constructed that the vapors discharge downward toward the floor, it being claimed by the advocates of this method that the fuses, being detachable by plug switches, may be renewed easily and that the attendant cannot be burned by the blowing fuses. The fuses used on this board are mounted in lignum-vitæ fuse holders, enclosed in a chamber which is air-tight, except for one small vent. The melting of a fuse causes rapid expansion of the air contained in this chamber, and consequently causes a strong and quick air blast through the vent, blowing out the arc. Lignum vitæ being an extremely heavy, close-grained wood, does not seem to be affected by the arc. It has strength, combined with consirable elasticity, and it is claimed, for this reason, the tremendous expansive tendency of the arc is properly restrained and enough flexibility is allowed to avoid rupture. The General Electric company's practice is somewhat different, as it places the fuses at the top of the switchboard panel. Its standard fuses for alternating-current panels are also the expulsion type. In this case the fuse block contains a chamber with a small opening in front. When the fuse in this chamber is subjected to overload, it ruptures, and the force of the explosion extinguishes the arc. The expulsion-fuse block is made with clips, so that it may be removed for refusing.

Measuring Instruments.—Measuring instruments are provided of such makes as may be found adapted to the work. Of the round-type instruments shown

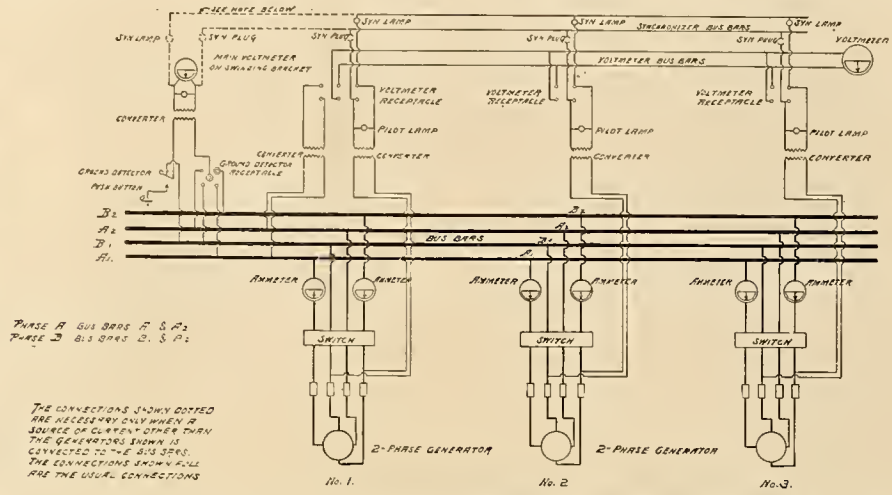


FIG. 3 MODERN SWITCHBOARD PRACTICE.— CONNECTIONS FOR THREE TWO-PHASE GENERATORS RUNNING IN PARALLEL.

in Fig. 1, the voltmeter is connected to the low-tension side of a voltmeter transformer. The voltage on any dynamo on either phase of the system will be indicated by inserting the plug switch into the proper voltmeter receptacle. For use with regulators and compensators, a special compensating

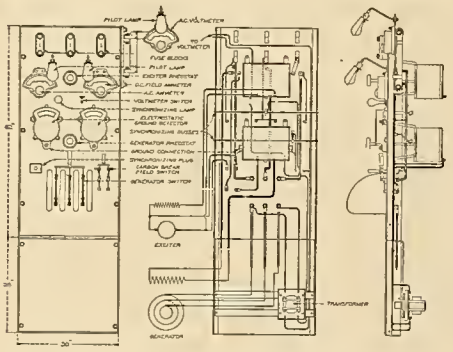


FIG. 2. MODERN SWITCHBOARD PRACTICE —PANEL FOR ONE THREE-PHASE ALTERNATING-CURRENT GENERATOR.

voltmeter is invariably used. Swinging voltmeters are often provided, and are arranged on a bracket to swing from the side of the panel; if a second panel is installed and the machines are to be operated in multiple, another voltmeter is needed; this will also be swung on the same bracket as the first voltmeter, so that comparisons of their readings can easily be made from any point in front of the switchboard.

It is often desirable to have an ammeter in the generator field, and it can usually be placed on the same panel without difficulty. The ammeters and voltmeters indicated in Fig. 2 are of the Thompson inclined-coil type, and are remarkably simple and thoroughly reliable. They are so designed that errors due to changes in temperature are avoided and no parts are liable to be altered or injured by use. The calibration parts are said to be practically permanent, and the scales are as long as the size of the instrument will allow, while the legibility is also somewhat increased by the use of wider divisions over the working portion of the scale than at the extreme ends, which are seldom used. The inclined-coil instruments are used with alternating currents of any frequency and the ammeters of capacity of 500 amperes or less take the entire current through the instrument winding, series transformers being required for greater currents. The voltmeters are connected direct to circuits up to 750 volts, while for high potentials, transformers are necessary. These instruments are installed for 50 per cent. overload capacity, and where very accurate dead-beat readings are required a special line of horizontal edgewise-inclined-coil ammeters and voltmeters are placed on the panels, instead of the ones described.

Ground Detectors and Synchronizers.—The diagram (Fig. 2) shows the details and connections of a General Electric panel for one three-phase, alternating-current generator up to 2,500 volts in capacity. It will be noted that the electric static ground detector is designed as a switchboard instrument and replaces the transformer method of detection. The synchronizing plugs, synchronizing fuses and lamps are indicated on this diagram.

The four-point receptacle is so wired that any generator can be synchronized with any other, whether with one or two sets of fuse bars. The arrangement provides for synchronizing with lamps bright, by cross-connecting one of the four-point plugs. To synchronize with lamps dark, both plugs should be connected alike.

The synchronizing method employed by the Westinghouse engineers may be seen by noting the diagrams, Figs. 3 and 4, the first showing connections with three two-phase generators running in parallel, the second diagram showing connections for three three-phase generators running in parallel. The method is simple, and may be expanded to apply to any number of generators, and affords an easy and sure way of properly throwing the machines together. The ground detector is said to be an extremely efficient and satisfactory device, it being possible to test independently either leg of the circuit.

Potential Transformers and Wattmeters.—The

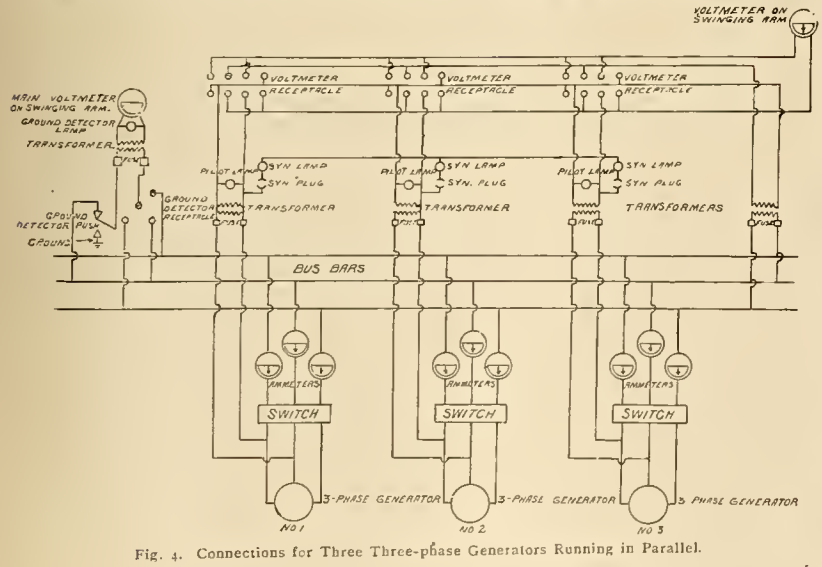


Fig. 4. Connections for Three Three-phase Generators Running in Parallel.

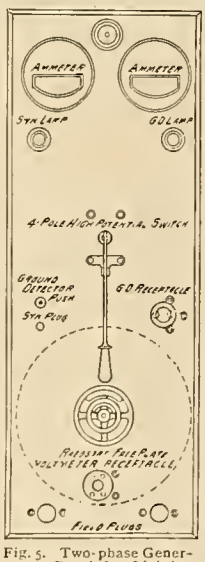


Fig. 5. Two-phase Generator Panel for Lighting Load.

Fig. 6. Two-phase Generator Panel for Lighting and Power Load.

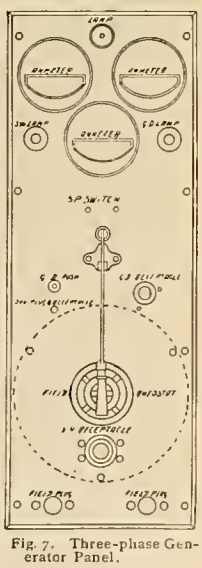


Fig. 7. Three-phase Generator Panel.

transformers, transformer fuse blocks and compensators are mounted on the back of the panels. The potential transformer is usually only of sufficient capacity to furnish current to the lamps while the generators are being synchronized. It is sometimes thought necessary that generators and feeder panels be equipped with wattmeters. Indicating wattmeters are then used on the generators and integrating wattmeters are used on the feeder panels.

Rheostats, Regulators and Lightning Arresters.—It is recommended by many prominent engineers that lightning arresters be preferably mounted on the wall of the power house where the lines enter the building, and they are usually not provided on the switchboard panels.

The alternating-current generator field rheostat is mounted on the back of the generator panel, and is so designed many times that the exciter rheostat can be placed within the alternating-current rheostat frame. Both rheostats are then independently operated by concentric hand wheels, on the front of the board, as seen in Figs. 5, 6 and 7, on page 99, which also indicate arrangements for both two-phase and three-phase generator panels. In the case of very large machines the face plate only is on the switchboard panel; the rheostat, then being too large to mount on the back of the board, is installed on an iron tripod or under the floor, and is connected by leads to the rheostat switch.

Regulators for single-phase feeders are frequently mounted directly below the feeder panels. For a two-phase feeder panel the regulator is not mounted on the board, but is a separate piece of apparatus placed in front of the feeder panel to which it belongs.

Separate and Multiple Running.—Referring to the diagram of Fig. 2, the panels are laid out, providing for generator leads from below, and feeders at the top. The connections are shown for one three-phase alternating generator panel to 2,500 volts. It is necessary that all the high-tension wiring be well insulated and separated from adjacent wires and from the back of the panels to avoid leakage and grounds. The low-tension wiring, directly back of the marble panel, is fastened to it by small insulated cleats. The transformers are mounted on the back of the board on upright iron brackets, bolted to angle bars on the back of the panel. All work on the back of the board should be as neatly and carefully executed as on the front, thus insuring freedom from future trouble by short-circuits and breakdowns.

The Westinghouse generator panel shown in Fig. 6 illustrates an arrangement of switchboard for separate running, and in this design the synchronizing devices are not used nor is the switch necessary, and the generator can be taken out of service by opening the field circuit by means of the field plugs.

The feeder panels are arranged so that for a four-wire circuit two panels are placed side by side, the switches being connected by a bar and operated together. The feeder wires are connected permanently to the middle points of the dynamo-changing switch. Two of the four-play connections in each horizontal row are connected to each bus-bar of a generator. To switch a feeder from one generator to another the proper plugs are first inserted; then the transfer is made with one quick motion of the changing-switch handle.

For multiple running the generator panel receives current from four wires from a two-phase generator, and delivers it through a switch to four bus-bars. The two wires of each phase are treated just as two wires of a single-phase circuit. Each of the two circuits or phases is provided with an ammeter (see Figs. 3 and 4), one voltmeter being so arranged that it can be connected to either phase by a plug switch. When two or more generators are to be run in multiple, each panel is provided with a synchronizing lamp, as shown in the illustrations and diagrams.

The feeder panels are arranged for multiple running, being provided with dynamo-changing switches, permitting the transfer of their feeders from one phase to another.

Capacities of Panels.—The current-breaking capacity of any given switch is affected by the frequency and by the character of the current broken. Current furnishing incandescent lighting supplied from fairly loaded transformers has little or no lag, on account of having little inductance, and constitutes practically a non-inductive load with a power factor of 100. Current furnished to motors, arc lamps and transformers lightly loaded has some lag, and may be called an inductive load. The latter current has a greater tendency to arc when broken than the former, and consequently any given switch may safely break a heavier current supplying a non-inductive load than an inductive load. The number of cycles per minute also has an effect upon the breaking capacity of panel switches. If the frequency is increased from 7,200 alternations per minute to 16,000 alternations per minute, it will decrease the breaking capacity of the switches to a very great degree.

It will thus be seen that the building of switchboards has been reduced to a definite system. Efficient, simple and well-designed switchboards are now made that may be enlarged at will, and which are neat and artistic in construction and as nearly perfect as can be produced.

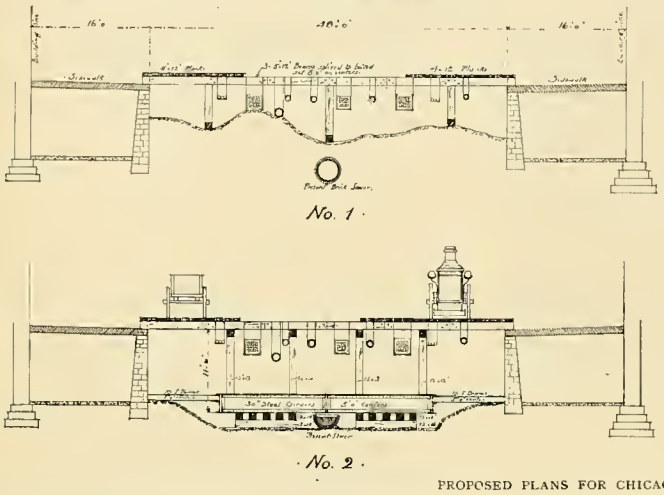
[To be continued.]

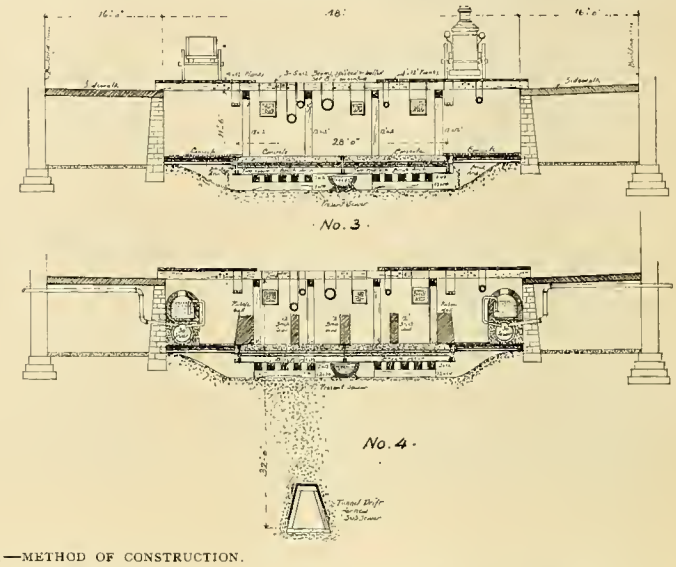
Proposed Plans for Chicago Subways.

In the issue of August 4th the Western Electrician published a partial description of the plans for the proposed street-railway subways in the business district of Chicago that had been submitted to the street-railway commission of the Chicago City Council by John M. Roach, president of the Chicago Union Traction company. This scheme is only one of many that have been proposed by different parties for the relief of the congested portion of the city, but on account of the careful working out of the details of construction and engineering difficulties to be overcome, it is probably the most practicable plan yet made public. Briefly, the plans provide for the construction of six subway loops, which will take care of all the street-railway lines entering the business portion of the city. Provision will be made in tunnels above the subways for wires, and the sewer, water and gas pipes will be carried near the surface of the street, at either side.

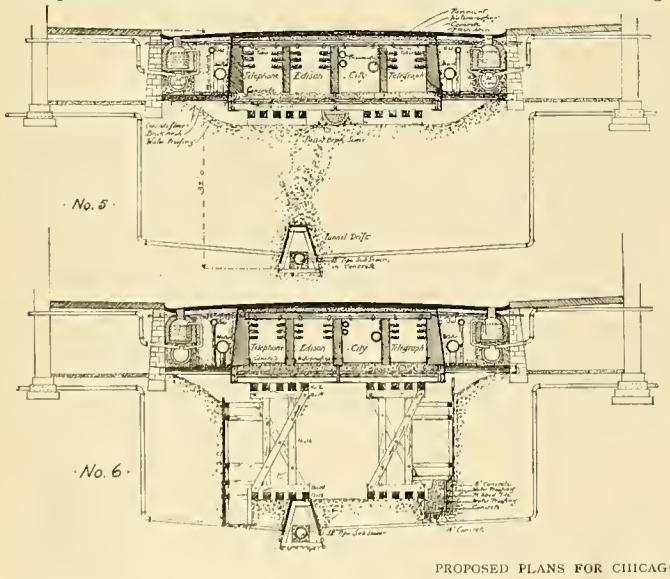
On account of the narrowness of some of the streets and the vast network of wire conduits, pipes, sewers, etc., existing in Chicago, the plans and methods of construction of this system of subways are of considerable interest. The accompanying illustrations, showing different stages in the construction of the subways and also some details of the more important features, are from the plans prepared by Mr. Roach's engineers.

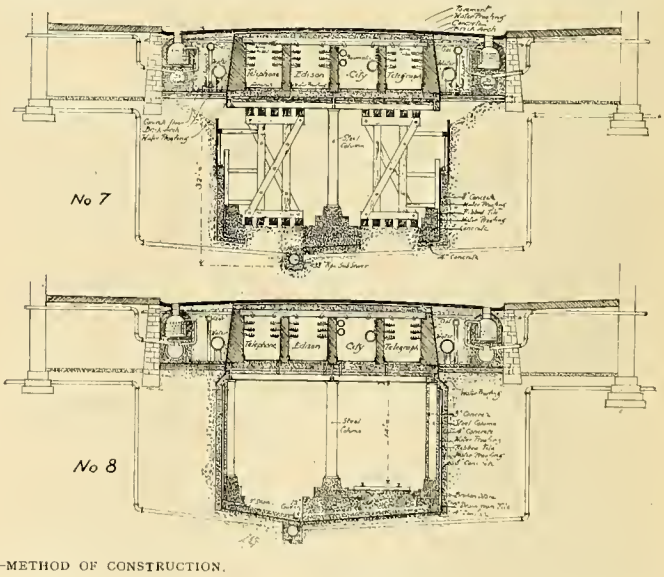
The method of construction proposed contemplates the tearing up of only one block at a time, the idea being to complete the wire tunnels and restore the pavement as quickly as possible, after which the work of completing the subway beneath may be carried on without interruption to traffic on the





PROPOSED PLANS FOR CHICAGO SUBWAYS.—METHOD OF CONSTRUCTION.





PROPOSED PLANS FOR CHICAGO SUBWAYS.—METHOD OF CONSTRUCTION.

street above. The drawings show the work on a street of average width of 80 feet. Fig. 1 indicates the first stage of construction. This will consist in digging down to the present wire conduits and water and gas pipes, and supporting these pipes, etc., by chains or wire ropes, from temporary wooden beams placed across the street and supported by 12 by 12-inch wooden columns. The ends of these beams, which will be five by 12-inch timbers, spliced and bolted three together and set eight feet apart, will rest on the edges of the sidewalks. At no time will the sidewalks be obstructed. To provide a temporary roadbed for construction wagons and also for the fire department, four by 12-inch planks will be laid across the beams and lengthwise of the street. These planks will be loose

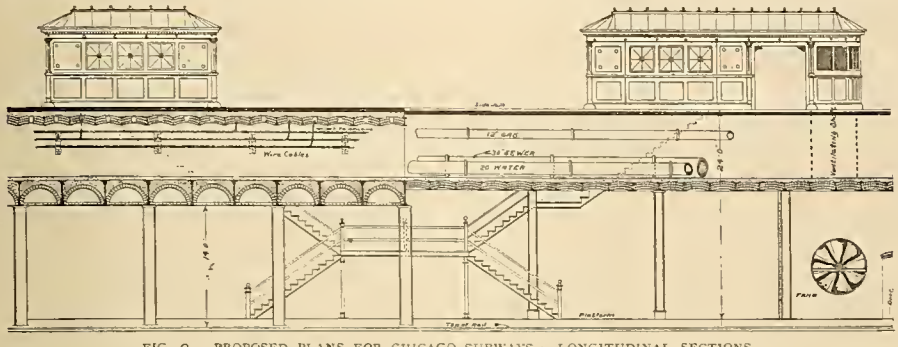


FIG. 9 PROPOSED PLANS FOR CHICAGO SUBWAYS.—LONGITUDINAL SECTIONS.

and held in place by loose bolts, projecting into the spaces between the three beams in each crosspiece. By this scheme of removable planks the temporary roadbed can be taken up entirely or widened quickly to the full width of the street, when necessary for a large fire.

After the conduits and pipes are firmly secured in their relative positions the excavation is carried on and the 30-inch steel girders that are to form the bottom of the wire tunnels and the roof of the subways are set in place in their permanent location, with five-foot centers. The 10-inch I-beams that are to form the support for the sewers at either side are also laid. This stage of construction is indicated in Fig. 2. In some of the streets a portion of the present sewers will be removed to make room for the steel girders.

Next will immediately follow the setting of the brick arches between the girders and between the beams, to support the new sewers and the laying of concrete over the arches, as indicated in Fig. 3. Then the new 30-inch sewers, set in concrete blocks, will be constructed (Fig. 4), and simultaneously a tunnel drift, 32 feet below the surface, will be cut for a new sub-sewer. As the 30-inch sewers at each side of the subway will be only eight feet below the surface of the street, the construction of a sub-sewer will be made necessary, to carry away the sub-drainage and also the sewage from some of the older buildings, in which no means are provided for raising the sewage from the basements to the street sewers. The tunnel drift will be six feet high, and the sub-sewer will be an 18-inch pipe, encased in concrete block.

At the same time this sewer is being changed the walls of the tunnels will be carried up. The three inside walls will be of brick, 12 inches thick, while the outside walls will be constructed of rubble. Then, as indicated in Fig. 5, the brick arches over the tunnels will be built, a concrete layer put on, and finally, the pavement will be restored. A damp-proofing of cement, tar and asphalt will be put on the sides of the tunnels and underneath the pavement. Of course, with the completion of the tunnels, the wires and pipes will have been changed to their new location. One tunnel will provide for telephone cables, another for the Edison company's wires, a third will be devoted to the city's uses for pneumatic tubes, wires, etc., and the fourth will provide for telegraph wires. The water and gas pipes will be supported on either side of the street on wooden columns, and the space surrounding them and the sewers will be filled in with earth to prevent frost from reaching the pipes.

Probably the most difficult engineering problem to be encountered will be that indicated in Figs. 6 and 7, viz., the excavation of the space for the subway beneath the tunnels without weakening the supports of the 30-inch girders in any manner. As the work is carried down wooden sheathing will be put in at the sides, and foundations will be prepared for the steel columns in the center and at the sides. Fig. 7 shows the center steel column in place and the side walls started. These walls will consist of eight inches of concrete on the outside, a water or damp-proofing, ribbed tile, waterproofing again, then four inches of concrete, the steel Z-bar columns and three inches of concrete, as shown in Fig. 8. At the bottom of the subway will be laid four inches of concrete and a two-inch drain, running from the side-wall tile to the sub-

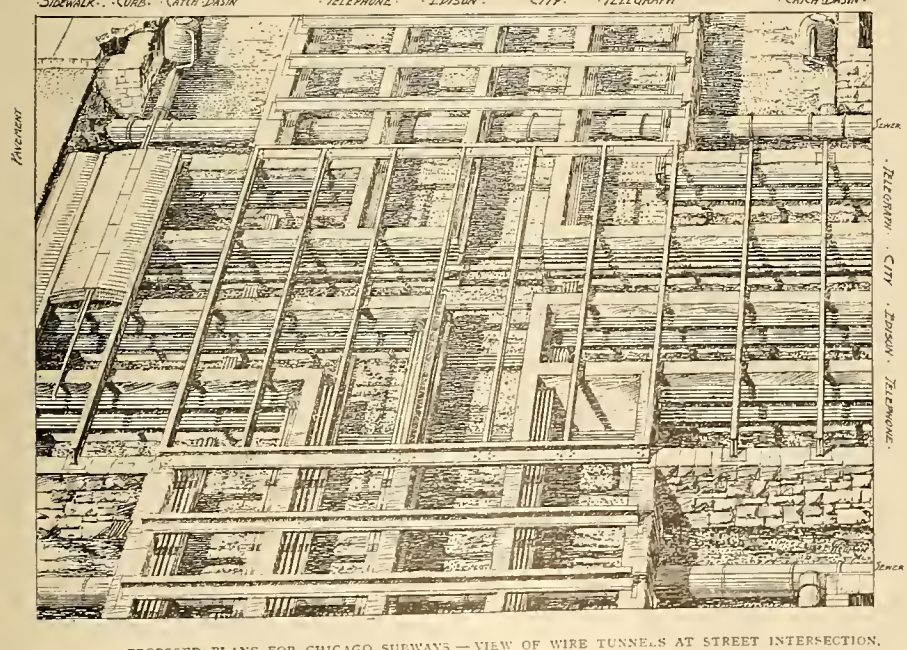


FIG. 11 PROPOSED PLANS FOR CHICAGO SUBWAYS — VIEW OF WIRE TUNNELS AT STREET INTERSECTION.

sewer. The roadbed will be built up of broken stone, and the rails will be laid on this according to ordinary railroad construction. The clear space between the rails and the roof of the subway is to be 14 feet. All cars to be run through the subways will be electrically operated.

The ventilation of the subways will be an interesting problem. The plan proposed comprises a ventilation chamber at the end of each station building, as shown at the right end of Fig. 9. A six-foot fan, driven by an electric motor, will draw the foul air from the subway and force it up through a shaft and out the wire grating in the ventilating chamber. Fresh air inlets will be provided at intermediate points between the stations.

Fig. 9 shows two longitudinal sections of the subway. The section on the right indicates the relative positions of the sewer, water and gas pipes and shows the brick-arch construction at the sides of the streets. The other section is made through a wire tunnel and the subway proper. An ingenious plan has been devised for providing outlets to the wire tunnels. The roof girders are set at five-foot intervals, with brick arches between. A cast-iron hollow keystone will be placed at the top of each of these arches, and through each of these keystones wires may be run from the tunnels to the buildings. Fig. 10 is a detailed and perspective view of one of these arches, and illustrates clearly the method of running the branch wires.

A birdseye view of the continuous tunnels for wires over the subway at a street crossing, is shown in Fig. 11. It shows the tunnels before the pavement is laid. Sewer catchbasins are provided near the corners. Where wires branch and turn down another street they are carried across the floors of the intervening tunnels.

It is interesting in considering the plans pro-

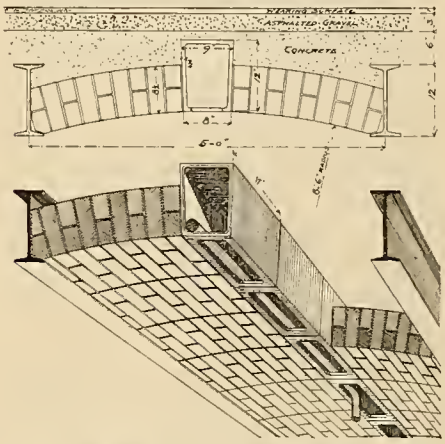


FIG 10 PROPOSED PLANS FOR CHICAGO SUBWAYS.— BRICK ARCH OVER WIRE TUNNEL SHOWING KEY STONE CONDUIT.

posed by Mr. Roach to note that the cross-sectional area of the subway, under ordinary conditions, will be 380 square feet, while the average area of the Boston subway is 350 square feet, and that of the tunnel at Budapest, 193 square feet.

Canadian Electrical Association.

The annual convention of the Canadian Electrical association will be held in Kingston, Ont., on August 29th, 30th and 31st. The convention was originally planned to be held in Ottawa during June, but had to be postponed and changed to another city on account of the large Ottawa fire. Extensive preparations are making in Kingston for the reception of the delegates and a successful meeting is looked for. The sessions will be held in the City Council chamber, and space will be provided in the city hall for exhibits of electrical appliances. The local electrical companies have agreed to furnish, free of charge, current and labor to exhibitors. Visitors will be given a trip through the Thousand Islands. The programme includes the following papers: "Utilizing the Available Central-station Capacity," by Professor R. B. Owens, McGill University, Montreal; "Use of Dynamo and Storage Battery in Telegraph Offices," by W. J. Camp, Canadian Pacific railroad telegraph office, Montreal; "Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Enclosed Arc Lamps," by F. H. Leonard, Jr., Montreal; "Government Electrical Standards," by O. Higman, Ottawa; "Railway Subject: Giving Several Curves, Showing the Average Power During a Day, and Maximum and Minimum Requirements for Power Called for on the Quebec System," by Mr. Blair, Quebec Railway and Lighting company, Quebec; "Rotary Converters," by A. Gordon Grier and J. C. Hyde, Montreal; "Conditions Affecting the Wave Form of Alternators," by Professor L. A. Herdt, McGill University, Montreal, Que.

The Electric Company of America, a Philadelphia corporation, has brought suit against the officers and directors of the Edison Electric Illuminating company of Altoona, Pa. The Philadelphia company recently bought 53 per cent. of the stock of the Edison company and then brought injunction proceedings to restrain the issue of 650 shares of new stock to the highest bidder. The Philadelphia company wants the stock issued to the stockholders in proportion to their holdings, while the Altoona stockholders want the stock sold to the highest bidder. Colonel A. Louden Snowden is president of the plaintiff corporation, which is desirous of keeping a majority control of the company.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

Canadian Electrical association, Kingston, Ont., August 29th to 31st.

Association of Edison Illuminating companies, Saratoga, N. Y., September 4th to 6th.

Inter Ocean Automobile Meet, Chicago, Ill., September 18th to 22d.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria November 27th.

The last month has been notable for the number of electric-railway accidents, due not so much to fault of the railway companies as to the panic of passengers caused by some slight accident to the equipment. In several cases the injuries of passengers were due almost entirely to frantic efforts to get off the car, when, if the occupants had retained their presence of mind and had remained quiet, there would have been little trouble. Such accidents must sorely tempt street-railway managers to adopt the Minneapolis plan of keeping gates closed to all passengers except when the car is at a standstill. The latest accident of this kind is that reported from Paterson, N. J., where a trolley wire fell on the roof of the car and two dozen passengers jumped down a steep embankment, injuring four children seriously.

Of course, there are city officials and city officials. Some of them are prompt, energetic and devoted to the duties of their positions; but many untoward experiences have taught electrical salesmen that a very large proportion of the politicians of this class put their own interests and their own pleasures before those of the municipalities they serve. A particularly flagrant instance of neglect of duty of this kind occurred in Saginaw, Mich., last month, and as a number of electrical men were involved, a brief recital of the facts may prove instructive:

By public announcement July 27th was the date fixed for the opening of bids for furnishing apparatus for a municipal lighting plant in Saginaw. The bids were to have been opened on that day by the Board of Public Works of the city. When the appointed hour arrived to representatives of the various electrical companies which had submitted tenders were on hand to attend the opening. Some of these gentlemen had come from Detroit, others from Chicago, and one man from Pittsburg. All were in attendance at a considerable expenditure of time and money, and were entitled to attention. But when the city clerk called the meeting to order at the time set it was to announce that he had received a telephone message from the president of the board to the effect that there would be no meeting, as most of the members had important business that demanded their attention. All efforts to secure a meeting later in the day set were of no avail, the earliest time that could be arranged being three days later. Investigation into the whereabouts of the members of the board revealed the fact that several of them, including the president, were enjoying themselves at a horse race. The electrical representatives could not afford to waste three days, so all agreed to go home.

By this cool neglect of duty on the part of members of the Board of Public Works of Saginaw the means of a number of electrical manufacturing companies were inexcusably wasted. The incident was an exasperating one, but it points to a two-fold moral: First, that the manufacturing companies themselves could put an end to this sort of petty imposition by concerted action; second, that as the city of Saginaw has been offered its lighting at the very low price of $65 per annum by private contract, it is especially unwise to construct a municipal plant at all in view of the revelation of the spirit of the men who would control it.

As has been frequently remarked in the Western Electrician courts of law look with an apprehensive eye on the dangers of electricity in ordinary commercial use and require the most extreme care on the part of every person and corporation having to do with the distribution of electric current. This point is curiously illustrated by a recent decision of the Court of Appeals of Kentucky, in which it was held that while in the case of the charging of a battery and delivery thereof to the owner of an automobile or an electric launch there rests upon the company furnishing the electricity no duty as to the manner of its use, it is otherwise where electricity is supplied to a purchaser's wires. The case before the court was that of Thomas' Administrator against the Maysville Gas company. This company was furnishing an electric street-railway company with electricity to operate its cars. An improperly insulated guy wire broke loose, and caused the death of a boy who came into contact with it. Both companies were sued for damages. The main question in the case was, however, limited to whether the gas company that was furnishing the street-railway company with electricity at so much a month was liable. This precise question, the court says, has not, so far as it is aware, ever before been answered by any court of last resort.

That there was a duty imposed by law upon the street-railway company to keep its wires properly insulated, so that those whose business or pleasure brought them in dangerous proximity to them might be protected from the current which they conducted, the court says, cannot be questioned. But it asserts that electricity is "unlike any other dangerous matter or force known to science," and that without it the wire in question would have been harmless. Because of this it holds that if the wires were not properly insulated, and the death of the boy resulted therefrom, both companies were liable, as it was the duty of the street-railway company to have its wires properly insulated, and there was a duty resting on the gas company to see that it was done before charging them with electricity. In other words, the court holds that when one, through the instrumentality of machinery, can accumulate or produce such a "deadly force" as electricity, he should be compelled to know that the means of its distribution are in such condition that those whose business or pleasure may bring them in contact with it may do so with safety.

Someone with the time and inclination could make an interesting article on "Electrical Storms in Fiction." Novelists have not been slow to avail themselves of the "lightning's lurid flash" and the "deep rumble of heaven's artillery" to add to the dramatic effect of their situations or to provide opportunity to display the hero's intrepidity. A collection of the story-tellers' descriptions of thunder-storms, with comparative notes, could not fail to be entertaining. It should include, for instance, the graphic account of that storm in which Gabriel Oak rendered such effectual service to the lady who afterward became Mrs. Oak, as related by Mr. Thomas Hardy in "Far from the Madding Crowd." The connoisseur in the odds and ends of literature—a Disraeli or a Mathews, say—would have no difficulty in gathering other examples to make a list of respectable size and curious interest.

In such a compilation as has been indicated the fine description of an electrical storm in the Mozambique Channel to be found in "The Cruise of the Cachalot," written by Frank T. Bullen, would naturally take a conspicuous place Many readers of the Western Electrician take an interest in the electrical phenomena of the atmosphere, and those of them who are not familiar with the story will find the following extract worth reading:

As the pall of thick darkness blotted out the cool light, it seemed to descend until at last we were completely over-canopied by a dome of velvety black, seemingly low enough to touch the mastheads. Presently thin suggestions of light, variously tinted, began to thread the inky mass. These grew brighter and more vivid, until at last, in fantastic contortions, they appeared to rend the swart concave asunder, revealing through the jagged clefts a lurid waste of the most intensely glowing fire. The coming and going of these amazing brightnesses, combined with the Egyptian dark between, was completely blinding. So loaded was the still air with electricity that from every point aloft pale flames streamed upward, giving the ship the appearance of a huge candelabrum with innumerable branches. One of the hands, who had been ordered aloft on some errand of securing a loose end, presented a curious sight. He was bareheaded, and from his hair the all-pervading fluid arose, lighting up his features, which were ghastly beyond description. When he lifted his hand, each separate finger became at once an additional point from which light streamed. There was no thunder, but a low hissing and a crackling which did not amount to noise, although distinctly audible to all. Sensations most unpleasant of pricking and of general irritation were felt by everyone, according to his degree of susceptibility. After about an hour of this state of things, a low moaning of thunder was heard, immediately followed by a few drops of rain large as dollars. The mutterings and grumblings increased until, with one peal that made the ship tremble as though she had just struck a rock at full speed, down came the rain.

This is a vivid piece of word painting, and it would be interesting to know how much of it is imaginative and how much the recollection of the observation of a real storm or storms during the author's experience at sea. It sounds truthful and seems to be meteorologically correct. Either as a bit of imagination or a straightforward description, the work is excellently well done.

Electrolysis.[1]

By E. E. Brownell.

It is not the purpose of this paper to ridicule the management of any electric street railway, but to present the facts for what they are worth. These will show the actual operating conditions of electric street railways and the unnecessary destruction resulting therefrom.

Let us briefly consider the usual construction of the railway return circuit and see if there are any reasons for the escape of the current from the rails.

Take, for example, the rail bonding commonly used for 90-pound girder rails. Here they generally have but one No. 0000 copper bond. If properly bonded so that the relative conductivity of the bond was equal to that of the rail, it would require at least nine No. 0000 copper bonds, assuming perfect electrical contact between the bonds and rails.

I have carefully tested the efficiency of the bonds used on some 37 different electric roads, as compared with the conductivity of the rails, and the highest found was but 15 per cent., while the remaining 36 varied from that down to zero.

In four different cities, where what is called the "cast-weld" joint has very recently been installed, these joints showed seven, eight, nine and 11 per cent. efficiency of the relative conductivity of the rails. The sellers of these joints claim the very highest electrical conductivity, but their claims are not sustained by my tests, as this was all new work. A 36-inch water main offers 4.6 times the resistance of a perfectly bonded 90-pound girder rail, or 18.4 times the resistance of a double track, perfectly bonded. From these figures we can definitely say that with perfect rail bonding, which is by no means a practical impossibility, a 36-inch water main buried under a double track of 90-pound rails would never carry more than one-eighteenth of the current. But we find, in actual practice, that the rails have often but one-tenth of the current, on account of the high resistance of the bonds.

In three sizes of water mains, 6, 20 and 36-inch, an average of 37 per cent. of their total resistance was found to be in the joints of these pipes.

Early forms of iron bonds soon proved inadequate and were succeeded by solid-copper wires, either riveted or wedged by driving taper pins or cones. It was found that these wires were broken by the motion of the cars upon the rails. The copper was then laminated, and the bonds put under the joint plate, but lamination has, in many cases, merely hastened the breaking of the copper. Many of these bonds have failed entirely during a single year. Irrespective of the breaking of the bond, its conductivity may be greatly reduced by the rusting of the surface of contact between the steel and the copper.

The New York, New Haven and Hartford railroad, upon its third-rail electric road, between Hartford and New Britain, Conn., has used up two different sets of copper bonds in two years' service. These were of high resistance, even when new, though their theoretical conductivity should have been equal to that of the rail. After the second set of copper bonds had failed, the Edison-Brown bond was applied, one under each angle-plate. Recent tests show that the conductivity of the joints through these bonds is practically the same as that of the rail.

Let us for a moment look at the conditions found in the city of Indianapolis, Ind. Here four 90-pound rails, which were carrying less than 200 amperes each, as measured upon the terminals near the power house, showed the loss or fall of potential of 145 volts, in four miles of the double track. With perfect rail bonding, this loss could be reduced to less than 20 volts. In another portion of the city, where the rails should be returning 500 amperes, they were carrying but 15 amperes. Thus, the remainder of the current was at work destroying the pipes.

These are but a few examples of hundreds of such cases, which I have found in all parts of the country.

In the city of Detroit, Mich., the rails with the inadequate bonding are supposed to take care of and return as a momentary maximum load 13,000 amperes; 2,000 amperes per rail should be the maximum, if each rail was a continuous piece of metal.

The greatest objection in allowing any piping system to act as a return conductor, even though that piping system is negative to all other return conductors, is that serious electrolytic action will occur at the joints. I have noted this electrolytic action in some 16 different cities in the negative districts. In some places the cast-iron gas pipes were eaten entirely through at these joints, not a single piece of iron holding the pieces together. Upon many cast-iron water pipes the pittings extended nearly through the pipe. The current in these cases was large, as I have never noticed this action where the cast-iron pipes were carrying less than 10 amperes. It should be remembered that the resistance of no two calked joints is alike.

The Grand Rapids, Grand Haven and Muskegon Railway company has been reorganized and the road is now said to be a certainty. The following-named gentlemen are the new officers: President, James D. Hawks; vice-president, Thomas F. Carroll; treasurer, Wallace Franklin; secretary, Joseph Kirwin.

1. Abstract of a paper read before the New England Waterworks association.

Applications for Renewal of Allowed Applications in the Patent Office.

It has been the practice of the Patent Office, for many years past, to accept renewal petitions for lapsed allowed applications signed simply by the attorneys who filed the original applications, and not, as required by law, by the "inventor, discoverer or assignee." The matter was recently called to the attention of the commissioner of patents, and a circular was issued by the department to parties interested, calling attention to the statue governing the case, by which the law requires the petition for renewal of allowed applications, forfeited through failure to pay the final fee within the six months from date of allowance, to be signed by the inventor, discoverer or assignee; and that such application must be filed in the Patent Office within two years after the allowance of the original application. In the event that the inventor be dead, then the petition must be signed by the administrator, or the executor; if insane, by the guardian, conservator or legal representative. It will not be accepted if signed by the attorney.

Protests have been entered with the commissioner against this ruling, but he states that, while it is furthest from his desire to disturb any practice that has been followed and permitted for years past, yet antiquity of practice cannot justify an illegal act. There seemed to be no knowledge at the Patent Office, until recently, that this practice had been permitted.

From the foregoing brief extract of the law, it is clearly to be seen that the person to whom is given the right is clearly designated. The person is the one who has an interest in the invention or discovery, either in the capacity of inventor, discoverer, or simply as assignee. The right is not, nor has ever been given to the attorney of any such party by the statute. The phraseology is equally clear as to the course to be followed. The application is to be made "the same as in the case of the original application." That can mean nothing else but that it is to be made by the inventor or discoverer, unless the statute invests in some additional person the right to make the renewal application. The only other person mentioned in the statute is the "assignee." Hence, it follows that the petition for the renewal application cannot be signed by the attorney. Such person is not mentioned, and is, therefore, excluded.

It is apparent that an inventor may have good reason for permitting his application to become forfeited, and he may not wish to renew the same. There is no reason why he should notify his attorney of his wishes in the premises; but without so notifying his attorney he runs the risk of having the application renewed by the attorney, provided such right has been given to the attorney. It follows that an inventor or assignee might be injuriously affected by the unauthorized renewal of his application. If the inventor or assignee can request the attorney to renew the application, it would seem that it would be just as easy for either one to sign the renewal application, and he should do so. This practice is, therefore, discontinued.

Another Board of Trade Quotations Decision.

Judge J. W. Henry of Kansas City has granted a permanent injunction in favor of the Christie Street Commission company and the Grain Brokerage company, both bucket shops of Kansas City, restraining the Western Union and Postal Telegraph companies from refusing to furnish them with grain quotations from the Chicago Board of Trade. In view of the fact that the telegraph companies, since August 1st, have not had the quotations to give, the decision is rightly regarded as a most remarkable one. To force a company to furnish something which it does not possess and has no legal means of getting, is certainly remarkable law and, of course, on the face of it, cannot stand. The court, evidently, based its decision on the condition of affairs which existed previous to August 1st, before which time the telegraph companies were giving a regular quotation service from the Chicago board. The companies will ignore the order of court and appeal the case. In order to get stock quotations the companies would be obliged to steal the quotations from private messages sent over the wires, and this is contrary to the laws of the state.

Association of Edison Illuminating Companies.

The annual meeting of the Association of Edison Illuminating companies will be held at the Grand Union Hotel, Saratoga, N. Y., on September 4th, 5th and 6th. This association is composed of the various Edison electric-lighting companies throughout the United States. John W. Lieb, Jr., New York, is president of the association and John W. Howell, Newark, N. J., is secretary. An interesting meeting is promised.

The Miami and Erie Canal Transportation company is surveying the canal for the proposed introduction of electric haulage from the towpath.

Plans for Telegraphic Communication with Belle Isle, Newfoundland.

Ottawa, August 10.—Shortly before the close of the recent session of the Dominion Parliament the announcement was made in the Commons that the government determined to have a cable to Belle Isle before the present season of navigation closes. This announcement has raised the question in Newfoundland as to whether the undertaking can be proceeded with, in the face of the fact that Belle Isle is a part of Newfoundland territory. Labrador is a dependency of that colony, and Belle Isle is included in Labrador. The Anglo-American Telegraph company enjoys a monopoly of the cable and telegraph rights in Newfoundland and its dependencies for 50 years, which period does not expire until April 6, 1904, and until that date it is within the power of the Anglo-American people to prevent the Canadian authorities landing a cable on Belle Isle. As to the completeness of their right to do this, there seems to be no question. It has already been upheld by the Imperial Privy Council, which, in 1872, restrained the Commercial company from even dropping the shore end of a cable within three miles of the Newfoundland coast. This decision, therefore, is an effectual bar to the Dominion government, should the Anglo-American company assert its rights and disregard the humane considerations which are moving the Canadian government to bring Belle Isle into closer touch with the world.

It is asserted by the Anglo-American authorities that a submarine cable will never outlast a winter in Belle Isle Strait. Most of the transatlantic cables now pass north or south of the Grand Banks, and every year they are broken by the icebergs, which drift southward and ground on them in the shallows. In the early days of the telegraph service, a cable was laid across Cabot Strait, the southern entrance to the Gulf of St. Lawrence (Belle Isle being the northern), and though this channel is 300 miles farther south than Belle Isle, the cable had to be abandoned, so frequent were the interruptions caused by icebergs and floes. It will, therefore, be readily seen that the dangers which beset a Belle Isle cable are by no means trifling, and the proposed one, when laid, will be a subject of much interest to those versed in telegraphy.

Cable experts in Newfoundland say that from December until June each year, the Strait of Belle Isle and the waters adjacent are packed with ice. The present season is a case in point. The whole surface of the ocean is covered with heavy Arctic floes and great upstanding bergs, six-sevenths of their bulk being below the sea. These are forced into the narrow strait by winds and tides, and piled upon one another until the very bottom of the channel is reached. Then they are forced to and fro by the furious tides, until the sea bottom has been scooped out as a deep gully in which nothing may lie. A cable there could not possibly live throughout one season of such conditions, for not even the stoutest "shore ends," specially armored with heavy steel wire, as an extra protection in shoal waters, could survive the relentless pressure of these bergs and floes, even if a whole cable could be protected in the same way.

In the judgment of these experts, it is claimed that the Dominion government would obtain much more satisfactory results from the installation of the Marconi system of wireless telegraphy. One instrument, it is suggested, should be set up at Chateau, Labrador, 12 miles from Belle Isle, and connected with a land line, running west to Quebec. A second instrument should be located on Belle Isle itself, and a third at Cape Bald, the most northern point in Newfoundland, 15 miles from Belle Isle. This instrument should connect with a land line, running back by the northwest coast to the present terminus of the colonial telegraphs at Bonne Bay. The item of expenditure also merits consideration. The cable will be about 70 miles long, and will cost $800 per mile. Including the expense of putting it down, the total cost will be some $60,000. A land line can be built for $140 a mile. To keep a cable in repair involves a very heavy outlay, while a land line can be maintained at the minimum of expenditure. Therefore, on every ground, economy, efficiency, suitability and the serving of the entire region, two land lines and the Marconi system would seem to be the proper solution of the difficulty of opening Belle Isle to telegraphic communication with the world. W.

Some Good Electric Vehicle Mileages.

The mileage run on one charge of battery by an electric vehicle is an exceedingly variable quantity, running all the way from close to 100 miles to 15 or 20, or less, the former being the result of one of the best runs ever made, and the latter the too-frequent limitations found in actual daily service. Anent some of the long runs recently made in the East may be mentioned the fact that some of the Woods electric vehicles in this city have made mileages that were excellent. The batteries used were the Helios-Upton, Plante type of cell. A run of over 50 miles is a common occurrence, and on one occasion 71 miles was made on one charge. This latter was made with a road wagon, equipped with cells weighing 17 pounds each and rated to give 17 amperes for three hours, or 51 ampere-hours, at a three-hour rate.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Exchange at Sandusky.

The Sandusky Telephone company, Sandusky, Ohio, has contracted for a new switchboard, which will be installed in the new offices in the Kingsbury building within a short time. Since the contract was awarded the board has been subjected to several very rigid tests, and has proved equal to all requirements for cities of any size.

For some time the Independent telephone company at Sandusky was allowed to get along as best it could, there being little interest taken in it by either the officers or stockholders. The equipment was not of the best, and only a limited number of subscribers could be accommodated. The value of the stock declined, until it went for almost nothing, and for a time it was thought it would soon drop out of existence. But it was to see better days. A year or so ago Carl S. Curtis, his brother, and a number of other Sandusky gentlemen bought up the stock and determined to put the company on a better working basis. The present list of officers is made up of the best business men of the town, and is as follows: President, Louis Duennisch; vice-president, Jacob Kuebler; secretary, Arthur Arend; treasurer, J. C. Hanser; superintendent of construction, Charles Stevens.

Carl S. Curtis is the general manager, and, with Secretary Arend, is rapidly putting the plant upon a solid basis. At the present time the exchange has nearly 900 subscribers, additions to the switchboard having been made to accommodate as many as possible. Now, however, it is operating up to its full capacity, and no others can be added until the improvements are made.

The new board, which will be installed by October 1st, is of the North supervisory multiple type, and is being constructed by the North Electric company of Cleveland. It will be in three sections, with three operators each, and will have a capacity of 3,000 lines. Each operator will have 200 lines under her control. This board is somewhat different in construction from those in use in some other cities, but is proving very successful. It is provided with automatic and visible signals, the call bells being done away with. Instead of lights, as used in some others, the signals consist of a tablet, containing the line numbers. When a subscriber signals his number shows, being thrown up by an electric current. Upon the plug being inserted, after the number is obtained, the signal is restored. When the plug is inserted at the number called the signal opens and when the party called takes his receiver from the hook, it closes, thus indicating that both parties are at the telephones and talking. Should there be trouble in any way the operator may be signaled in the usual manner, by working the hook up and down. The number tablet will thus be raised and lowered, indicating the person who desires attention. Both signals open when the lines are not in use or when the subscribers hang their receivers on the hooks, thus indicating that they are through with their conversation. There is also a long-distance section on the new board, which will accommodate a large number of lines. Any operator may call the number desired on the toll section by signal, which is communicated to the long-distance operator.

The plant will have a central power station, and there will also be batteries in the instruments used by subscribers. When an operator calls a subscriber, one side of the metallic line and a ground wire will be used, the current being furnished from the central station. This will save the subscriber's batteries, which will only be used on the talking circuit. It is the intention of the company to have its own power plant. A small dynamo, operated by a gasoline engine, will be used. This will supply the current from the central station.

The plant is now equipped with about 700 North instruments, and when the improvements are put in, it is expected that they will be used exclusively. The plant will have at least 1,200 subscribers to start with when it is rebuilt.

Sandusky is connected by the United States Telephone company's long-distance lines with more than 200 towns in the state. There are also two sub-exchanges in the county, one at Castalia, with 40 subscribers, and another at Bogarts, which has about the same number. There are also a number of farmers' telephones in use. Persons at these places get the service at Sandusky rates, viz., $1.50 a month for residence telephones, and $2.50 for business houses. These outside stations have the full-metallic circuits, the same as in the city. The city exchange averages 8½ calls per line per day.

The company has had some trouble in getting the cable lines in the city properly arranged. It was the intention to place them underground, but as the solid limestone in that section extends to within a foot or 18 inches of the surface, the plan would have entailed an immense outlay of money, so this plan was given up. The cables extend from the office to a strong steel tower in the public square, whence they are distributed in different directions, as desired. It is probable that no attempt will be made in the future to place the cables in conduits.

The plant, when completed, will occupy 10 rooms on the third and fourth floors of the Kingsbury building. The business office and manager's private office, situated on the fourth floor, are handsomely furnished with the latest office equipment. In the rear of this will be located the operators' room, which is long and well lighted. It will give plenty of room for the new switchboard. Just in the rear of this a smaller room will be used for distributing purposes. The other rooms will be used for various purposes, and the whole will constitute a handsome little plant for a city the size of Sandusky. The company is capitalized at $75,000, but it is probable that twice that amount will be put into the plant before it is completed. At the present time the stock is worth 100 cents on the dollar.

The other telephone plant in Sandusky is operated by what is known as the Home Telephone company. It is the old Bell plant, and is supposed to still belong to the Bell company, inasmuch as it would be impossible to sell it because of the trust bonds floated by the company. The directors of the Home company are James Flynn, C. L. Wagner, R. E. Schauck, August Schmidt and W. W. Woodward. Mr. Wagner was the first president of the Sandusky Telephone company, but last fall withdrew and associated himself with the other company. Since then the fight for supremacy has been a warm one, but, from all outward appearances, the Sandusky company has not suffered severely. When the change in the Bell company was made last fall Manager A. J. Mellen went out and a Mr. Miller was appointed in his place. Within a few months Mr. Mellen resumed the position, however, and is still at the helm. O. M. C.

New York Telephone Company Increases Stock.

The stockholders of the New York Telephone company, at a called meeting held in New York city on August 8th, voted unanimously to authorize an increase of $14,000,000 in the capital stock of the company, or from $16,000,000 to $30,000,000. It is not announced what the new stock is wanted for or how it will be used, but it is asserted by authorities more or less familiar with the affairs of the American Bell company that it is a step in the general scheme of the Bell company to move from Massachusetts and locate in New York.

"Aside from the peculiar significance of the increase authorized by the stockholders of the New York Telephone company," says the New York Commercial, "it is interesting to note that the Bell companies throughout the country have lately been swelling their liabilities and taking in new capital. This means that the Bell company has a keen appreciation of the war impending, and desires to strengthen itself to all possible extent against the aggressions of the new National Telephone and Telegraph company, lately incorporated, with a capital of $50,000,000. The organization of this latter concern has been deferred from time to time. The cause of the delay is the constantly expanding scope of the project. Independent concerns in several parts of the East are being brought into line, and as long as the procession continues the new combine will not be organized. When completed the financial plan will embrace interests not hitherto identified with Bell opposition. It is expected that the Massachusetts Telephone and Telegraph company will be absorbed by the National."

Notes from Ohio.

The West Jefferson Telephone company of West Jefferson, Madison County, has been incorporated, with a capital stock of $6,000. The town has a population of about 1,200, and the plant will not be a large one.

The Portsmouth Telephone company of Portsmouth, Ohio, has increased its capital stock from $50,000 to $100,000.

The John Roebling's Sons company has been granted the contract for 16,000 feet of telephone cable, to connect the west crib of the waterworks with the permanent crib at Cleveland. The consideration is $3,400.

The Board of Appraisers and Assessors at Columbus have been appealed to by the United States Telephone company to exempt its property from taxation, on the grounds that the lines are unfinished, and therefore unproductive at the present time.

The Citizens' Telephone and Message company of Fostoria is completely rebuilding the plant there.

The New Concord Telephone company of New Concord, Ohio, has been incorporated, with a capital stock of $10,000. The articles of incorporation will allow the company to do a general telephone business. The incorporators are L. J. Graham, O. M. Shipley, S. W. Lorimer, T. J. Rader and John B. Bain.

The People's Telephone company of Shelby, Richland County, has increased its capital stock from $25,000 to $50,000. The president of the company is G. M. Skiles and the secretary Edwin Mansfield.

The Butler County Western Telephone company of Philanthropy, Butler County, has been incorporated, with a capital stock of $5,000. The incorporators are John Morehead, Clem Conn, W. S. Beard, S. E. Fye, John F. Gillispie, William H. Beard and R. D. Gillispie. O. M. C.

Telephone News from the Northwest.

Eastern capitalists have bought the stock of the Tri-City Telephone company of Clinton, Iowa, and will extend the system. It is thought that the National Telephone company of New Jersey is back of the deal.

A local telephone company is being organized at Baldwin, Wis.

The Fergus Telephone company of Fergus Falls, Minn., contemplates building a toll line to Rothsay, Minn.

The Wisconsin Telephone company has agreed to repair all streets and leave them in as good shape as before, when putting in the subway system at Oshkosh, Wis.

The telephone company at Hastings, Minn., has kept track of the number of calls from non-subscribers, and will present bills for the service rendered during the last half of July.

A telephone line will be constructed along the Sanborn-McHenry branch of the Northern Pacific railway in North Dakota.

A telephone line between Vesta and Echo, Minn., is projected.

A story was recently published in Minneapolis to the effect that the recent deal with the Mississippi Valley Telephone company whereby local men became interested was off. It was stated that the deal was to include a controlling interest, and that Mr. Hubinger, the present controlling interest, had failed to complete the contract. The statement is denied, and it is announced that the negotiations are working toward a successful conclusion.

The city of Minneapolis has lost the case in the Supreme Court of Minnesota against the Northwestern Telephone company for violating the underground-wire law, and also for constructing after its franchise had been annulled. The court holds that a franchise granted, whereby moneys are induced to be expended, becomes a contract and not a license, and as such is not to be voided at the whim or caprice of the council. The right of the city to exercise police power is not denied, but it must be shown that public safety, convenience, health, morals or necessity require it. In the case in hand, the underground district is claimed to be extended far beyond any of these requirements. The city will ask a rehearing.

The Wolf River Telephone company is canvassing Waupaca, Wis., with a view to establishing a local exchange there. It is expected that an exchange of 100 connections will be put in.

There is talk of a telephone line from Lamberton to Wabasso and Vesta, Minn.

A farmers' telephone company has been formed to cover Oregon and Highland townships, with a central office at Ainsworth, Iowa. The promoters have secured 65 connections.

The telephone operators at Tacoma, Wash., have been granted an increase of wages and a reduction of working hours by the Sunset Telephone company. The company will also erect a new exchange building and place its wires in the business portion of town underground.

Connection is being made with a number of farms around Redfield, S. D.

R. A. Hall of Cedar Rapids, Iowa, is an applicant at Brooklyn, Iowa, for a local exchange.

George Morrison, a lineman of the Winona Telephone company, at Winona, Minn., fell from a 30-foot pole to the street, but escaped with only a sprained ankle.

A local exchange is to be installed for St. Thomas, N. D., at once.

A line is to be built from Danvers to Hagen, Minn. R.

New Company Proposed at Seattle.

The telephone operators of the Sunset Telephone company at Seattle, Wash., rejected the offer of the company to settle the strike, and all offers were at once withdrawn on both sides. Efforts are being made to induce subscribers to order their instruments taken out. It is stated that as many as 3,000 will be ordered removed. A new company is proposed, to install a system. Christopher W. Horr, Nicholas H. Thedinga and William B. Allison, all of Seattle, are interested. The county commissioners have ordered all instruments of the old company out of the courthouse.

MANUFACTURERS AND DEALERS.

Jones & Winter, telephone engineers and contractors, have removed their office from St. Paul, Minn., to Chicago, where they have located at 1259 Monadnock building. They will be pleased to see all their old friends and hosts of new ones at their new office.

The Eureka Electric company is forwarding to Independent companies, free, a new name-plate sign to go on the front of the companies' instruments. The design embraces the well-known Maltese cross. The Eureka company will be pleased to mail or express as many of these name plates as may be desired to any of the Independent companies in the field, for the purpose of attaching them to their telephones in their exchanges. The words "Independent System" have been added in connection with the well-known design, and will no doubt help to educate the general public to the use of the Independent system.

A Workshop Form of Wheatstone Bridge.[1]

The ordinary form of Wheatstone bridge as made by most instrument makers has some disadvantages when used as a workshop instrument or for outdoor purposes. Instrument makers are much inclined to the use of lacquered brass and polished ebonite, and the ordinary form of Post Office bridge, consisting as it does of a slab of polished ebonite having a number of blocks of lacquered brass fixed upon its surface and a large number of nicely-fitted plugs, is hardly suitable for use by rough hands or in dirty places. Exposure to the light and dirt soon deteriorates the surface insulation of the ebonite, dust accumulates underneath the angles of the blocks and in the plug holes, and the numerous loose plugs get dirty and are sometimes lost. In the series plug pattern there is always a risk of the plugs becoming jammed in their places, and the heads therefore twisted off in the process of extricating them.

A form of Wheatstone bridge has been devised by Dr. J. A. Fleming which has some novelty in design for use as a workshop instrument. The coils and electrical portions are all contained in a

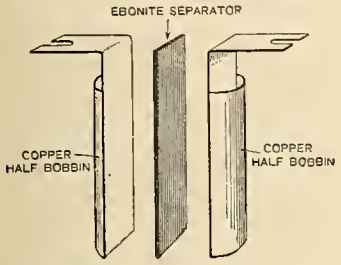


FIG. 1. A WORKSHOP FORM OF WHEATSTONE BRIDGE — CONSTRUCTION OF RESISTANCE BOBBIN.

stout teak box 20 inches by 8 inches by 5 inches, provided with recessed box handles. The top and the bottom of the box are not screwed on, but recessed and held in place by turn-button bolts, so that by simply turning four buttons the top of the box can be at once removed, carrying with it the whole of the bridge mechanism. In the case of the ordinary patterns of Wheatstone bridge the opening of the box to repair a damage involves procuring a screwdriver and taking out about a dozen little screws.

In Dr. Fleming's pattern of bridge there is no exposed ebonite of metal work except three pairs of terminals. The resistance coils, which are arranged on the dial pattern, are formed as follows:

Two hollow half-cylinders of thin sheet copper (Fig. 1) are constructed, each having a lug, and two of these half-cylinders are put together with a thin separating piece of ebonite and bound together with a thin silk tape. This constitutes the bobbin. The resistance wires of magnanin are then cut the proper length, and the two ends of the wire are soldered to the two lugs of the copper half-cylinders (Fig. 2), the remainder of the wire being wound non-inductively on the bobbin and tied in position by a thin silk tape. The wire is therefore so arranged that it quickly gets rid of any heat, and no paraffin wax is used to overlay the wire or coils.

The measuring arm of the bridge consists of three sets of coils—units, tens, and hundreds—each set consisting of nine coils interposed between 10 brass blocks, which are arranged in a circle and carried in a sort of ebonite tray fixed on the underneath side of the teak lid of the box. These blocks are

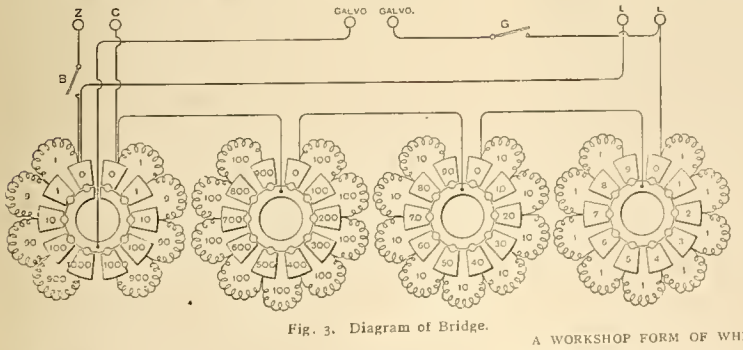


Fig. 3. Diagram of Bridge.

interconnected as required with a central brass ring by means of a traveling plug. A diagram of the bridge is given in Fig. 3, and a section of the dials in Fig. 4. The plugs resemble bradawls, except in their lower extremities, and have a substantial handle; they are kept when not required in a sort of umbrella stand attached to the box, seen in the general view of the instrument, Fig. 5. These plugs are inserted into interconnectnig holes between the brass blocks, and the common ring through small holes bored into the lid of the box. Hence the outer surface of the box exhibits only sets of small holes arranged in circles and which are marked respectively units, tens, hundreds.

1. From the London Electrician.

In order to prevent dust getting into the holes between the brass blocks, there is an ingenious contrivance in the form of a self-closing shutter. On the underneath side of the lid there are a series of circular discs of thin ebonite, which are perforated by holes corresponding with the holes for the plugs in the lid of the box. These circular shields move around a central pivot, and by means of a spring are kept so turned that the holes in the shield do not normally coincide with the holes in the box lid. Hence all these box lid holes are closed as it were by a small shutter, but when once opened and a plug inserted in the hole the plug prevents the shutter from closing.

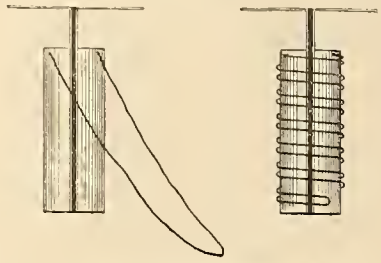


FIG. 2 A WORKSHOP FORM OF WHEATSTONE BRIDGE.— METHOD OF WINDING.

The circular shutters can be turned around by means of a common bar and finger pin protruding through the lid, so that, in order to insert the first plug when commencing his test, the user presses back the pin and thereby opens all the shutters. But the moment all the plugs are withdrawn from their hole, the shutter under the lid springs back and closes all the holes belonging to that dial.

The ratio arm of the bridge is formed of a series of coils which are arranged dial fashion, and which are therefore not 1, 10, 100, 1,000 ohms as usual, but 1, 9, 90, 900. Two plugs are therefore provided for the ratio-arm dials, and the ratio-arm dial is furthermore marked in such a manner that the user has no difficulty in discovering the number by which he must multiply and the number by which he must divide the ratio-arm resistance to get the resistance of the circuit measured. The shutter closing the holes of the ratio dial is independent of

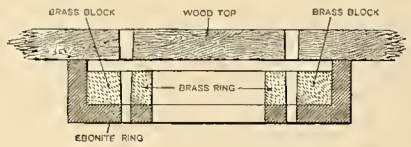


FIG. 4. A WORKSHOP FORM OF WHEATSTONE BRIDGE — SECTION OF DIAL.

the others, and is not provided with a finger-pin for opening. The spring which keeps the shutter of this dial normally closed is not very strong, and the shutter is easily pushed back by the point of the first plug as it is inserted.

The whole of the connections are made under the lid to three pairs of terminals, marked on the outside as in Fig. 5, and in addition two keys are fixed under the lid, which are manipulated by two little ivory buttons, like electric-bell pushes, protruding through the lid. There is, therefore, absolutely no exposed ebonite to deteriorate in insulation, and no lacquered brass, with the exception of the aforesaid six terminals, the handles by which the bridge is carried about, and the plugs. The terminals are constructed with a peculiar kind of lip, which renders it easy to grip in them either a single large wire like a No. 10 wire or a single small wire like a No. 40.

One other point is worthy of notice. In the ordinary patterns of plug bridges the frequent use of the plugs wears them down into a shoulder, so that they no longer fit tightly into the plug holes. In Dr. Fleming's form of bridge the plug has a semi-circular groove turned in it at such a height in the plug that when in place the top of the block is just on a level with the middle of the groove. This device is an effective cure for "shouldering" in the plugs.

It may be mentioned that this pattern of bridge is being constructed for sale by the Telegraph Manufacturing company of Helsby.

A WORKSHOP FORM OF WHEATSTONE BRIDGE.

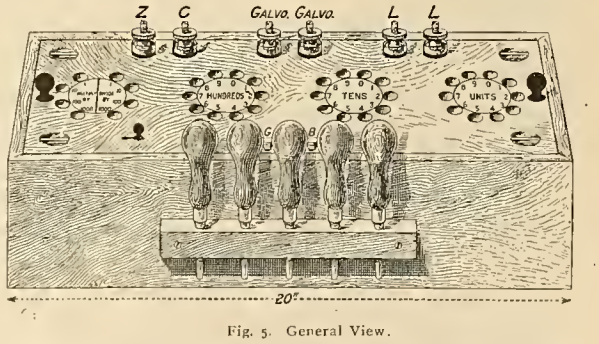


Fig. 5. General View.

Niagara, St. Catherines and Toronto Electric Railway.

When the electric lines now being built by the Niagara, St. Catherines and Toronto Electric Railway company are completed, the Greater Buffalo-Niagara district will have one of the best systems of electric railways in the world. This company is building on the Canadian side of the Niagara River, and it will work in conjunction with the International Traction company, which now affords such a fine service. Work is progressing rapidly, and in a few weeks the Canadian company will have all its lines operated. The company, some time ago, purchased the franchise of the Niagara Central Railway company, between Niagara Falls, Ont., and St. Catherines, as well as the Niagara Falls road between that town and Niagara Falls South.

The company is rebuilding the roads with new materials throughout. Beginning at Bridge street, Niagara Falls, where connection is had with the Niagara Falls Park and River railway, the Canadian company's line runs to Niagara Falls South and Falls View, a distance of four miles. Branching from this point is the Toronto line of the system. It runs through Thorold, 3,000 population; Merritton, 2,000 population, to St. Catherines, 10,000 population. The rail line is being extended to Port Dalhousie, where connection with the boat line to Toronto will be made. It is proposed, also, to run a line to Hamilton, Ont., and possibly to Toronto, by the way of Beamsville and Grimsby Park.

The line between Niagara Falls and St. Catherines is now being operated. Six cars, each 50 feet long, divided into smoking, baggage and passenger compartments, are running, and more of the same pattern are being built for the same company. These cars are strongly built. The peculiarity about them is that they contain what is believed to be more glass than any other car ever constructed. The windows are very large, and all the partitions are of glass. It is officially stated that the equipment is of the best and that a speed of 70 miles an hour can be maintained on the line. The company has already spent over $200,000 in rebuilding the roads. It is understood that an arrangement is to be made between the Niagara, St. Catherines and Toronto and the International Traction companies, whereby a through service from Buffalo to the Canadian company's pier at Port Dalhousie, and thence by boat to Toronto, is to be inaugurated. The principal stockholders in the Canadian company are Addison B. Colvin of Glens Falls, N. Y., formerly state treasurer; Robert Jaffray of Toronto, millionaire and owner of the Toronto Globe, newspaper; Samuel H. Blake of Toronto, H. H. Herbert of New York, and the Bank of Commerce of Toronto.

China's Telegraph System.

Information about the Chinese telegraph system, like everything else Chinese, is timely, says the Little Chronicle, but this subject has a special interest in view of the fact that the minister of telegraphs, Sheng, is believed to be using the system to conceal the real state of affairs at Pekin.

The first telegraph line to be erected in China was in 1884, and the inhabitants of the country looked on the enterprise with great displeasure, often digging up the poles and damaging or cutting the line wires. Two years later a line was carried from Pekin to the Siberian frontier, whence connection was made with the Russian system. The lines belong to the government and are used largely for governmental purposes, though they are available for private and commercial business.

The apparatus and methods employed are most antique, and the operators are Chinese. As the Chinese have no alphabet, each word being represented by a special sign, the message must be translated into numbers by the receiving clerk before it is sent. The table he employs for the purpose resembles a logarithmic table and contains 9,800 numbered signs. The table is most elaborate and has been arranged by learned Chinese scholars, who have grouped the characters together according to their sound. In sending a message the writer inscribes it in Chinese characters on a blank, and it is then converted into numbers, telegraphed, received and retranslated into Chinese characters. It is possible to have 9,999 different words without using more than four figures, so that there is a practical advantage to the use of the table and system.

Some General Conditions Governing Power-station Design.[1]

By Phillip Dawson.

At the present moment, when electric traction is making such rapid strides, the question of the source of supply of power is a very important one. In this paper it is proposed to briefly consider this question from the economical point of view. This is the most important one, and the engineer's knowledge and experience should be used to design and construct the source of supply of electrical energy in such a manner as to furnish the Board of Trade unit at the switchboard at the lowest possible cost, interest on capital, depreciation and sinking fund included. It may be argued that the cost of the unit at the switchboard being low, it does not necessarily follow that the cost of the power, say, per car or per train mile, will also be low, as it is posible that in order to secure cheap current, the power station may be so located as to cause great expense in feeders, substations and loss in the transmission.

In the numerous cases, both in Great Britain, on the Continent, and in America, which have come under my notice, I have never found this to be the case. This applies to power-supply stations intended for traction and power primarily, and lighting secondarily. It may be mentioned at once that the demand of current for both traction and power-transmission purposes is increasing so rapidly that lighting will shortly in any case be only a secondary consideration.

The combination of a lighting and traction station is not to be recommended, and good results cannot be expected. The case is, however, entirely different where traction and lighting are combined, and the best results are then obtainable, that is to say, where the station has been designed by experienced traction engineers for traction and lighting.

It may be of interest to consider what are the differences between a station designed for lighting and one designed for traction and power transmission.

The average number of hours per annum during which a lighting station will be running full load will probably never be equivalent to more than three months' continuous running per annum, that is to say, taking the total Board of Trade units generated in one year, and seeing how long the plant under consideration would have to run its full capacity continuously to generate this amount, this time would probably never exceed three months. Taking a representative traction station, the time of continuous running would probably be at least 9, and in some cases 10 and even 11 months.

A lighting plant must in three months earn enough money to pay working expenses and to pay interest and allow for depreciation and sinking fund for a whole year, whereas a traction plant has from 9 to 11 months to do the same thing.

A lighting plant is on an average practically at a standstill 18 hours a day, while a traction plant is running 18 to 20 hours a day. Economical boilers, engines and electrical generating and transmission devices are therefore far more important in a traction than a lighting plant, because it is well known that running at very light loads and keeping the fires banked and the boilers, steam pipes, engines, etc., hot uses very nearly as much fuel as running them at full load.

Furthermore, whereas in a lighting plant there is ample time to overhaul the plant and execute necessary repairs, the men during the day have little or nothing to do, and can well do this work. In a traction plant there is little or no time to do this. The conditions are quite, if not more, arduous than on a ship. There at least every few days or few weeks the whole plant is entirely shut down for several days and can be taken to pieces and overhauled.

Unexpected and rapid overloads must be able to be supported by the traction plant, which is not generally the case in lighting.

In a traction station it will be seen that a far greater figure is cut by the cost of generation, pure and simple, than in a lighting station, and that the question of interest on capital expenditure and sinking fund is relatively smaller in the former than in the latter.

The following figures, which are the result of actual experience, may be of interest, and show the influence of continuous running on the cost of production:

	Cost in pence per Board of Trade unit. Lighting.	Traction.
Fuel	0.03 to 2.2 d.	0.09 to 0.5 d.
Oil, waste and stores	0.05 " 0.38d.	0.005 " 0.2 d.
Wages and salaries	0.26 " 1.60d.	0.03 " 0.4 d.
Maintenance	0.054 " 0.6 d.	0.0025 " 0.06d.
Total	0.684 " 4.78d.	0.1275 " 1.16d.

The difference which exists between a plant working practically continuously and only intermittently is at once seen in the average amount of coal consumed per unit generated. The type of engine used must, however, also be taken into consideration.

Thus, taking the published results of British electric-light plants, we find that the cost of coal per unit generated varies approximately between 0.3d. and 2.2d. Comparing this to traction plants, we find the cost of coal varying between 0.09d. and 0.50d. per unit generated. Again, considering the item of wages and salaries in a lighting station, we have 0.3d. to 1.6d.; in the case of traction this is 0.03d. to 0.40d. per unit.

Comparing the total cost of production of one Board of Trade unit generated in a lighting station and in a traction station, interest and sinking fund excluded, in the former the unit varies 1.00d. to 4.00d., as compared to 0.25d. to 1.00d. for traction purposes. The cost of power when generated for traction and power purposes is one-quarter of that when generated for lighting only.

The amount to be added for interest and sinking fund, of course, depends on the length of the concession, on the terms of final purchase, and on the life of the machinery employed. The cost of producing power varies with the amount to be produced, decreasing as the amount increases. This shows the advisability of concentrating as much power as possible in one station, and reducing the number of units.

In considering the various items which go to make a complete power or traction installation, including the system of feeders, distributors, track and overhead line, the cost of the power station is but a comparatively small item. The saving which can be effected by a properly designed station is very great, and a little extra capital expenditure is in many cases well justified.

The total cost of running an electric tramway or railway varies between 2.50d. and 8.00d. per car mile, according to circumstances; the electrical energy at the power station required varying from 0.49 unit to 1.4 units per car mile, according to the profile of the line and the weight and speed of the cars.

The cost of power varies between 10 and 30 per cent. of the total working expenses, all charges included, and if it can be reduced by ¾d. to 1d. per unit, or we may say per car mile, as one unit at the switchboard is a fair estimate of the average power requisite at the switchboard per car mile run, it is well worth doing.

In the early days, before polyphase high-tension currents were known, the situation of the central station was practically imposed, very little latitude being possible owing to the maximum distance of economical transmission being limited. Electricity works being most required in crowded centers, it was not only difficult to obtain a site at all, but the cost of the ground was very great. Hence the necessity of crowding the greatest amount of power into the smallest possible space. The plant being mostly used for lighting and only running a few hours each day, highly economical engines and boilers and labor-saving appliances were of but little advantage. At present, circumstances have altered; electricity can be economically transmitted to any distance, and is utilized—and will be more and more so every day—firstly for power purposes, and secondly for lighting purposes.

The initial cost of a plant may be roughly divided into four parts—land and buildings; plant; including all machinery in station; mains, feeders and distributors; miscellaneous, which includes such things as meters, instruments, cost of provisional order, and such like.

According to Mr. Emile Garcke's figures in the "Manual of Electrical Undertakings," the average cost of existing British plants expressed in percentage of total capital expenditure is approximately as follows:

Land and buildings	19 to 23 per cent.
Machinery and plant	36 to 37 per cent.
Various remaining items	4 to 14 per cent.

As regards the first item, the above average includes several old lighting stations, and there is little doubt that if a new plant were installed the cost of land would be materially reduced.

The question of system of generation, whether in several large stations, generating continuous current or in one large station generating either continuous or polyphase currents, is of great moment.

As already stated previously, in a traction station much greater capital expenditure is justified, and coal-handling appliances can be installed which enable one or two men to look after the largest boiler room. Automatic lubricating system and ash conveyors, etc., enable one or two men to be sufficient in the largest engine room. It will be evident that the item wages and salaries will be far greater in several than in one station. Also the waste of coal, etc., will be far greater. From a careful study it is nearly certain that, for anything above 5,000-kilowatt capacity, one polyphase station operating rotary-converter substations is the best. Large units are also always advisable. It interests me to see that the sizes of units I recommended several years ago are generally being adopted. For reference, it may perhaps be advisable to append this table:

Sizes of Engines Recommended for Use in Power Stations.

Maximum Power Required, I. H. P.	Number of Engines.	Power of Each Engine, I. H. P.
200	2	200
400	3	200
600	3	300
1,000	3	500
1,500	4	500
2,000	4	750
5,000	6	1,000
10,000	6	2,000
20,000	6	4 000
40,000	9	5,000
60,0 0	11	6,000
90,000	10	10,000

All engine builders who have had experience in tramway work now make an entirely different kind of engine for traction from that which they supply for lighting stations. The conditions under which a tramway engine works are, if anything, more onerous than those of a rolling-mill engine. A slight variation, either in number of revolutions per minute, or in angular velocity per revolution, is of the greatest importance in a traction station, whereas it is of small importance in a rolling mill.

A uniform speed is especially important where compound-wound dynamos are run in parallel direct on to the line. If the momentary difference in speed between two engines exceeds very narrow limits, the voltages of the machines differ, and cause very heavy currents in the equalizing bars, and largely increased core losses, hence great waste. If the difference becomes too great, one of the generators may even be reversed. Where multiphase machines run in parallel, constant speed is of even greater importance to keep the machines in step. In cases where shunt-wound generators with heavy batteries of accumulators run in parallel on the line, the question of engine regulation is not so important.

A traction station where compound-wound dynamos are used should be so arranged that, if the normal load be suddenly thrown on or off an engine, the speed shall not vary more than two per cent. either way. In some cases a maximum variation of 1½ and 1¾ per cent. is all that is allowed. Where polyphase currents are used, constant speed is of even greater importance; and a guarantee should be required that under no circumstances shall the angular velocity during one revolution vary more than one-half per cent., and in some cases not more than half of one per cent. With heavy flywheels, and governors properly designed for tramway work, it is quite practicable to fulfil the above conditions.

Or expressed in a different way, in polyphase work, the engine should not produce by variation of angular velocity a phase displacement of more than 5° per half cycle.

From careful comparison of many existing systems, it may be taken that the total cost of power, all fixed charges included, for one large station, as compared to that for two or more smaller stations, together equal in power to the larger one, is from 30 to 75 per cent. lower.

1. Paper read before the Tramways and Light Railways association at the Agricultural Hall Exhibition, London, June 25, 1900.

Substitute for Rubber.

Owing to the present high price and increasing use of rubber, the discovery of a substitute has been eagerly sought after. Such a substitute would be especially welcome to the electrical industry, and it is to be hoped the following extract from the Scientific American is not an exaggeration of the qualities of the newly discovered product:

"An Italian residing in Mexico has recently devised a new composition intended as a substitute for caoutchouc in the manufacture of rubber goods. While residing in Mexico he observed a shrub growing in Central Mexico, and known to the Indians by a variety of names, of which Yule is one. The shrub grows wild on the rolling land and attains the average height of three feet. An examination of the shrub led him to experiment with the same with reference to ascertaining what use might be made of it, since it grows abundantly, may be easily cultivated, roots readily from cuttings and may be cut two or three times a year and immediately begins to grow and shoots up again to form new wood. It does not belong to the plants which yield milky juices, being a comparatively hard wood and growing as a small scrubby bush, but there is found within its bark and wood a large amount of gummy matter, and upon comminuting it by cutting finely, grinding, or pounding the same and macerating it with a hydrocarbon solvent such as gasoline, naphtha, ether of petroleum, oil of turpentine, or the like, this gum is softened and extracted from the wood, and when extracted does not harden to crystallization, but still holding a small portion of the hydrocarbon, remains as a viscid, sticky mass that fulfills all of the physical conditions of crude rubber. It may be vulcanized perfectly and is superior to most india-rubber since it is free from all mechanical impurities and needs no preliminary cracking, grinding and washing, as does the ordinary crude rubber."

The Chicago Automobile Club.

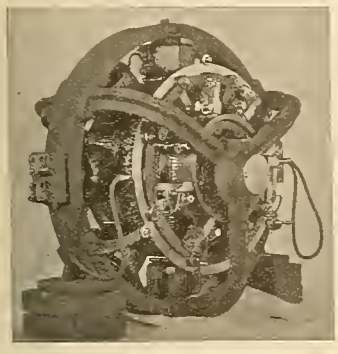
The Chicago Automobile Club is the name finally fixed upon for the motor-vehicle organization of this city. The originally proposed name of Western Automobile association was not well thought of by some, because of being too broad a title, and one that would be inconvenient when the day comes that an organization of western automobile clubs is feasible. The officers are: President, A. J. Eddy; first vice-president, J. Ogden Armour; second vice-president, Samuel Insull; third vice-president, F. C. Donald; secretary, C. T. Jeffery; treasurer, D. Cottrell, M. D. It is estimated that there are about 50 private parties owning or controlling automobiles in Chicago, and about half of these are charter members of the club.

The first club run was held last Saturday, August 11th. Sixteen vehicles turned out, of which three were electric. The threatening weather kept in some members. Meeting in front of the Auditorium Hotel on Michigan boulevard, the club went north to the Lake Shore drive and Lincoln Park, and on to the Bismarck Garden. After a short halt the party returned to the Edelweiss for dinner.

A New Sturtevant Eight-pole Motor.

The B. F. Sturtevant company of Boston, Mass., has just brought out a new type of eight-pole motor, as clearly shown in the accompanying illustration. This was designed for direct attachment to a fan shaft. The field ring is of wrought-iron, although in large sizes it is made of cast-steel or cast-iron. The field cores are of wrought-iron, with a special type of cast-iron pole shoe, the peculiar size and shape of which renders the machine capable of extreme variation in load without sparking or adjustment of the brushes. Machine-wound field coils are used, and the shape is such that the windings present the greatest amount of radiating surface, so that perfect ventilation results.

This type of motor was designed for comparatively low speed, but high efficiency, and therefore special care has been taken in the design of the armature. The coils are built up of laminated, slotted disks. These disks are solidly clamped between two brass rings, having teeth to correspond with the core teeth which support them at both edges of the core. The teeth are not only protected



A NEW STURTEVANT EIGHT POLE MOTOR.

in this manner, but a smooth and well-rounded corner is presented for the support of the slot insulation.

A commutator of large diameter is employed, with pure drop-forged copper-segments. Carbon brushes with self-adjusting and self-feeding holders are used. A tripod support upon each side carries the ring-oiler bearings. These motors are built in sizes from three horsepower up to 137.5 horsepower.

Plant for Investigating High Voltages at Harvard.

Professor John Trowbridge, department of physics, Harvard University, has probably done more than any other man in the investigation of very high continuous-current voltages, and an article by him in a recent issue of the Scientific American, describing the extensive plant the university now possesses for the production and investigation of very high voltages, is of interest. The plant, which is a part of the Jefferson Physical Laboratory at Harvard University, Cambridge, Mass., consists of 20,000 storage cells, with a normal voltage when charged of 44,000 volts. The plant occupies a room in the laboratory about 30 feet wide and 60 feet long. The battery is contained in a closet with doors, to protect it from dust. There are also a number of glass condensers in 12 trays carrying 25 plates each, there being 300 glass plates in all. The condensers are made one-eighth inch in thickness, and are coated with a surface of tinfoil 16 by 20 inches. The capacity of the entire condenser in multiple is about 1.8 microfarads. When the condensers are charged to 20,000 volts and discharged in series a spark 6½ feet long in air is produced. A longer spark cannot be produced while the apparatus is situated in a brick-walled room and not in an open space. It will be necessary, Professor Trowbridge states, if the full disruptive effects of the high voltage are to be studied, to place the apparatus in an open field and at least 30 feet above the surface of the ground.

He has lately been investigating the question, "Can lightning pass through a small orifice?" A plate of glass five feet square and one-quarter inch thick was placed between the spark terminals. The plate was necessarily of this size to prevent the sparks from passing around the edges of it. The plate had a small hole bored through it at its center. This hole could be made much smaller by filling the hole with paraffine and making a needle hole in the paraffine. It was found that when the discharge terminals were five feet apart and in line with the hole that the discharge would pass through the minutest orifice, but the portion that passed through the hole was only a fraction of the entire discharge, for there was an inductive action over the entire surface of the glass. This inductive action could be seen by hanging a large sheet of paper in front of the glass. After the discharge it was found closely adhering to the surface of the glass, while its presence did not modify the general appearance of the spark shown by the photograph. When the hole in the plate is entirely closed by paraffine and the spark terminals are placed opposite each other, about four feet apart, with the glass plate midway between them, a spark will jump from one terminal to the surface of the glass, while no spark is seen on the opposite side of the glass. On close inspection, however, a faint brush discharge can be detected on the sparkless terminal; the discharge has been continued by an inductive action over the entire surface of the glass.

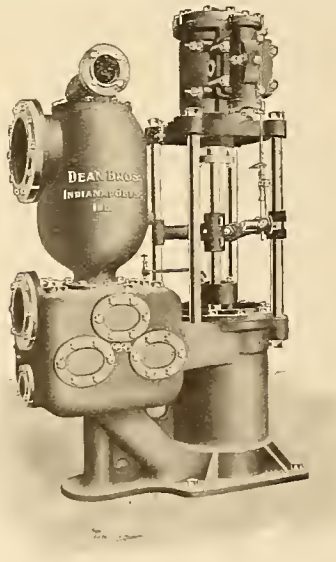
One of the most interesting results he has obtained with the great battery is the production of X-rays for the first time by a steady current. An X-ray tube is simply connected to the terminals of the battery and a water resistance of perhaps a million ohms' resistance is inserted in the circuit. The tube is then heated by an external source of heat. In an instant the tube lights with a most brilliant exhibition of X-rays, and photographs taken by means of them show unmistakable evidences of the tendons and muscles. Professor Trowbridge believes that when the right conditions are reached he will obtain satisfactory photographs of these objects.

Dean Vertical Steam-condensing Apparatus.

The air pump and steam condenser shown in the accompanying illustration is designed for the engines of electric-lighting stations, the steam plants of electric street-railway stations and other steam plants where economy of fuel consumption is important. This air pump can be speeded to deliver just the amount of water required for condensation. It is started before the engine and the vacuum obtained is used to assist in the first revolutions. This feature is important with compound engines, as the full power of the low-pressure cylinder is secured at once.

It was formerly supposed that a vertical air pump must be single-acting, but the manufacturers have designed a double-acting, vertical air pump that is believed to be entirely successful. The vertical type of air pump is said to be much more durable than the horizontal type, because there is no side wear in the cylinder and stuffing boxes. In horizontal pumps, especially large sizes, there is a constant downward wear of piston and rods, due to their weight. Any sediment in the water will settle on the lower side of cylinder, where this pressure is greatest, causing the piston and cylinder to wear rapidly. The vertical air pump occupies but little floor space, and it is much more convenient to set down into a pit, should it be necessary to lower the air pump, so as to reduce the vertical lift of injection water.

The piston rods are separable at the cross-heads. Tapering keys are used to hold them in place. The cylinder head can be easily removed and taken entirely out of the way, for inspecting the interior of the cylinder or for repacking the piston. The piston-rod stuffing box is provided with a water seal to prevent air from entering. The cylinder is lined



DEAN VERTICLE STEAM-CONDENSING APPARATUS.

with bronze. The piston rod is of bronze, and all valve seats are of this metal.

For electric-light or electric street-car plants this apparatus is claimed to be perfectly adapted. It is made with tandem-compound steam cylinders, where it is desired to reduce steam consumption. The apparatus can be operated on an expenditure of steam of one-half of one per cent. of the steam used by the engine, and it will save from 20 to 30 per cent. of the total steam consumed by the engine. The apparatus is manufactured by the Dean Bros. Steam Pump Works, Indianapolis, Ind.

The Susquehanna Electric Power company, which intends to develop a waterpower of the Susquehanna River near Muddy Creek, York County, Pa., it is now reported, has secured a contract from the United Railways and Electric company of Baltimore for about 20,000 horsepower for 40 years, at a price below what the United Railways and Electric company can generate it for in Baltimore. This contract will guarantee the power company enough revenue, so that it can safely go ahead with the project to develop 40,000 horsepower.

Crest Sparking Plug for Gasoline Engines.

The Crest Manufacturing company of Cambridgeport, Mass., manufacturer of gas and gasoline motors for automobiles, is putting on the market what is said to be a radically new design of sparking plug and one that is not affected by heat and expansion and consequently is claimed to be unbreakable. After a considerable expense in experimenting with the best porcelains of foreign manufacture, the manufacturer has, through the assistance of a well-known chemist, discovered a new material that is believed to be unbreakable by heat or expansion. The company has had these sparking plugs in use for a long time on its motors, without any reports of failures. It is well known that the sparking plug is a delicate piece of mechanism and gives considerable trouble, and the failure of gasoline engines can, as a rule, be traced to the failure of the sparking plug, and for this reason all automobilists using gasoline engines usually carry one or two spare plugs in their kit.

The material used in the Crest sparking plug is claimed to be a perfect electrical non-conductor, and does not expand under intense heat. It is a soft, tough material, not being brittle like porcelain. The plug, as shown in the illustration, consists of a shell of steel having a thread at one end to screw

CREST SPARKING PLUG FOR GASOLINE ENGINES.

in the orifice of the chamber of the motor. The sparking plug proper consists of a slight cone of this new material, which is inserted in the steel plug. This cone fits tight in the shell, making a gas-tight joint, without packing, which makes the plug proof against carelessness in the hands of unskilled persons. Through this cone a wire is passed, terminating at the bottom of the plug with an enlarged head. A platinum wire is inserted in the body of the steel shell, the spark jumping across between the two joints. These plugs are sold singly, or in lots of 25 to 100, to the trade. Directions go with each plug.

The Telautograph in London.

[From the London correspondent of the Western Electrician.]

After many years of experiment the telautograph is at length to be put on the market as a practical machine. Eight years ago Professor Elisha Gray startled scientists on the American side of the Atlantic with this machine. An operator taking up a pen, attached to the end of a wire, wrote a message with it in everyday handwriting. At the other end of the wire a similar pen, passing over a sheet of paper, reproduced the message exactly as written, even going back to cross the t's and dot the i's. Great things were then predicted for the telautograph—the signing of checks a thousand miles away, the drawing of criminal portraits for the benefit of the police, etc. Now, at last, the owners of the telautograph promise a realization of these wonders. Actual tests made by the postal authorities in England, in connection with the French postal authorities, between London and Paris, have established its applicability to long circuits. Messages sent from one room to another at the company's office passed through coils of over 200 miles in length and were recorded at the receiving end with perfect accuracy. The instrument is to cost $50 and is to be attached either to telephone or telegraph wires. Arrangements are now being made with the General Postoffice and the National Telephone company. The Prince of Wales, the Duke of York, the Khedive and several other distinguished personages have expressed their appreciation of the value of this, the latest, and not the least, important development of electrical communication.

Cars Seized at Sing Sing.

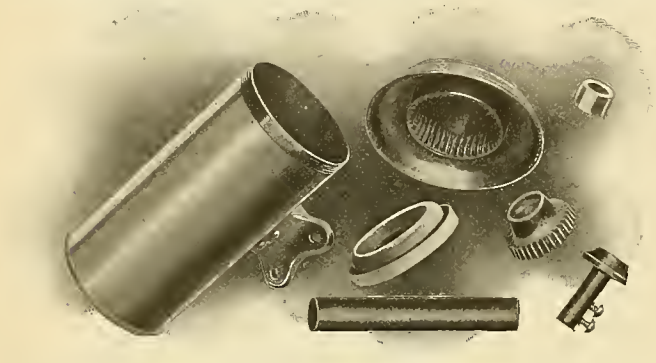
The cars and tracks of the Ossinning electric railway at Sing Sing, N. Y., have been seized for delinquent taxes by the Village Board. The principal result is a great inconvenience to the town. The material seized by the town has almost no market value, and the service is, of course, discontinued. The seizure was made in the afternoon of a day when large crowds of visitors were in town attending a Methodist camp-meeting. A more inopportune time could hardly have been hit upon, as the trolley was the chief means of getting to the grounds. Furthermore, taking the cars and shutting down the road at one of its most profitable times, defeats whatever small chance the village ever had of collecting the taxes. The road has been in receiver's hands for some time, and the receiver has advanced money to keep the road going. It is surprising how short-sighted the authorities in some small towns are in their treatment of an electric railway which is barely paying expenses. After the road has been shut down they usually repent their action; in fact, the business men in Sing Sing, as well as the traveling public, are doing so already, and at last reports a compromise had been patched up.

Wood's Lightning Arrester.

The accompanying illustration shows what is said to be a very novel lightning arrester and also one of the most efficient arresters made. It is known as the Wood's arrester. The shell is a seamless, drawn-brass tubing. The piece of porcelain shown in the center of the cut is placed in the bottom of this shell. The little socket containing the two set-screws on extreme right is then placed through the porcelain plate, and standing in this socket is the composition rod shown at the bottom. On the other end of this rod is placed a small cup with a corrugated edge, and standing in the top of this cup is the small porcelain button shown in the upper right-hand corner, and last, the cap, with corrugated cup inside, is screwed to the top of the casing, and by this means, all parts are brought into a rigid position.

There are no coils used in this arrester, and it is therefore entirely non-inductive. There are no moving parts to be in action when an extra amount of discharge is liable to appear. On the whole, it is claimed to be an arrester that requires no attention after being once installed.

An interesting experiment was tried with this type of arrester in a high altitude, where static discharges are more frequent than in any other place. A section of the casing was cut away, and a sheet of mica was put in its place. This would allow any discharges which went through the arrester to be readily detected. It was then placed on a circuit along with several other types of arresters, and while heavy discharges were coming in on the line, the



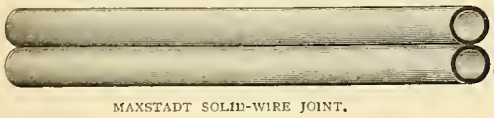
WOOD'S LIGHTNING ARRESTER.

Wood's lightning arrester was taking care of such discharges, while the other arresters, on the same circuit, showed no action whatever. This demonstrated that the arrester described above has a less resistance than the others and is absolutely non-inductive.

The Wood's lightning arrester is manufactured by the Central Union Brass company of St. Louis, Mo., and is sold by its general selling agent, the Central Electric company of Chicago.

Maxstadt Solid-wire Joint.

The name "Maxstadt" has for several years been identified with the output of the best of electrical apparatus, and particularly with the development of solid-wire joints. After long experiment and careful investigation Mr. Maxstadt has evolved his new Maxstadt improved American solid-wire joint, shown in the accompanying illustration, for which he was granted United States letters patent on August 14th. Patents have also been granted in foreign countries. F. W. Maxstadt states that he has brought suit in the United States Circuit Court against the American Electric Fuse com-



MAXSTADT SOLID-WIRE JOINT.

pany of Chicago, which company, he says, has been making wire joints in infringement of the Maxstadt patent. The solid-wire joint illustrated is being manufactured by the F. W. Maxstadt Manufacturing company, 18 West Randolph street, Chicago.

Brill Car-truck Patent.

Claim 1 of the patent upon which the Brill company won its suit against the Third Avenue Railroad company of New York for the use of infringing Bemis trucks is as follows: "In a motor truck the combination with a stationary frame supported upon the running gear, said frame having sections extending outwardly from the axle, of a movable frame supported upon said truck, spiral springs located between the movable and stationary frames and elliptical springs located between the extended sections of the said rigid frame and the movable frame, substantially as described."

The patent is No. 478,218, applied for June 26, 1891, and issued to George Martin Brill for an improvement in car trucks. Further information regarding the suit was given in the Western Electrician of July 21st.

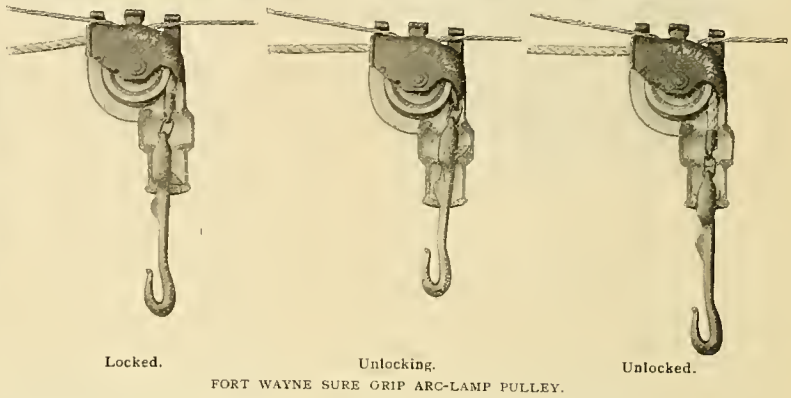
Consolidation in New Hampshire.

Massachusetts and New Hampshire capitalists put a deal through last week whereby the Manchester Electric company of Manchester, N. H., becomes virtually the owner of the Union Electric company of that city and the Merrimac Electric Light, Heat and Power company of Hooksett, N. H. The consideration was upward of $500,000. The officers of the purchasing corporation are unchanged, but Arthur E. Mason of Boston, who was the heaviest owner in the absorbed companies, retires therefrom as an official, the new directors being: William A. Tucker of Boston, P. L. Saltonstall of Boston, G. Byron Chandler, Harry E. Parker, Roger G. Sullivan and G. H. Hood. Mr. Tucker will be president of the Union company and treasurer of the Merrimac company, while Mr. Saltonstall is president of the Merrimac company and treasurer of the Union company. J. Brodie Smith will be manager for both.

The combination controls upward of 15,000 horse and steampower, and will furnish power for the street-railway company, street lights, commercial and home lights, and power and lights for a number of the great cotton mills on the Merrimac River. The consolidation is believed to be preliminary to a larger union of kindred interests.

Fort Wayne Sure Grip Arc-lamp Pulley.

The rapidly increasing use of arc lamps for street lighting has led the Fort Wayne Electric Works of Fort Wayne, Ind., to bring out what they call the "Sure Grip" pulley. Its appearance is not materially different from any regular suspension pulley, but its action is such that when it is automatically locked it cannot be lowered until it has been again raised three or four inches. This second raising reverses the locking dog in the lamp hook and permits the lamp to be lowered, but when once more the lamp is raised to its normal position the dog engages the rim at the lower edge of the pulley and automatically locks the lamp in this position. The accompanying illustrations show the pulley in locked, unlocking and unlocked positions.



Locked. Unlocking. Unlocked.

FORT WAYNE SURE GRIP ARC-LAMP PULLEY.

The extreme convenience of a self-locking pulley is evident to all practical arc-lamp station men. It is said that the saving in time over other systems of suspension would alone more than compensate for the slightly additional cost of the Sure Grip pulley.

For use in connection with the suspension pulley, the Fort Wayne Works also manufacture a pole pulley, which is quickly screwed to the pole by means of one large lag screw and a small wood screw.

Line Work "As She Is Done" in St. Louis.

One of the St. Louis friends of the Western Electrician sends an account of an incident in what he entitles line work "as she is done" in St. Louis, which has something of the dramatic, and what came near being some of the tragic, in it.

The Seckner Contracting company, in preparing for its city-lighting contract, which begins September 1st, was stringing wires on Ninth street on the Bell Telephone company's poles. A wire had been hauled over the poles for several blocks, but the slack had not been taken up, when a crowd of small boys began gymnastics on a part that hung near the ground. Several blocks from this festive scene the linemen, with two teams of horses, started to take up the slack of the wire. When the wire began to tighten two of the boys failed to let go and soon got so high they were afraid to let go. Excitement ran high on the street. Some wanted the youngsters to drop in their arms, others sent in a fire alarm and one man, in a nearby house, with presence of mind, ran out with a blanket which the crowd held under the boys until they could hang on no longer and dropped unhurt into the blanket. One of them, a four-year-old, hung on 15 minutes and the other, a 12-year-old, hung on for 25 minutes.

St. Louis boys must be unusually enterprising in the way of getting into trouble with line wires. A few years ago one of them electrocuted himself by throwing a fine wire over the trolley, grasping said wire and standing on the rails.

Sequel to St. Louis Strike.

The Labor Union Street Railway company of St. Louis has filed articles of incorporation. The capital stock is $5,000 and the officers named are: President, Thomas B. Edwards; vice-president, Simeon O. Collins; secretary, William D Benson; treasurer, John A. Roof. These three gentlemen are the committee appointed by the local street-railway union to organize a corporation to enter the street-railway business in St. Louis. The president of the corporation is chairman of the strikers' grievance committee.

CORRESPONDENCE.

London Letter.

London, July 31.—If the Metropolitan and District Railway companies succeed in carrying into practice their published intention of using electric traction on the Inner Circle, they will have deserved well of every traveler in underground London. It appears that the experimental electric train at Kensington has been working satisfactorily, and no doubt the companies have been stirred into greater activity by the enterprise of the Central London Railway company. The cost of such an undertaking will, of course, run into a large sum, but the railways have already an enormous traffic, which should be greatly increased when it is possible to travel on their line without semi-suffocation. When we have electric trains on the Inner Circle and electric trains from Westminster to Tooting, London will be practically regenerate.

The Right Hon. C. T. Ritchie, the president of the Board of Trade, has received a deputation from eight London electric-lighting companies who wish to amend the Board of Trade regulation so that they could change from 100 to 200 volts, by agreement with the consumer, or otherwise, by arbitration. The regulation at present says that no change shall be made in the pressure of the supply to any premises, except with the consent of the consumer. The deputation was headed by Lord Suffield, and consisted of the representatives of the following-named electric companies: The Westminster, the Metropolitan, the Chelsea, the City of London, the County of London, the Brush Provincial, the Notting-hill, the Brompton and Kensington, and Kensington and Knightsbridge. Mr. Ritchie admitted that it was a strong order for a few consumers to stand in the way of the application of the new system, but these people were within their rights, and if the board assented to what the companies asked they would be overriding the position which the former possessed. He would take the matter into consideration, but he urged the companies to use more conciliatory methods with their customers.

Wireless-telegraphy service in this country has undergone a species of mobilization. The great curse of the system at present is that if several ships talk together the messages get mixed. In order to obviate this, a confidential scheme has been drawn up. Lieutenant Allen, the English high priest of wireless telegraphy, is just now fully loaded with an idea, whereby if a ship is once talking with another, other messages may be flying around without the original message being interfered with. If it comes to anything, the value of the system will be quintupled. The theory depends upon some very delicate and minute adjustments, that can be varied at will.

The Central London electric railway was opened for public traffic between Shepherd's Bush and the Bank, on Monday. Ordinary tickets are sold at four cents return, any distance, from 5:15 a. m. to 7:30 a. m. From the latter hour until midnight the fare will be four cents single trip, any distance. In these torrid days a ride on this line is delightful. Forty degrees only was registered in the Oxford

Circus station on Monday afternoon. Another feature which gives satisfaction, particularly to folk of average girth, is "one man (or woman) one seat." There is an allotted seat space apportioned to each passenger, arm rests being provided on each side. This is justice. No longer will the lean have their legitimate domain encroached upon by the fat.

In addressing a meeting of the National Telephone company's shareholders, J. S. Forbes, the chairman, entered a plea for the telephone girl. He said the ladies deserved much consideration, as they worked under great stress. Their nerves were more sensitive than those of man and they resented any vulgar or rude expression in the exercise of their most delicate and trying functions.

Charles T. Yerkes arrived in London from New York on Thursday. Although he said he had not come with any project, yet it is generally understood that his mission is to negotiate with the County Council for the building of electric tramways in London. It is stated that it was at first Mr. Yerkes' intention to bid for the control of London's street tramways, but as this is obviously impossible, he will probably confine himself to the task of building the lines, if he can obtain the contract.

Last week an explosion occurred on the premises of the Crystal Palace District Electric Supply company. The great boiler burst, with a loud report, and wrecked two large buildings. The force of the explosion was so great that the roofs were blown off and the walls and windows shattered. One poor fellow was instantly killed, his body being frightfully mutilated, and another has since died, while a number were severely injured.

Marconi's system of wireless telegraphy is to be established on the mail packets running between Dover and Ostend, a distance of 68 miles. The establishment of this means of communication with the shore, whatever the weather, will be of great benefit and will greatly minimize the dangers from weather, breakdown or collision, as assistance will be easily obtainable.

The moving platform at the Paris Exposition has earned $200,000 since it began operations, and that is exactly the amount of money expended over the share capital originally raised, and $26,000 has to be paid in interest before the shareholders receive a cent. They are naturally very angry at the present position of affairs. A curious lawsuit has been brought against the company by the Régie, a government department, that corresponds, in some particulars, to the Inland Revenue office. The authorities claim that the platform is a public vehicle and that the company has fulfilled none of the laws and regulations appertaining thereto. They demand the imposition of a fine and the confiscation of the platform. W. H. B.

New York Notes.

New York, August 11.—At six o'clock this morning the cable ship Anglia began the formal laying of the American end of the new German-American cable. The cable starts from the Commercial Cable company's station at Coney Island, and will run to Fayal, where it will connect with the recently completed cable from there to Emden, Germany. Although the formal start took place to-day, the Anglia will not sail for Fayal until next week. It is hoped to have the cable ready for service early in September.

The Rapid Transit Commission has opened a branch office in Pittsburg, to have a representative at the place where most of the structural steel for the subway is to be turned out. W. A. Aiken, general inspector of materials, is in charge at the new office.

The State Board of Railroad Commissioners has approved the application of the Metropolitan Street railway of New York city for an increase in the amount of its capital stock from $45,000,000 to $52,000,000. The company will employ the proceeds of the sale of the new stock in changing its cable lines to the underground electric trolley on Columbus avenue, Broadway and Lexington avenue, and in changing from horse power on the Thirty-fourth street cross-town line to electric-storage batteries. These expenditures for construction and equipment work will aggregate about $3,000,000, and the company proposes to utilize the remaining $4,000,000 for the payment of its floating debt contracted for the purchase of stocks in other street-surface railroad corporations in New York city.

Good progress is being made with the electrical equipment of the Manhattan Elevated, and General Superintendent W. E. Baker expects to have trial trains running with current borrowed from the Metropolitan street railway, in October. The piers and foundation of the immense power house at Seventy-fourth and Seventy-fifth streets and the East River have been finished and work begun on the stack. The power house will have a normal capacity of 64,000 horsepower. On the Second avenue line the work of third-rail laying is well under way. The multiple-unit system of propulsion will be employed to the extent that two cars (the first and last) in the six-car trains will be equipped with motors—each motor car having a 100-horsepower motor on each axle. So there will be 800 horsepower in motors to a six-car train. Five-car trains are run with the present steam service. The adoption of electricity will not only increase the number of cars per hour that it is possible to safely run, on account of longer trains, but also the more rapid acceleration will permit a faster schedule, consequently more trains per hour. This, it is expected, will greatly relieve the congestion at the City Hall station on the Third Avenue line. Current will be transmitted at 12,000 volts, three-phase from the main power plant to the various sub-stations. The company has filed with the department of buildings plans for three sub-stations for the East Side divisions. The sub-stations are to be five stories in height, and each will cost $28,000. One station will be in Division street, near the corner of Allen; another at the southwest corner of Third avenue and Ninety-ninth street, and the third in Thirty-fourth street, just west of Second avenue. The first floor of each of the sub-stations will be occupied by the rotary converters. The transformers will be on the second floor. On the third will be the storage batteries, which will insure against stoppage should there be an accident at the central station. The storage batteries could keep the roads in operation for two or three hours. Plans for sub-stations of a similar character, to distribute power to the West Side roads, are now being drawn. It was stated yesterday, though, the locations have not been definitely settled.

It is reported that the Metropolitan Street Railway company will not renew the contract for carrying the mail on Third avenue, which expires in October. This contract was for five years. Formerly the elevated road carried it.

President H. H. Vreeland of the Metropolitan Street Railway company gave a clambake at Aonetta Lake to-day, the guests being a large number of the employes of the company. It was the second annual clambake and outing for the heads of the various departments of the railroad system. The party left the Grand Central station on special cars on the Pittsfield express shortly after nine o'clock. They were met at Brewster, where Mr. Vreeland has a country home, by Mr. Vreeland, ex-Assemblyman Addis, Postmaster Shove and other prominent citizens. Carriages were in waiting and the guests were driven to the Tonetta Outing Club on the shores of the lake. The Brewster band gave a concert before the clambake was announced. After dinner the party rode to "Rest a While," Mr. Vreeland's home. There Mrs. Vreeland greeted them. She was assisted in receiving by several ladies of the village. An address of welcome was made by Mr. Vreeland and responses assuring him of the esteem in which he is held were made. Mrs. Vreeland served a luncheon for her guests, who afterward went home in a special train. M. L. G.

From the Buckeye State.

Columbus, Ohio, August 11.—Director of Law Crum of Columbus has brought suit against the City Council, to compel that body to issue the reclaiming electric-light plant bonds. The suit is in mandamus, and was brought for the purpose of testing the question as to whether it is obligatory upon the council to issue the bonds, as authorized by the Legislature.

The electric-light plant and waterworks at Napoleon, Ohio, were destroyed by fire on August 8th.

The sale of 800 shares of preferred stock of the Columbus Railway company has been announced, but the name of the purchaser has been kept quiet.

The Fostoria Incandescent Lamp company of Fostoria ran its third annual excursion to Detroit Saturday.

The Board of Legislation of Cincinnati will likely advertise for bids for lighting the portion of the city now served by the Cincinnati Edison company. The contract with that company does not expire until 1903, but if a new company should get the contract, this will give time to build a plant. The specifications will call for bids on both electric and gas lighting.

George B. Frost, a tinware dealer of Carthage, Ohio, has applied for a franchise to build an electric road from Cincinnati to that village.

The New Dayton, New Carlisle and St. Paris Traction company has filed a trust mortgage of $1,350,000 in favor of the Central Realty Bond and Trust company of New York. This would indicate that the company expects to issue bonds and begin work on the road at an early date.

A fight over the extension of street-railway franchises in Cleveland is brewing. The Little Consolidated Railway company has asked for an extension, but it seems that many members of the Board of Control are in favor of waiting until the present franchise expires before doing anything.

The Rathmell resolution providing that the city clerk of Columbus advertise for bids for the use of Dublin avenue for street-railway purposes, as desired by the Urbana, Mechanicsburg and Columbus Electric Railway company, was adopted at the last meeting of the City Council. This will give the new road an entrance to the city.

A flaw in the title to lands at Monroeville has delayed the building of the power house of the Sandusky and Norwalk electric line.

The Dayton, Springfield and Urbana Railway company has been granted a franchise on Main and Columbia streets, Springfield. It is believed this was done to gain admission to the city for the Columbus, London and Springfield Electric Railway company.

The City Board of Equalization of Columbus has almost doubled the tax valuation of the Columbus Railway company, as fixed for the county. The valuation made by the board is $1,327,400.

The Toledo, Fremont and Norwalk Electric Railroad company ran an engine and six flat cars over its line last week. The train will be used in hauling ballast for the roadbed. The line is completed between Toledo and Clyde, and work from Bellevue to Norwalk began this week. Cars will be running between Fremont and Genoa within a few days.

The Millcreek Valley electric line at Cincinnati will give a three-minute service to its patrons during the fair at Carthage. The company has put 26 new cars in operation.

Miss Anna Riordan has asked for an injunction restraining the Columbus, London and Springfield Electric Railway company from constructing its lines along the National pike from Columbus through Franklin and Madison counties.

The Village Council of Kenton will submit the question of bonding the town for a municipal-light plant to the people, unless bids received on September 3d are low enough to suit it. The town is now in darkness. O. M. C.

Northwestern Notations.

Minneapolis, August 11.—It is reported at St. Cloud, Minn., that the electric-light plant of the Benton Power and Traction company, which has been closed down for several months from financial troubles, is about to resume operations.

The council of Chippewa Falls, Wis., is considering an ordinance regulating the speed of street cars in crossing the Chippewa River bridge, and the weight of the cars.

The assessed valuation of the Gas and Electric company's property at Madison, Wis., has been increased from $95,000 to $110,000.

The Fargo Edison company of Fargo, N. D., is setting poles for its wires on the opposite side of the street occupied by the Gas and Electric company. The latter secured an injunction against the Fargo Edison company, to prevent the latter from setting poles alongside of its own, claiming it affected them. The attempt to set poles on both sides of the streets causes considerable objection. Rev. William Ballou made a verbal objection to a pole in front of his property, which was unheeded. He then secured a shovel, and as fast as the dirt was thrown out, he threw it back. The comedy was continued until the workmen ceased.

The Twin City Rapid Transit company has made propositions to the council of Stillwater, Minn., which were acceptable and the threatened forfeiture of franchise will not be pushed. The company has agreed to build the extension to South Stillwater, but may not be able to do so until spring, as an extension to the power house at Wildwood will be necessary.

Warner Miller of New York was recently in Spokane, Wash. It is understood he is interested in the purchase of the waterpower at Kettle Falls, with which to operate an electric-car line.

Arrangements are being completed to rebuild the electric-light system at Mazomanie, Wis. New and improved machinery is to be installed.

The council of Shakopee, Minn., recently opened bids for the establishment of an electric-light plant for the city, but deferred action on them.

The council of Waterloo, Iowa, has contracted with the electric-light company for street lighting at $72 for arcs and $13.20 for incandescents, per annum, or service until 1 a. m., except on moonlight nights.

The Tri-City Railway company has about completed its new double track on Third street in Davenport, Iowa, and will soon open it for traffic.

Frank Dodson and John R. Swearingen have sold the electric-light plant at Perry, Iowa, to T. A. Grist of Cedar Rapids, Iowa, C. R. Lyon and Hartley B. Brown of Perry.

An electric railroad is projected from Burlington, Iowa, to Lowell and Salem, Ill., about 26 miles. Waterpower is available. A survey has been made.

John Bartholomew of Grand Forks, N. D., will rebuild the electric-light and gas plant at Aberdeen, S. D., which was burned recently. Mr. Bartholomew's new plant will have new and improved machinery.

The Northern Electrical Manufacturing company secured the contract to furnish machinery for the new lighting plant to be put in at Mantorville, Minn., by C. S. Wedge & Sons.

The armature in the large dynamo of the electric-light plant at Plymouth, Wis., was burned out. All lights were off until repairs could be brought from Pittsburg.

G. Norgren & Co. of Centerville, S. D., have just completed a modern electric-light plant in connection with their flour mill. Waterpower will be used a portion of the time to furnish power.

The Albert Lea Electric company has ordered two more boilers for its system at Albert Lea, Minn.

The Street Railway company of Des Moines, Iowa, is laying 90-pound rails on parts of its downtown loop line.

The Ohio Trust company has submitted a proposition to the business men of Preston, Minn., relative to an electric-car line, to run from Decorah, Iowa, to Chatfield, Minn., via Preston. It will be

of standard gauge, and capable of handling railway cars of the largest size.

A consolidation has been effected at Council Bluffs, Iowa, of the Omaha and Council Bluffs Bridge and Railway company with the Suburban Railway company, the former interests controlling. The price paid is said to be $400,000.

The council of Owatonna, Minn., has contracted with the Electric Light company for 43 lights at $6 per light per month, for the next 10 years. There is considerable criticism over the action of the council, as a new company is nearly ready to enter into competition.

Amos F. Gerald, formerly superintendent of the electric railway in Eau Claire, Wis., is now running for Congress on the Democratic ticket in the Gardiner district in Maine, and he expects to be elected.

The Citizens' Heat, Light and Power company of Waterloo, Iowa, has put up a forfeit bond for $2,000, as a guarantee that its new plant will be in operation by September 1, 1901.

The council of Albert Lea, Minn., has granted a franchise to the Albert Lea and Geneva Railway company, which plans an electric line to Geneva, Minn.

The council of Great Falls, Mont., has made a number of alterations in the franchise submitted by the Tribune, in its application for an electric-light system.

Work is to be begun at once for improvements on the electric-light and street-railway systems of Keokuk, Iowa. New and modern machinery is to be installed. There will be a new boiler and engine, three more dynamos, two 80-arc generators for arc lights, and one 4,000-light incandescent dynamo.

It is expected that electric power will be transmitted from the Apple River Falls, in Wisconsin, to St. Paul by the 15th of September. The plant at Apple River Falls is completed and will develop 5,000 horsepower. The plant has cost over $1,000,000. R.

Canadian Intelligence.

Ottawa, August 10.—There is a project afloat for the construction of an electric-railway line, to connect Three Rivers, Que., with Grand Mere, Shawinigan, St. Barnabe, St. Severe, Louisville and Yamachiche. The principal promoters are Mayor Paquin of Three Rivers and P. E. Paneton.

On the 31st of July the ratepayers of Brockville, Ont., voted on a by-law to raise $100,000, by debentures, for the purchase of the plant of the Brockville Light and Power company. Only about one-third of the eligible vote was cast, and the by-law was carried by a majority of 404 votes. A by-law was also adopted favoring commissioners to manage the works, which will be taken over next October.

The Montreal Street Railway company has introduced a new style of car upon its lines. The car is 41½ feet long. It is closed in and has doors in the middle, as well as the front and back. In the middle of this car is a sort of porch, open on one side, and before and behind this porch are two compartments, capable of holding 24 passengers each.

The town of Bracebridge, Ont., has passed a by-law to raise $27,000, by debentures, for the purpose of extending the present power, putting in new waterwheels and dynamos, etc. It is the intention to proceed with the work at once. Four contracts will be let, one covering excavating and rock work, another the dam and power house, the third the steel flume and waterwheels, and the fourth the electric plant.

An incandescent coal-oil lamp is the latest invention brought to the attention of Ottawa capitalists. A company is being formed for the purpose of manufacturing coal-oil lamps, according to a model made by V. L. Emerson, the American scientist, who is now residing at Ottawa. The incandescence is created by blowing a thin stream of coal-oil in a spray over a film which is shaped like the auer-light burner, and the result is claimed to be a light of about 20 times the brilliancy of an ordinary 16-candlepower electric light. It costs only about one-tenth of a cent per hour.

Edwin Hanson, president of the Havana Electric Railway company, has just returned from New York to Montreal. He has been in the former city looking after matters pertaining to the enterprise. The Havana Electric Railway company, which has taken over the property of the Ferro company, has now in course of construction about 80 miles of track, and the company proposes to operate on its system about 120 cars.

William Kennedy, C. E., of Montreal, has returned from a trip to Europe. He has been abroad for the purpose of attending to the shipment of turbines for which he had contracted with a Switzerland firm last fall. The turbines are for the Cataract Power company of Hamilton, Ont., and are to be used under a head of 267 feet of water in the transmission of power from St. Catherines to Hamilton, a distance of 34 miles. Mr. Kennedy went to Austria, France and other European countries, but found that in Switzerland the people were farthest advanced in the utilization of water under high heads.

At a meeting of the Cape Breton Tramway and Electric company, recently held at Sydney, C. B., it was decided to build an electric railway in the town of Sydney and suburbs, to engage an engineer, and, as soon as proposed routes will be surveyed, to commence the construction of the railway. A committee was appointed to consider the advisability of extending the line to Glace Bay. The construction of the line between North Sydney and Sydney mines was considered, but not decided on. The company is capitalized at $500,000.

J. B. Charleson of Ottawa, who is building the Dominion government telegraph line to the Yukon, says that the section from Atlin to Telegraph Creek, a distance of 222 miles, is completed. The section from Tagish to Atlin, 80 miles, was previously built, which makes a total of 302 miles of wire in the northern end. To the south, wires have been strung from Quesnelle to Hazleton, 342 miles, leaving 300 miles between the two inside ends of the wires. A connection will be made about the end of September, or early in October. About the same time, connection will be made with the line into Dawson City. In the meantime, communication with that city is kept up on the interspaces north and south by relays of horses. The line from Quesnelle to Ashcroft, a distance of 220 miles, is being repoled. Branches are to be put to Horsefly, 72 miles, and from French Lake to Manson Creek and Omenica.

A special cable from a press correspondent at London, England, says: "A high cable authority tells me that although the Pacific cable committee called for tenders, it is face to face with the greatest obstacle yet encountered. Guttapercha, of which 2,000 tons are needed for the cable, has gone up from three to eight shillings per pound, and is so scarce that no contractor will dare to bind himself to tender within a specified period. Interviewing another cable expert, I find this scarcity of guttapercha traced to the Eastern Telegraph group, which, he suggests, hopes thus to defeat the Pacific cable plans. When the Eastern group saw the Pacific cable tenders coming out, it gave orders for about 14,000 knots of cable, and so choked the sources of production. Other large cable orders have also been placed on the market." W.

News from the Carolinas.

Charlotte, N. C., August 10.—At Union, S. C., parties are projecting plans for a seven-mile electric railway, to connect the town and milling sections. It is stated that application for a charter will be made in a few days.

The Board of Aldermen of Statesville, N. C., have authorized the electric-light committee to close a contract for electrical machinery and a new engine. The cost will be about $4,000. The machinery has been selected.

The Asheville and Biltmore Street Railway company has made a contract to furnish electric lighting for the buildings and grounds of the Southern Railway company, at Asheville, N. C.

A. C. Zollicoffer, trustee, will, on September 1st, sell at auction the plant of the Henderson, N. C., electric-light company, also the franchise under which the plant has been operated in the town of Henderson. L.

PERSONAL.

Mr. E. B. Ellicott, the city electrician of Chicago, is spending a month's vacation in Yellowstone Park. He left Chicago on the 8th inst.

ELECTRIC LIGHTING.

Loveland, Colo., is advertising for bids for an electric-light plant.

W. T. Riley is promoting a $30,000 electric-light plant at Hailey, Idaho.

West Plains, Mo., contemplates the erection of an electric-light station.

It is reported that Bellevue, Iowa, will spend $4,000 on its electric-light plant.

The Electric Power and Light company's plant at Grass Valley, Cal., has been destroyed by fire.

An engineer has been appointed to prepare plans for the proposed new electric-light plant for St. Mary's Ont.

The City Council of Mantorville, Minn., has granted a 10-year franchise for electric lighting to C. S. Wedge.

R. W. Nelson, mayor of Newport, Ky., has purchased the Georgetown (Ky.) waterworks and electric-light plant for $30,000.

E. J. O'Bierne of Birmingham, Ala., has made a proposition to the town of Florence, Ala., to establish an electric-light plant.

The New Southern Hotel, Chattanooga, Tenn., of which F. A. Lincoln is manager, will be in the market for a 700-light plant.

At Crisfield, Md., the Crisfield Ice Manufacturing company will put in an electric-light plant, if it can get a franchise and a municipal contract.

The City Council of Galesburg has voted to build a municipal lighting plant. The lowest bid submitted is by L. E. Meyers of Chicago, for $40,000.

F. Glackmeyer, clerk of Pensacola, Fla., asks bids, until August 31st, for lighting the streets and alleys of Pensacola for three, five, or 10 years, from January 1, 1901.

The proposals for a plant for lighting the city of Saginaw, Mich., will be rejected by the Board of Public Works and new specifications will probably be drawn up.

The Columbia City Heat, Light and Power company of Columbia City, Ind., has been incorporated, with $10,000 capital, by S. J. Peabody, J. A. Rush, A. A. Adams and T. R. Marshall.

ELECTRIC RAILWAYS.

The Seattle-Tacoma Railway company has filed a $1,000,000 mortgage to secure its bonds.

F. C. Boyd of New Haven, Conn., is promoting a new electric line between Peru and Wabash, Ind.

The Battle Creek and Coldwater electric road has been granted a franchise by the council of Battle Creek, Mich.

Elwood, Ind., has given franchises to the Union Traction company, which proposes to run a line from Indianapolis to Kokomo.

The New Albany (Ind.) City Council has passed an ordinance granting the New Albany Street Railway a 30-year franchise for $200 a year.

The Lima Railway company of Lima, Ohio, has increased its capital from $200,000 to $500,000, and changed its name to the Lima Electric Railway and Light company.

The Citizens' Light and Power company will probably complete the electric railway between Newport News, Va., and Hampton, which was started by the defunct Peninsula Railway company.

The matter of electric power for one of the heavy-grade divisions of the Baltimore and Ohio railroad is being considered. W. D. Young is electrical engineer of the railroad company, with offices at Baltimore.

The Shamokin and Edgewood Light, Heat and Power company of Shamokin, Pa., is about to construct a plant for the purpose of supplying power to the Shamokin and Edgewood Electric Railway company, and light and power to the public of that vicinity, and is in the market for electrical machinery.

The promoters of the Buffalo, Niagara Falls and Rochester Electric Railway company have secured the necessary rights-of-way and the company will apply to the State Railroad Commission for permission to begin the construction. A. D. Beach of Watertown, W. H. Gillette of Charlotte, C. S. Barker, G. L. Brown and others are directors.

The Chicago, Milwaukee and St. Paul railway has put on a number of fast suburban trains in Chicago to connect Evanston with the Northwestern elevated railroad. These trains will run from Evanston to Sheridan Park, the northern terminus of the elevated road, in 12 minutes, and the run on the elevated by its express service will be made in 25 minutes. Trains will run every 30 minutes during the day and every 20 minutes during the rush hours. The fare from Evanston to Chicago by this arrangement will be 15 cents.

AUTOMOBILES.

The Remington Automobile and Motor company has been incorporated, under the laws of New Jersey, with a capital stock of $250,000. The proposition is to start a factory at Ilion, N. Y. The officers are Philo E. Remington, president; S. C. Burch, treasurer; P. A. Stubblebein, secretary.

The Woods-Morton Cab company of Chicago has filed articles of incorporation. The incorporators are Harry Goodman, C. F. B. Goodspeed and Arthur B. Schaffner. The object of the corporation, as stated in its charter, is to let, hire, manufacture and sell all kinds of cabs, automobiles, etc. The company is incorporated for a period of 99 years, and has a capital stock of $500,000. There are five stockholders—Albert E. Dattelzweig, Isaac S. Rothschild, Louis M. Cahn, Arthur B. Schaffner and Benjamin V. Beeker. The last four mentioned possess, together, six shares, while the remainder, 4,994, are owned by Mr. Dattelzweig.

A ruling was recently made by the inspector-general of steamboats, whereby carriage on passenger steamers of gasoline automobiles, when the tanks are filled with gasoline, was prohibited. The Jamestown and Newport Ferry company asked for a modification of the ruling, which was refused. The matter was then taken up by George W. Chamberlin, president of the Automobile Club of America, and to his protest the Treasury Department makes reply to the effect that section 4,472 of the Revised Statutes absolutely forbids the carriage of naptha, benzine, etc., under any circumstances, either as freight or stores on passenger steamers, which includes ferry steamers, and, therefore, would prohibit gasoline automobiles when their tanks are supplied with gasoline. It is stated that Congress alone has the power to amend this statute, and it is suggested by the department that those interested should bring the matter before that body at its next session.

PUBLICATIONS.

The Emerson Electric Manufacturing company of St. Louis has issued Bulletin No. 3020, relating to hack saws operated by alternating and direct-current motors.

Catalogue No. 30 of the Paragon Fan and Motor company of 572 First avenue, New York, illustrates

and describes an interesting line of small motors for fan and power purposes.

Circular No. 59 of the Electric Storage Battery company of Philadelphia describes the installation of Chloride batteries in the mill of the R. and H. Simon company, Union Hill, N. J.

"The Five Hundred Volt Lamp; Will the Carbon Filament Ever Become Obsolete?" by F. M. F. Cazin of Hoboken, N. J., is the title of an article in pamphlet form, published for general distribution to the electrical engineering fraternity.

The Sprague Electric company, New York, has issued a bulletin (No. 200) on Lundell motor equipments for printing establishments and book binderies. This company has made a number of very large and fine installations in this line. Bulletin No. 401, on Greenfield flexible steel-armored conductors, is also ready for distribution.

The American Electro-therapeutic association has issued a neat booklet for the use of delegates and visitors to the tenth annual meeting of the association, to be held in New York city, September 25th to 27th. The pamphlet contains the names of the officers, committees and a complete programme of the meeting, including the names of the papers to be read and the topics for discussion.

TELEGRAPH.

Since the American occupation of Cuba much work has been done to bring all the principal cities and towns into telegraphic communication. Lines were badly demoralized or entirely non-existent after the long revolution, but the service is now in excellent shape, considering the difficulties of running lines through tropical forests.

The telegraph instruments on the Brooklyn elevated railroad are being worked by current from the trolley. A tap from a trolley feeder is brought in through a knife switch and the current run through a bank of 16 100-volt lamps in series to ground. In shunt with about the last four of the lamp series is placed the telegraph outfit. A one-half-ampere fuse is put in series with the telegraph circuit.

The postmaster-general has issued a circular to all parties interested, prescribing the rates to be paid by the government for telegraphing during the fiscal year ending June 30, 1901, as follows: For day messages containing not more than 20 words, exclusive of place from and date, 20 cents, not exceeding 1,000 miles, and one cent for each additional word. One-quarter of this rate is to be added for each 500 miles, or fraction thereof, but no rate on a message of 20 words to be more than 40 cents, nor any additional word more than two cents. In cases where the price of a message, calculated as above, shall include a fraction of a cent, such fraction, if less than one-half, is to be disregarded; if one-half or more, it is to be regarded as one cent. Night messages, not exceeding 20 words, exclusive of place from and date, 15 cents for any distance within 2,000 miles, and for greater distances, 25 cents; in each case one cent for each additional word.

POWER TRANSMISSION.

The Twin City Power company has applied for a charter in South Carolina. The principal place of business is to be Parksville, Edgefield County, and the company proposes to develop waterpower on the Savannah River in the counties of Edgefield and Abbeville, and to build electric-light plants. The capital stock is placed at $100,000.

MISCELLANEOUS.

The Castner Electrolytic Alkali company has been formed to buy out the Mathieson Alkali Works at Niagara Falls and enlarge the plant. The Mathieson Alkali plant is now consuming about 2,000 horsepower, and when the contemplated enlargements are made 6,000 horsepower will be used.

The growing importance of the Argentine Republic as a market for electrical goods is apparent from a glance at the import statistics of that country. During the first quarter of 1900 the imports of electrical goods and apparatus, electric-light, telegraph and telephone material amounted to $826,299. United States manufacturers secured a good share of this trade.

The Building Trades Council of Chicago has suspended the Brotherhood of Electrical Mechanics from its membership. The electricians had threatened to withdraw and the action of the council was in anticipation of any such move. The council had attempted to force the electricians to give the electrical conduit work on the Illinois Theater building to the gasfitters' union. The electricians refused and served notice on the council that they would withdraw if interfered with further.

TRADE NEWS.

The Utility Carbon company of Chicago, capital $25,000, has been incorporated by James R. Goodrich, Charles B. Stafford and Adolph Keitel.

C. H. Worcester & Co. manufacturers and wholesale dealers in lumber, cedar poles, etc., have moved their office from Koss, Mich., to Marinette, Wis.

On August 3d George W. Paterson took the exclusive Chicago agency for the Gordon Battery company and removed his office to room 220, 134 Van Buren street.

The Crouse-Hinds Electric company of Syracuse, N. Y., has filed incorporation papers at Albany. The capital is $10,000, and the directors are H. B. Crouse, J. L. Hinds and J. A. Hopper.

The General Incandescent Arc Light company has opened an additional branch office at 57 Perin building, Cincinnati, Ohio, where F. C. Colwell, who has previously handled the Cincinnati business from the Cleveland office, will be in charge in future.

The Diesel heat engine, manufactured by the Diesel Motor company of New York, has been awarded the "Grand Prix" in the class of gas and petroleum motors at the Paris Exposition. The manufacturer says this is the highest award that could have been given, and it shows the important place which the Diesel engine is acknowledged to hold in the field of gas and petroleum motors.

BUSINESS.

The town of Boulder, in the new gold fields of West Australia, was recently equipped by the B. F. Sturtevant company of Boston, Mass., with generating sets for lighting and power purposes and electric motors for operating hoists, etc., in the mines.

The Chicago and Northwestern Railway company announces the establishment of a through sleeping-car line between Chicago and Mason City, Iowa, via its new line from Belle Plaine. Through sleeper leaves Chicago 5:30 p. m. daily, arrives at Mason City 7 a. m. Returning, a sleeper leaves Mason City 8 p. m. and arrives at Chicago 7:42 a. m. daily. A train leaving Chicago 10:30 p. m. daily will have through connections for Mason City daily, except Saturday. The Chicago ticket offices of the Chicago and Northwestern Railway company are at 212 Clark street and Wells street station.

The Treasury Department has awarded to the Otis Elevator company of New York the contract for installing an electric elevator in the main building, at $4,310, and one in the hospital building of the United States immigrant station at Ellis Island, N. Y., at $3,580. The work is to be completed by October 1st.

The Chicago Mica company, whose main office and factory is at Valparaiso, Ind., attributes the increase in sales of its product in the central and western states to the fact that manufacturers and other consumers of insulating materials appreciate being able to deal direct with the manufacturers. The thorough equipment and organization of its factory, together with its fine location, 40 miles from Chicago, on the great trunk lines of railways, are said to enable it to make delivery of its products in less than one-half the time ordinarily required when orders are placed with eastern factories. Micabond products, it is asserted, are fast becoming standard throughout the United States.

The cedar poles for telephone, electric-light and electric-railway work, furnished by W. C. Sterling & Son of Monroe, Mich., are said to be making for them an excellent trade. This firm is a long-established one, and has increased its business each year, until now it ships to all parts of the United States. A very large demand for cedar poles and ties this summer is reported. Sterling & Son have over 200 men at work in their different yars. Their system is a very complete one. They have 11 different sorting yards in Michigan, and their stock when brought in from the woods is sorted in lengths and different size tops, each size in a pile ready for prompt shipment, all culls being taken out and standard poles for city use stocked. Over $50,000 worth of cedar has left their yards in the last two weeks. This firm also operates large shingle, tie, lumber (both hemlock and hardwood), stave and lath mills.

A new soldering flux is now being put upon the market by the Cream Flux company of 100 Washington street, Chicago. The flux is in paste form. The formula is said to be the work of one of the best expert chemists and electricians in Chicago, and has been tested for over a year before being placed upon the market. It is claimed that it is the only absolutely non-corrosive soldering flux, containing no acid or elements injurious to good electrical connections. After an exhaustive test by the electrical department of the National Board of Fire Underwriters, it has been approved. The construction department of the Chicago Edison company has tried the new product and has found that it meets all the claims the manufacturer makes for it. The same management that made Gale's commutator compound a success is managing the Cream flux, and if the results from the commutator compound have any significance, Cream flux will be very widely known and a favorite soldering flux in the electrical trade. "I have thoroughly investigated the merits of all soldering salts, soldering sticks and pastes on the market," stated M. J. Isaacs, manager of the company, "and find it to be a fact that there is now not a single absolutely non-corrosive soldering flux other than our Cream flux before the electrical trades. Its great feature over all others is its easy application, its efficiency and its cheapness. It is an actual fact that wiremen can make more than double the number of perfect connections in one-half the time with Cream flux, than with the same amount of any other flux or salt. It is always ready for use, and it is not affected by climatic conditions."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 7, 1900.

655,176. Electric Arc Lamp. Johann F. Ackermann, New York, N. Y. Application filed October 20, 1899.

In an arc lamp, a negative pole member and a positive pole member, one of which is recessed at one end and the other pointed at one end and chambered longitudinally, an ejector communicating with the chamber, a fuel receptacle arranged to communicate with the ejector, a source of compressed-air supply communicating with the ejector, and devices for regulating the feed of the fuel to the ejector as shown. (See cut on next page.)

655,216. Switch for Suspended Electric Conductors. John Floyd, Washington, D. C. Application filed December 8, 1899.

The switch comprises a single piece of wire, having arms extending integral therewith, the wire bent upwardly in a loop, the arms having a twist in the center of the loop and extending obliquely.

655,217. Crossing for Suspended Electrical Conductors. John Floyd, Washington, D. C. Application filed December 8, 1899.

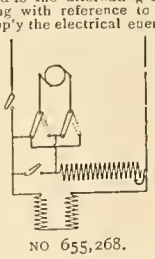
Two suspended electrical conductors, each being bent in a double arch at the point of interception, the inner portion of the arches forming a lug.

655,219. System of Electrical Distribution. Emmerich E. Frischmuth, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed October 2, 1899.

The combination with a conducting wire, of a swinging supporting means therefor, and a weight attached to one end of the wire,

655,237. Apparatus for Transforming Alternating Currents into Continuous Currents and Vice Versa. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed April 28, 1899.

An apparatus for transformiog monophase alternating currents into continuous currents comprising magnetic cores, secondary windings thereon for supplying the continuous-current leads, a primary circuit on one of the cores, connected to the alternating current leads and an inductor moving with reference to the other core, and arranged to supply the electrical energy of transformation.



NO 655,268.

655,238. Process of Transforming Alternating Currents into Continuous Currents and Vice Versa. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Société Anonyme pour la Transmission de la Force par l'Electricité, Paris, France. Original application filed April 28, 1899. Divided and this application filed May 29, 1900.

The process of transforming alternating currents flowing along alternating-current mains into continuous current flowing along continuous-current mains which consists in charging an inductor from the continuous-current main and rotating the inductor with reference to a magnetic core carrying secondary windings and thereby supplying thereto either part of the energy of transformation.

655,239. Process of Bleaching by Electrolytic Chlorin Water. Thomas Jespersen, Neenah, Wis. Application filed May 29, 1899.

The process consists of electrolyzing a dilute watery solution of hydrochloric acid, allowing the chlorine gas liberated at the immersed anode to dissolve in the water of the watery solution, bleaching with the resulting chlorine water and by the act of bleaching restoring hydrochloric acid to the solution and again electrolyzing as before, all of the processes being performed simultaneously and continuously in the same tank or container.

655,249. Telegraphic Typewriter. Reinhold Kübler, Berlin, Germany. Application filed August 29, 1898.

A telegraphic typewriter having a keyboard with alternating contact and breaking fields or surfaces, the keyboard forming one pole of an electric circuit, and a pointer forming the other pole and adapted to be passed along the keyboard, a rotary longitudinally movable type wheel and a series of actuating electromagnets and line wire and local conductors and means for energizing the type-wheel adjusting magnet when the pointer is passed over the keyboard, means for energizing the printing magnet when the pointer is on the last field or strip and means for energizing the wheel sliding magnet when the pointer is placed first on a conducting (in contradistinction to a non-conducting) strip of the keyboard.

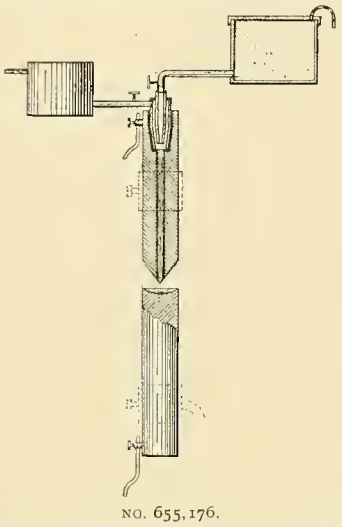
655,265. Electric Cable. George H. Nisbett, Huy-

ton, England. Application filed December 28, 1897.

In an electric cable, the combination with the outer strengthening and insulating layers and the inner conductor, of an interposed separating coil of substantially triangular cross section.

655,268. Electric Motor. Ernst G. P. Oelschläger, Charlottenburg, and Carl O. F. Schrottke, Berlin, Germany, assignors to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed December 27, 1897.

The combination with a main circuit, of a motor, means for connecting it in circuit with and disconnecting it from the circuit, a pole-changing switch having suitable connections for reversing the polarity of the motor, the motor having a field winding in shunt of the armature thereof, starting resistance, a parallel path about the field winding, and means for closing the same through the starting resistance when the motor is to be cut out of circuit, whereby injurious sparking is avoided. (See cut on page 111.)



NO. 655,176.

655,276. Measuring Instrument. Franz Schrottke, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed November 18, 1899.

The combination with a polyphase system of electrical distribution, of a wattmeter having motive windings comprising series and two sets of pressure coils, a pressure coil of one set being connected in parallel with a pressure coil of the other set, one terminal of each of the remaining pressure coils of each set being connected to the conductor in which the series coil of the other set is included, the other terminal being connected to one of the remaining conductors of the system.

655,317. Electric Temperature Indicator. Leslie S. Wilder, Springfield, Mass. Application filed November 18, 1899.

In an electric temperature indicator, the combination with a hollow base provided with a cross-support, a thermostat disk thereon, a plate secured on the top of the base comprising a binding post and upstanding earpieces, an upright plate supported on the base suitably distant from the binding-post plate, and having a recess, a lever rod pivoted in the earpieces and projected through the recess, a thrust rod between and in bearing on the thermostat disk and the lever, the circuit-conductors, a generator and an alarm device.

655,335. Motor Starter. Ethelbert M. Fraser, San Francisco, Cal., assignor to the Otis Elevator company of New Jersey. Application filed March 11, 1899.

The combination with an electric motor and its circuit, of a resistance placed in the motor circuit, a shunt circuit and operating switch therefor, a solenoid forming part of the shunt circuit and energized thereby, another solenoid having a heavy wire coil in series with the resistance and the armature of the motor and the lighter wire coil in shunt across the line, a plunger moved by the first solenoid, a contact maker carried by the plunger and arranged, when moved, to close the motor circuit with the resistance and heavy coil of the other solenoid remaining therein, a plunger in the other solenoid moved by its lighter coil when receiving the electric current from the first solenoid upon the rise of its plunger, and a contact maker raised by the other plunger and operating to cut out the resistance and heavy wire coil from the circuit of the motor.

655,336. Controller. Ethelbert M. Fraser, San Francisco, Cal., assignor to the Otis Elevator company of New Jersey. Application filed July 20, 1899.

The combination with one or more contact blocks and one or more spring-actuated switches, of a spring-actuated counteracting device of a force superior to the switch springs, and means for preventing the operation of the switch or switches before the counteracting device.

655,340. Starting Device for Electric Motors. Johannes H. F. Görges, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed December 31, 1897.

In an alternating-current motor, the combination with a field portion, of an armature therefor having a multiphase winding comprising a plurality of divisions for each phase, and means for changing the connections of the divisions to vary the effective electromotive force.

655,341. System of Alternating-current Transmission. Johannes H. F. Görges, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed October 11, 1899.

The combination with a source of alternating current, of a motor having a plurality of energizing windings, a Wheatstone bridge for effecting the phase adjustment of the energizing windings and a secondary circuit in inductive relation with a winding of the Wheatstone bridge and including a condenser.

655,344. Cathode for Use in Electrolytic Cells. James Hargreaves, Widnes, England. Original application filed January 31, 1899. Divided and this application filed October 2, 1899.

In an electrolytic cell, the combination with a porous diaphragm of a woven-wire cathode having the prominent parts of its surface, where the wires cross one another, flattened.

655,353. Meter. Carl O. F. Schrottke, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed December 27, 1897.

In an alternating-current meter, the combination with an annulus of magnetic material, of two shunt coils placed at opposite points of the annulus, a closed coil wound about the annulus nearer to one of the shunt coils than the other, a series winding, an armature subjected to the action of the fields created by the series and shunt windings, and a measuring train actuated by the armature.

655,368. Electrical Battery. Charles E. O'Keenan, Paris, France. Application filed December 30, 1897.

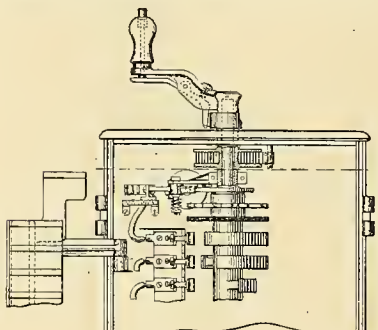
In a battery cell, the combination with a tin casing, of a negative electrode contained therein, consisting of a spongy lead plate, two zinc plates constituting the positive electrodes and in contact with the inner face of the casing, insulating blocks fitted into the ends of the cell and grooved to allow the independent insertion and withdrawal of the plates, while keeping them apart from each other, electric circuit connections to the plates and an excitant for the plates within the casing.

655,389. Safety Device for Electric Vehicles. Frank E. Case, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed May 20, 1899.

In combination, a controller for electric circuits, an operating handle therefor, a circuit-opening device, and means operating independently of the controller, upon the release of the handle, for opening the circuit-opening device. (See cut.)

655,406. Electric Sparker for Gasoline Engines. John G. MacPherson, Philadelphia, Pa., assignor to the MacPherson Automobile company of New Jersey. Application filed November 22, 1899.

In combination with a gasoline and gas engine, of a sparker therefor, comprising an insulator mounted in the end of a gas-supply chamber, a cylindrical conductor fitting in the insulator, a circular disk carried upon the inner end of the conductor, a sleeve mounted in the head of the explosion chamber, a shaft mounted in the sleeve, a spring arm carried by and at right angles to the inner end of the shaft, the free end of the spring arm extending into the gas-supply chamber, a plate carried by the free end of the arm in position to have its face contact with the edge of the disk upon the conductor, and a spring tending to separate the disk and plate, and a cam for bringing them together provided with means to release the spring to disengage the disk and plate to make a spark.



NO 655 389

655,411. Electrical Detector for Heat or Cold. Jeremiah O'Meara, New York, N. Y. Application filed May 12, 1899.

In an electrical apparatus for detecting abnormal temperatures, the combination of an atmospherically sensitive wire or support, a weight suspended from the wire or support and carrying contact points, a holder containing electrically conductive material forming the terminals of an electric circuit, stationary adjustable contacts in the circuit, a stationary support for the holder, and a movable support for the holder adjustably connected to the weight, the wire or support, contact points and movable support for the holder capable of relative adjustment whereby the apparatus may be set either for the detection of abnormal heat or for the detection of abnormal cold.

655,412. Circuit Closer. Jeremiah O'Meara, New York, N. Y. Application filed May 20, 1899.

In an apparatus for detecting abnormal temperatures, the combination of an atmospherically sensitive wire or support adapted to be slackened and tightened, a movable contact carrier suspended therefrom, stationary contacts arranged in proximity to the contacts of the carrier, and an adjustable connection between the contact carrier and the sensitive wire or support to compensate for the slackening or tightening of the wire or support according to the setting of the apparatus either for the detection of abnormal heat or for the detection of abnormal cold.

655,427. Burglar or Fire Alarm. Franklin D. Wallace, Wheatland, Ind. Application filed October 20, 1899.

As an article of manufacture, a casing, a movable terminal mounted therein, a co-operating terminal carried by the casing, a head carried by the movable terminal, the head being adapted to be acted upon and moved with relation to the co-operating terminal by means of a finger forced into engagement therewith, and means carried by the casing for supporting a fusible bar in position to engage a portion of the head.

655,433. Magnetic Separator. Charles F. Courtney and Robert Butterworth, Broken Hill, New South Wales. Application filed March 19, 1900.

A magnetic separator, comprising two cores, energizing coils for the cores, a rotary separating drum supported between the inner ends of the cores and having a series of longitudinal spaced pole pieces connected alternately with the inner ends of the cores, the pole pieces being tapered from those ends which are connected with the cores toward their free ends, the surface of the non-magnetic drum being exposed between the pole pieces, and means for feeding the material to the drum.

655,455. Electric Railway. William B. Purvis, Philadelphia, Pa. Application filed April 24, 1900.

In an electric-railway system, a closed conduit containing a flexible main feeder, a third rail electrically connected with terminals situated within the conduit and adapted for contact with the main feeder, the covering for the conduit and the material of the conduit situated above the main feeder being composed of non-magnetic material.

655,476. Electric Lock. Henry G. Carleton, New York, N. Y., assignor to the Carleton Electric company, New York, N. Y. Application filed November 28, 1899.

In a lock, the combination with one of the engaging parts, of a controller normally locking the part against movement, mechanical means operating in the first instance to move the controller from its locking position, electrical means for thereafter holding it out of locking position, and devices for actuating the part.

655,491. Electrically Driven Machine. Theodore H. Joseph and James J. Ehrenreich, New York, N. Y. Application filed January 27, 1899.

The combination with a machine to be driven by a motor, of a brake for the motor, a rheostat for regulating the current of the motor, a starting pedal connected up with both the brake and the rheostat, and a retractile spring for returning the pedal, rheostat and brake to their normal phases, and means for causing the brake to be non-active, permanently, the means consisting of a rod adjustable in length forming a connecting rod between the brake and the rheostat.

655,526. Electric Arc Lamp. Thomas Spencer, Philadelphia, Pa., assignor to the Helios-Upton company, Philadelphia, Pa. Application filed May 14, 1900.

In an electric arc lamp, the combination with a regulating solenoid, of a carbon holder, a dash-pot operatively related to the solenoid, and means arranged to prevent the braking action of the dash-pot during the normal movement of the carbon holder, and to automatically secure the braking action of the dash-pot by sudden movement of the carbon holder.

655,562. Brake for Electric Motors. Charles A. Lindstrom, Chicago, Ill., assignor to the Hewitt-Lindstrom Motor company, Chicago, Ill. Application filed May 5, 1899.

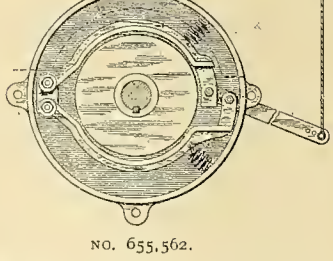
The combination with an armature shaft, a case inclosing it, and a dished head closing one end thereof, of a friction wheel secured to the shaft and inclosed within the circumference of the head, two braking arms having their adjacent ends pivoted at fixed points to the inner surface of the case at one side of the wheel around which they extend in opposite directions to an extent slightly greater than one-half of the circumference of the wheel, radially arranged contraction springs for normally keeping the arms out of contact with the wheel, and a suitable lever, one end of which extends through a suitable slot in the circumference of the head and is pivotally connected to the movable ends of both of the braking arms. (See cut.)

655,563. Electric Carriage. Charles A. Lindstrom, Chicago, Ill., assignor to the Hewitt-Lindstrom Motor company, Chicago, Ill. Application filed March 3, 1900.

The combination of a battery, a pair of electrical motors having their fields connected in multiple and their armatures connected in series, and electrical connections between the motors and the battery; with a switch interposed in the circuit between the motors, whereby the speed of the motors may be changed by varying the electromotive force from the battery while maintaining the motor fields always in multiple and the motor armatures always in series.

655,620. Telephonic Apparatus. Alfred Graham, London, England. Application filed October 17, 1898.

Telephonic apparatus comprising a microphone transmitter inclosed in a movable water-tight casing provided with a thin flexible wall or diaphragm, a receiver having its diaphragm held in a horizontally arranged holder provided with a downwardly and forwardly projecting tubular extension, and a switch arranged to be moved by the transmitter and to control the circuits of the transmitter and receiver.



NO. 655,562.

655,651. Multiplex Telephony. Ernest A. Faller, San Francisco, Cal., assignor of one-half to James W. Chisholm, San Francisco, Cal. Application filed April 27, 1900.

A system of multiplex transmission of speech over a single line comprising instruments at the different stations adjustable as to their ability to send and select voice currents, controlling means at the different stations for effecting the adjustment of the instruments in pairs and selecting means for actuating the controlling means.

655,671. Electric Conductor for Exercising Apparatus. Alfred M. Crooker and Frank N. McDonald, Boston, Mass., assignors to the Galvanic Health Exercising company of South Dakota. Application filed March 10, 1900.

The combination with a galvanic battery, of an exercising device consisting of the elastic and distensible insulated conduits, having the distensible conductors therein, the distensible conductors being connected with the rigid conductors.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, AUGUST 25, 1900. No. 8

Electrically Operated Steel and Iron Foundry.

There is probably no place where the advantages of electric transmission of power are more apparent than in a foundry, but as yet the number of electrically driven foundries is not very great and the new foundry of the Sargent company at Chicago Heights, Ill., is of interest as being among the first to adopt electric power transmission throughout. The Sargent company, which, for a number of years, has had a foundry at Fifty-ninth and Wallace streets, Chicago, recently built, in addition to this plant, an iron and steel foundry at Chicago Heights, 27 miles from Chicago. The company has always been a progressive one, and when the new foundries were built, electrical transmission was used throughout. The plant in reality consists of two distinct foundries, one for iron and one for steel, each having excellent railroad-siding facilities for handling both the incoming pig-iron and fuel and the outgoing finished product. As can be seen from the general view of the plant, Fig. 4, on the next page, the power plant is an entirely separate building and is located at the extreme left of the picture. A railroad switch runs around to the rear of the power plant for the delivery of coal in front of the boilers. Another siding runs to the rear of the foundry, between the power house and foundry, for taking away the finished castings, while tracks run in between the two foundries for the delivery of iron, coke and sand. There is also a commodious yard in front of the foundries, shown at the right of Fig. 4, where railroad cars can be stored and push cars run alongside of them, into which they can be unloaded.

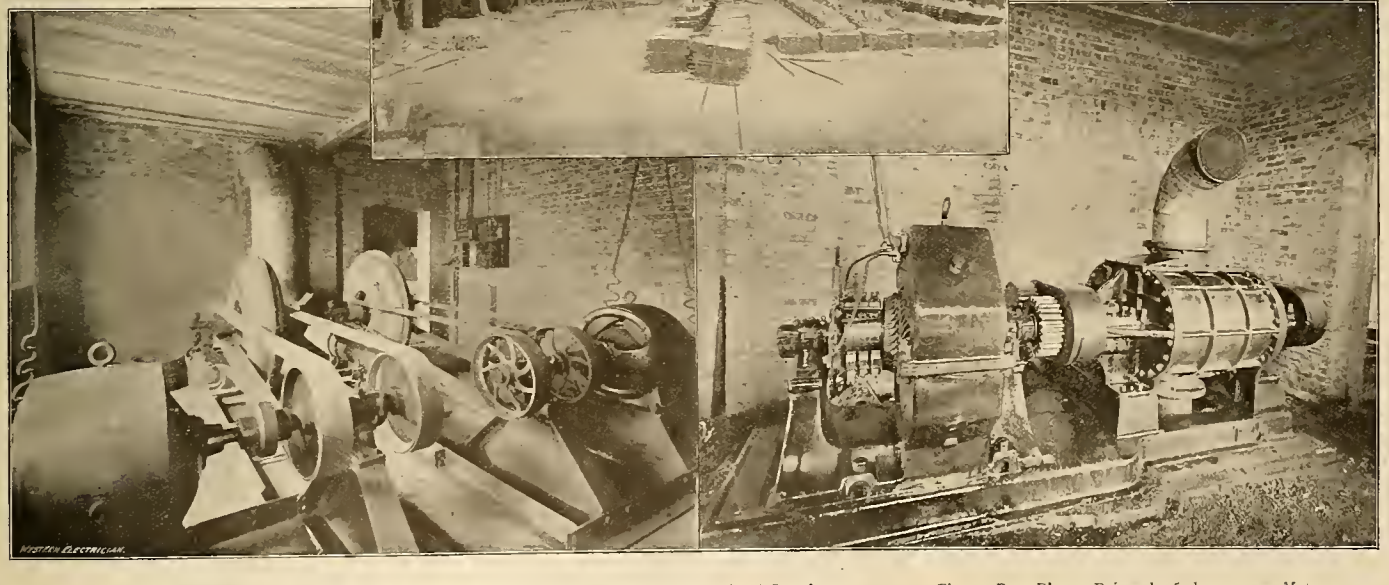


Fig. 1. Two 30-horsepower Motors Driving Cupola Blowers.

Fig. 3. View in Steel Foundry.

Fig. 2. Root Blower Driven by 63-horsepower Motor.

ELECTRICALLY OPERATED STEEL AND IRON FOUNDRY.

The power house is a roomy brick structure, having plenty of room for the enlargement of its capacity without altering the building. Fig. 5 is the interior of the engine room showing the 150-kilowatt Western Electric generator now installed belted to an Allis-Corliss engine running 93 revolutions a minute. The generator is a six-pole machine, compound-wound. There is also an air compressor in the engine room. The generator is a 220-volt machine, and the whole plant is wired on the 220-volt, two-wire system. The 220-volt incandescent lamps seem to be giving good satisfaction. The feeder circuits to the foundries are controlled at the switchboard, each by a double-pole knife switch. At present there are two of these feeder circuits, two for motor circuits, and one for lights. From the switchboard the feeders run underground in lead-covered cables to the distribution boxes in the foundry. The two power circuits are 350,000 circular mils and the light circuit is 175,000 circular mils. Each of the two power circuits is led to a cut-out box, from which are supplied three power circuits, each with a capacity of 250 amperes. The cut-out boxes are supplied with double-pole knife switches for each circuit. The lighting is done very largely by open-arc lamps, of which there are 12 in series of four each.

Proceeding from the cut-out boxes to the nearest motors, the first motor found is a 7½-horsepower, driving a Buffalo fan for drawing dust from the rattlers, so as to keep the air in the cleaning room of the foundry reasonably pure. In the iron-foundry end of the cleaning room a 50-horsepower motor drives three rattlers and three emery-wheel stands, each stand having two 18-inch wheels, running about 1,500 revolutions a minute. In the steel-foundry end of the cleaning room a 50-horsepower motor drives similar machinery. All the motors in this plant, except those for the cranes and the Root blower mentioned later, are of the Milwaukee Electric company's make. Cutler-Hammer rheostats are used. In the machine shop a 10-horsepower motor has been put in to run a large planer, shaper, drill press, lathe and cold saw, by means of shafting.

The motors and blowers for the cupolas in both foundries are installed practically in duplicate; that is, the air piping is so arranged that either fan can be turned on to the work. Fig. 1 shows two 30-horsepower motors, for driving the two No. 7 Sturtevant fans, which supply the cupolas in the steel foundry. Each fan is belted to its motor by two belts and the interchangeable arrangement of piping just mentioned is employed for the purpose of guarding against the breakdown of any one fan or motor. In the iron foundry a similar arrangement of fans is installed, but the two motors are each of 50 horsepower and are belted to No. 11 Sturtevant fans. In the steel foundry it is necessary to grind some of the sand used, and a machine for this purpose is operated by a 22-horsepower motor.

The largest motor in the Sargent plant is a 63-horsepower Western Electric machine, driving a Root blower, for supplying air under a pressure of four pounds to the square inch to the steel converters. The motor makes 475 revolutions a minute. This motor, geared to the Root blower, is shown in Fig. 2. In Fig. 3 is shown a general view of the steel foundry, with the row of converters and a cupola at the left. The blast from the Root blower was on one of the converters at the time the photograph was taken. In making steel castings the pig-iron is first melted in the elevated cupola seen at the left. Then it is run, by a trough, into one of the converters and air is blown through the iron until the carbon is burned out. The iron is then poured into the big ladle, swung from one of the two 30,000-pound Shaw Electric Crane company's cranes seen in Fig. 3, and is run to whatever part of the floor it is wanted to be poured into the molds. The tipping of a converter to pour it, after a blast, is done by hydraulic power, controlled from an elevated platform, and on this same platform is the starting box for the Root-blower motor. As the output of air from a Root blower at constant speed is nearly constant, and the amount of air needed on a converter is variable, there is a by-pass provided in the Root-blower exhaust, that can be opened more or less to regulate the amount going to the converter.

The Shaw cranes, seen in Fig. 3, have a capacity of 30,000 pounds, and are equipped with four motors each, one for the movement of the crane on its tracks from one end of the foundry to the other, one for the movement of the trolley across the bridge, one for the main hoist, which lifts heavy weights at slow speeds, and the other for an

auxiliary hoist, which lifts light weights at high speeds.

As stated in the beginning of this article, there is no place where electric transmission of power is more applicable than in a well-arranged foundry of this kind. The arrangement of the foundry, for the most convenient and economical handling of materials, as here, necessitates the scattering about the plant of the apparatus requiring power in a way that would call for hundreds of feet of line shaft. The labor required to keep the necessary amount of shafting oiled and in running order in the Sargent foundry, if shaft transmission were used, would be an important item as compared to the small attention required by the electric motors, and the

FIG. 4. ELECTRICALLY OPERATED STEEL AND IRON FOUNDRY.—BUILDINGS OF SARGENT & CO.'S PLANT

power wasted by constantly running the shafting would pay interest on the cost of several electrical equipments. In this foundry the fans and blowers, which require the most power, are the most distant from the engine room of any of the power-consuming apparatus. The electrical installation in the plant was put in by the Sargent company, under the supervision of J. Cork, to whom the Western Electrician is indebted for the courtesies which made possible the preparation of this article.

Aside from the fact that this foundry is electrically equipped, the steel foundry is of especial interest to electrical men, because it was built with the idea of catering very largely to the wants of electrical manufacturers, in the way of steel castings suitable for field-magnet frames. The process is one which is used very extensively abroad, and is the invention of Alexandre Tropenas of Paris. It is claimed that by this process the steel castings produced approach in purity and magnetic qualities the best Swedish iron, and the castings are also very uniform in quality. In fact, the company will guarantee a permeability equal to the best Swedish iron. The Sargent company has the patent rights for the process for Chicago and vicinity. The total impurities in the castings amount to only 0.35 of one per cent., of which 0.1 is carbon.

The converter used with the Tropenas process is unlike a Bessemer converter in that the tuyeres for the admission of the air blast are not placed at the bottom, but at the sides. There are two sets of tuyeres, one above the other. The bottom of the converter is conical. The air forced into the upper set of tuyeres aids in the combustion of the gases which are set free by the action of the air forced in at the lower set. In this way and by working at four pounds pressure on the air blast, a high temperature is reached, and the fluidity of the steel is remarkable, considering the fact that most of the impurities have been burned out of it. An iron high in silicon is selected for this process. The high temperature and fluidity of the steel at the time of pouring is, of course, the element of the process that makes possible the successful pouring and casting of such a soft metal. Tests, by Professor J. A. Ewing, on samples of this steel made by the Tropenas process in England show excellent magnetic results. These castings are so soft that they can be welded to each other or to wrought-iron or welding-bar steel, a fact which speaks for itself as to softness of the castings.

New York Street Railway Association.

The eighteenth annual convention of the Street Railway association of the state of New York will be held in Buffalo on September 18th and 19th, instead of September 11th and 12th, as has been previously announced. The change was made necessary to secure adequate hotel accommodations. Owing to a number of conventions to be held at Buffalo during the week commencing September 10th, the hotels will be overcrowded upon the original dates named. G. T. Rogers of Binghamton is president of the association, and Henry A. Robinson of New York city is secretary and treasurer.

Evanston Heating and Lighting Plant.

The Evanston Yaryan company, which recently secured a franchise at Evanston, Ill., for a hot-water heating and electric-light plant, expects to have its system in operation by the latter part of September. The installation that is being put in is what is known as the Yaryan system, by which electric light is furnished from a central station from which also run hot-water mains for residence and other heating purposes.

The power house is being erected on Grove street, according to plans by the architects, Hunt & Co. It will contain two 500-horsepower Sterling boilers and two four-valve Russell engines. One of the engines, of 220 horsepower, will be directly connected to a 150-kilowatt Western Electric 220-volt, direct-current generator, while the other, a 125-horsepower engine, will drive a 75-kilowatt Siemens & Halske generator. The plant will have provision for an increase of 200 per cent. The building and construction is of the best material, and everything in connection with the plant will be of the best workmanship. The contractors for the underground work and all the electrical equipment and construction outside of the generators are J. A. Erner & Co. of Columbus, Ohio. The engineer in charge of the work for Erner & Co. is C. D. Jones of the department of electrical engineering of the University of Michigan. H. H. Dickinson is assistant engineer on the work.

The Edison three-wire system is to be used, 110-volt lamps being used with a compensator. Work on laying the conduits was begun July 7th, and nearly all of the 60,000 feet to be laid is now in position. McRoy vitrified-clay duct is used. The conduit work has been very difficult, on account of the water levels. The depth of the manholes is seven feet six inches, and in general water and quicksand are reached at about five or six feet below the surface. Standard underground paper-insulated cables are used. The feeders are 400,000 circular mils in size, one conductor being laid in each duct. The mains run up to No. 0000 in size and are laid three wires in one cable.

The Evanston Yaryan company is said to be meeting with splendid success in placing yearly contracts to supply hot water and electric light. Its charges for electric light, by meter, it is announced, will not exceed 50 per cent. of rates heretofore charged in the city.

Systems and Efficiency of Electric Transmission in Factories and Mills.[1]

By William S Aldrich.

As applied to factories and mills, electricity is simply a means to an end, which is primarily the transmission of power over quite short distances, from 50 to 500 feet, and within one building or a group of buildings. In almost all cases of new manufacturing plants, however, the features of electric transmission have received thorough consideration, resulting in many factory installations in which this system is exclusively used.

There are many factories and mills in which the introduction of electricity for power transmission will not pay, under existing conditions; there are more establishments in which it would pay, in which an investment in electric transmission would prove to be a dividend-paying investment. No general rules can be laid down. Each case must be carefully examined, and a most thorough preliminary survey made of all the conditions and requirements.

Each year more and more machinery is thrown into the scrap heap to make room for new and improved types, yet antiquated and costly methods of transmitting power are left in service. Modern methods of workshop production, in which machine tools are worked up to the power limit, are seen to be sought after, side by side with belted transmission of power, which makes it quite impossible to realize fully the value of the new method, by not giving the operator the utmost freedom of speed control of machine and tool. Electric-motor drives provide suitable and quickly adjusted speed ranges under all of the ordinary starting loads of workshop appliances. This has resulted in increasing the output from 10 to 80 per cent., compared with the old and fixed speed conditions with belts and gears.

This method of transmission results in a saving of from 20 to 30 per cent. of the power required by the old method. The electric motor is in operation and consuming energy only when needed. It is ready for instant service under any change of conditions of speed or power required by the work. It will meet easily 50 per cent. overload. It admits of readiest expansion of workshop facilities, and machines so driven may be placed anywhere to best advantage.

The system of electric transmission for a manufacturing establishment is the only one which admits of economically centralizing the so-called "mechanical plant" supplying light, heat and power. It is a great advantage to be able to locate the power house near coal and water supplies. In some cases it thereby allows the use of condensing engines, instead of non-condensing. By adopting electric transmission the engine may be located at any convenient distance from the machines. Shafting transmission imperatively requires that it be located as near as possible.

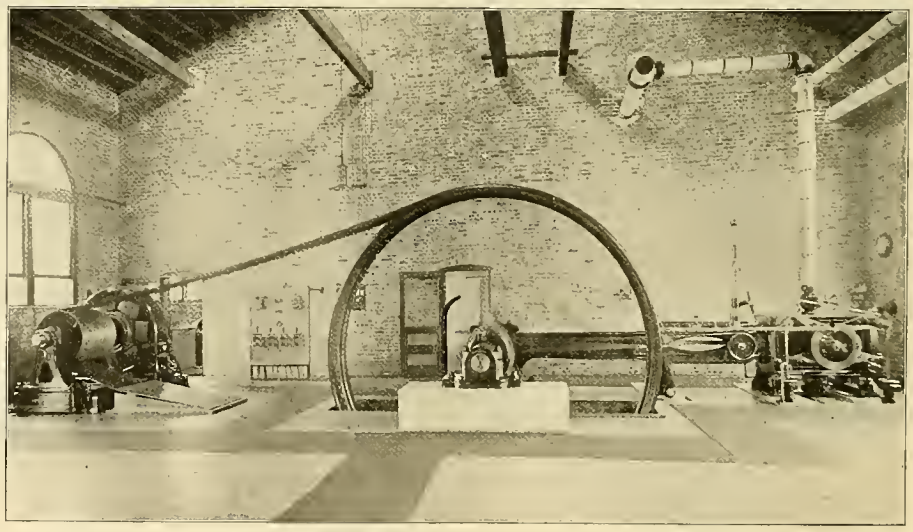


FIG. 5. ELECTRICALLY OPERATED STEEL AND IRON FOUNDRY.—ENGINE ROOM.

In some cases it may be found necessary or desirable to have a mixed system of steam and electric distribution, but it can be obviated, with increased economy, by judicious installation. The use of small steam engines about an establishment, for any purpose whatever, is to be deprecated. The maximum economy to-day is to be obtained by centralized power generation. Electric transmission is equally adapted for all of the so-called auxiliary machinery of a manufacturing establishment, the non-productive machinery, pumps, compressors, fans, blowers, cranes, hoists, lifts, etc.

The introduction of electric transmission has been greatly facilitated by the recent standardization of electrical machinery, and especially that required for power purposes. As made to-day, electrical machinery requires the simplest moving parts and the fewest repairs and renewals. Many motors have been in constant service for over six months and

1 Abstract of paper read before the American Society of Mechanical Engineers at Cincinnati, O., May, 1900.

have required only a supply of oil. Others have been in service for years, with renewals of brushes only required.

It has usually been the custom to compare the relative efficiencies of mechanical and electrical transmission without any reference to the loads, or to the proportional part of the full load on the system. It is well known that almost all examples of mechanical friction, as in steam engines, shafting, etc., show that the power lost in friction is practically constant, within all ordinary ranges of loads and at uniform speeds. The efficiency of any mechanical system, as an engine driving shafting, rapidly falls off below full load. This is shown in Fig. 1. The engine is assumed to be about 275 horsepower, and to have a mechanical efficiency at full load of about 90 per cent. The curves for the several classes of machinery (A), (B), (C), (D), (E), (F), show similar falling off of the mechanical efficiency of power transmission by shafting. The resulting or combined efficiency of an engine driving heavy machinery is shown in curve (M). It is to be especially noted what little power there is left for useful work at light loads. At a load of 55 per cent. of the full load there is nothing left for work, all power being consumed in overcoming the combined friction of the engine and transmission machinery.

The transformations of energy in the electric system from steam power into electric, thence to mechanical power, are accompanied with inherent losses. Electric motors have the characteristic feature of high maintained efficiencies at part load.

It is not so much a question of what the friction horsepower (or its per cent. of the total) may be at any load, such as the normal, as it is a question of how the total or combined efficiency of the system is going to vary with the load. The best performance of the mechanical system of transmission by shafting and belts is at full load. The best performance of the electric system may be maintained from 75 per cent. to 125 per cent. of the full load—from three-quarter load to 25 per cent. overload.

These differences become more vital when it is borne in mind that very few factories and mills are operated at full load all day. For machine-shop practice, for instance, an average of about half time for the actual work would be rather liberal. In many shops several machine tools will not be worked much more than one-third of the time. The losses at these light loads are exceedingly expensive for the mechanical system of transmission, but scarcely require consideration in the electric system. In fact, by proper selection of dynamo and motors, a combined efficiency at half load may be maintained equal to that at full load. The all-day efficiency of the electric system may thus be made very high.

In choosing a system of electric transmission for manufacturing work, it is not necessarily best to have that one system which will the most readily lend itself to all of the work to be performed, for light, heat and power service. A composite system may prove best suited, even in such short-

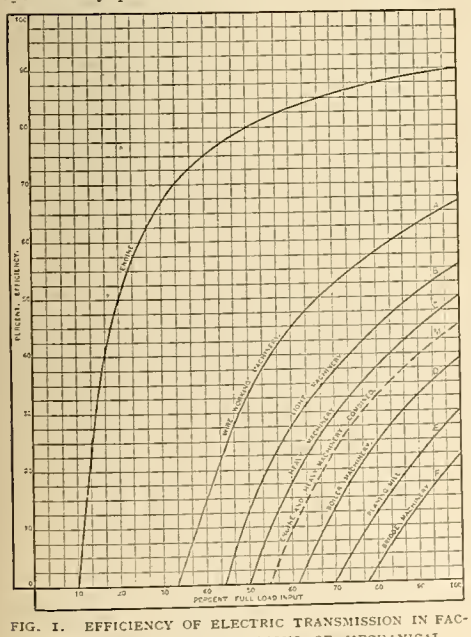


FIG. 1. EFFICIENCY OF ELECTRIC TRANSMISSION IN FACTORIES AND MILLS—VARIATIONS OF MECHANICAL EFFICIENCY OF ENGINE AND SHAFTING TRANSMISSION.

distance transmission. Direct and alternating currents are equally adapted for factory transmission, and by simple or multi-circuit systems of distribution; that is, by two, three, or four-wire systems, as the case may require. Preferably, all distribution should be without the use of storage batteries, rotary converters or transformers, except for certain lines of work in which it may be necessary to use one or the other of these indirect systems of distribution.

In general, it will not be necessary nor advisable to use over 550 volts, direct or alternating current. Shocks arising from accidental contact with wires carrying currents of this voltage are not necessarily dangerous. Experience has shown that workmen respect the distributing wires the higher the voltage. But it is not necessary to command such respect by raising it above 550 volts.

At the time that electricity was introduced into manufacturing establishments the direct-current system was the only one available. For the peculiar and exacting service required in driving all kinds of machine tools and various workshop appliances, there were difficulties to be overcome with any system. It was necessary to secure satisfactory methods of producing a large starting turning moment, or torque, for varying the speeds as might be required under uniform or variable loads, and for reducing to a minimum the trouble arising from the use of a commutator.

With direct-current motors, it was a simple matter to introduce starting boxes (resistances) in the armature circuit to control the torque, as well as rheostats (resistances) in the fields to control the speed in particular. But every such resistance meant an expenditure of energy in otherwise useless heating of the wire or other material of which these resistances might be made.

The difficulties with commutators have been almost entirely overcome, and many refinements in design effected, so that the direct-current motor of to-day leaves little to be desired. Such objectionable features as still remain are inherent in the direct-current system used, and are found to lie chiefly in the kind of armature, commutator and brush devices required. These parts are most liable to derangement, require systematic attention for cleanliness and efficiency and renewal of brushes. Somehow, workmen expect an electric motor to take care of itself, at least they treat it on this assumption. If a motor were sure of the daily care and inspection formerly bestowed upon shafting and belting, it would have made a much better record earlier in its history.

The induction machine, as it stands to-day, is probably the most perfect motor yet developed from the standpoint of electric transmission in factories and mills. It may be started and operated from any point, at any time, at practically any load and speed within its predetermined ranges. It may be used on 110, 220, 440 or 550-volt, alternating-current circuits of one, two or three phases. It does not require any direct-current supply as the synchronous motor does for its field excitation. It does not require any brushes, commutator or collecting rings. Offsetting these advantages, however, are certain restrictions. The speed of an induction motor falls off slightly as the load is increased. The ability to start an induction motor from rest under a heavy load, as well as the possible speed changes during its operations, is obtained at some sacrifice of efficiency.

Induction motors, moreover, permit of higher lineal speeds than are possible with any other type, from 6,000 to 7,000 feet not being infrequent. By suitable arrangements of its field windings, this type of motor may have its speed altered in regular steps, so reducing it one-half, one-quarter, one-eighth, etc. This makes possible similar changes to gear-wheel combinations, which may therefore be eliminated to the extent that the induction motor is installed to effect such changes. In almost all cases of shop driving, the slip is not objectionable any more than the increasing slip of the driving belt as the load is thrown on. These motors will stand almost any amount of rough usage and heavy overloads, as they cannot be burned out. If excessively overloaded, the motor slows down and stops, starting up immediately as soon as the load is lightened. Ordinarily, machine tools and almost all classes of shop machinery are started at quite light loads, and the full load is thrown on when the work of the tool is up to the speed desired. For this class of work the induction motor seems specially fitted.

Synchronous motors are admirably adapted to factory service where absolute uniformity of speed is required, and where the extra installation of a direct-current supply for their field excitation is not deemed objectionable. While induction motors are always wasteful of some energy, through their high self-induction, synchronous motors may, on the other hand, be brought into that condition of operation practically equivalent to the use of direct-current motors, at least for a large range of their loads. In other words, the power factor of a synchronous motor may be made almost anything from zero to unity, according to the extent of excitation of its fields by the direct current applied for this purpose.

When made in the revolving-field type, synchronous motors are self-starting from rest, at light loads. They may be very heavily overloaded, without falling out of synchronism or out of step, and when they do for an instant, they may be brought back again by throwing off some of the load. A well-designed synchronous motor will carry at least three times its full normal load, and not drop out of step. If an induction motor is built for such overloads, it is likely to have quite low efficiency at ordinary loads.

The more nearly the power factor approaches unity, the more nearly the conditions are realized which are found in direct-current motors. The generating plant may thus be much reduced in size, compared to that required for motors with low-power factors. In fact, the power plant need not be larger than ordinarily installed for direct-current working, where the synchronous motors are properly designed, installed and operated under the best conditions.

Higher efficiencies may be obtained with synchronous motors than with induction motors of the same output. In fact, such motors realize the ideal conditions of motor working in which the motor attains almost the same efficiency as the generator. Both induction and synchronous motors have usually higher efficiencies than direct-current motors of the same size, as is shown in Fig. 2. These three curves represent the efficiencies plotted for a 40-horsepower motor.

The ideal conditions in a factory installation no

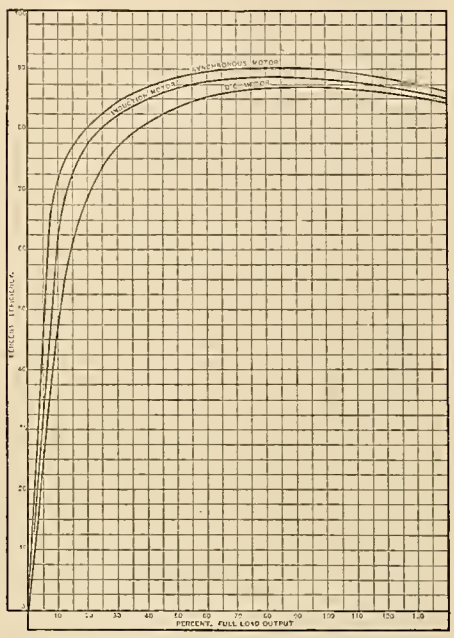


FIG. 2. EFFICIENCY OF ELECTRIC TRANSMISSION IN FACTORIES AND MILLS—EFFICIENCY CURVES OF DIFFERENT MOTORS OF THE SAME SIZE.

doubt would be secured where both induction and synchronous motors were used, the former for small machines and direct driving, the latter for operating a set or group of machines. The synchronous motors would be started up just before beginning the work of the day, have at all times a light, constant load, and might easily be so regulated as to produce an almost balanced system in combination with the induction motors. In such a system of transmission the lagging currents of the induction motors would be offset by the leading currents of the synchronous motors, if the latter were operated to produce such leading currents. The whole system would be operated practically throughout quite a range of load variations, as if it were a simple, direct-current system. The advantage of such a condition is apparent; it means least installation for any given output, or greatest output for any given capacity of generating plant. The group method of electric driving is much better adapted for small machines, up to and including two-horsepower capacity, and especially where such machines are in almost constant service. Above this size, individual motor driving becomes more and more efficient, particularly if the machines are operated only a fraction of the day.

It might naturally be expected that the greatest saving would be noticed in those factories designated in the earlier part of the paper, as engaged in heavy-machine work, where the loss in shafting and belting amounts to over 50 per cent. of the total power developed at the engine. On the other hand, many small industries have introduced electric driving to marked advantage. A few cases may be cited:

Case I.—Electric driving reduced the cost one-half over the former method, for engineer, coal and water.

Case II.—Fuel account, by electric driving, reduced to one-fifth of what it formerly was by shafting and belting.

Case III.—Cost of power 44 per cent. lower than what it was by shafts and belts.

Case IV—Gross saving about 30 per cent. with direct-coupled motors, and 22 per cent. with geared or belted motors.

Baltimore Linemen's Strike Ended.

The strike of the linemen of the United Electric Light and Power company of Baltimore has been declared off by the men. This strike began May 21st and was closed August 13th. Those of the strikers that had formerly gone back to the company and those taken back continue to draw pay at the old rate of $3.75 a day. The great majority of the members of the union were back at work for the company before the strike was declared ended, and the small minority left out magnanimously decided that they would not keep the majority from work on the minority's account, so declared the strike at an end.

Sandusky Interurban Electric Railways.

The interurban electric-railway systems in Northern Ohio are rapidly assuming a place of importance among the great enterprises of the Buckeye state. It is not the intention to outline all the plans which are now being consummated in this article, but to refer briefly to two lines which are now under way and will be completed some time within the next few months—the Sandusky and Interurban and the Sandusky, Monroeville, Bellevue and Norwalk Traction railways. Both of these lines are destined to become important ones, and will greatly facilitate the means of traveling in that part of the state.

The Sandusky and Interurban Electric Railway company's line is now completed from Sandusky to Huron, a distance of 10 miles, through as pretty scenery as the southern Lake Erie shores afford. From there to Lorain, 20 miles, the rails have not as yet been laid, but work is progressing rapidly upon it, and there is little doubt but that it will be in operation before long. Thomas Wood, manager of this company, has been identified with the street-railway business for years, and it was from some of the earlier enterprises that this last and most important one originated. The first line in the city was the Sandusky Street Railway company's horse line, extending from the center of town to the Lake Shore depot. In 1890 this was rebuilt and extended to the state Soldiers' Home, and was operated from that time on by electric power. The second line was known as the People's electric railway, and was built in 1892. It extended from the city to the Soldiers' Home. In 1893 the Sandusky, Milan and Norwalk company's line was begun, and it was opened for traffic in June, 1894. The distance covered by this line was 21 miles, and for some years it was the longest electric road in the state. Mr. Wood was closely identified with this company for some time, but now he devotes all his time to his other road, although he still holds stock in this one.

The old Sandusky Street Railway company was placed in the hands of a receiver in 1898, and later on was purchased by the capitalists who built the Sandusky and Interurban road. This gave them an entrance into the town and furnished lines for city business, which otherwise might have been difficult to obtain by franchise or otherwise. This, then, is the real foundation for the magnificent new line which is being built to Lorain, a distance of 30 miles, where it will connect with the Cleveland and Lorain, making a through electric line between Sandusky and Cleveland.

This railway is built on private right-of-way the entire distance and crosses no railroads at grade, going either under or over them. The roadbed is well built and ballasted with limestone, which is abundant in that section of the country. The track is standard width, and laid with 70-pound steel T-rails. If desired, steam trains can be operated upon it at any time. The culverts are all sandstone and steel. The cars operated on the line are 46 feet in length and are fitted with 250-horsepower motors, capable of a speed of 55 miles an hour. The seats are cushioned and there are smoking and baggage rooms in the cars, as well as toilet rooms for the convenience of the passengers. In elegance of finish, it is said, these coaches are not excelled by railway cars. They run as steadily and with as great speed as the average first-class train. There are three of these cars in use, and they leave each end of the line hourly, which gives a very good service over the portion of the line completed.

The power house is well constructed, of limestone block, and designed for convenience and use. In the main portion of the building is the engine room, and a wing on either side is used for boiler room and car sheds. There are two batteries of Babcock & Wilcox boilers, each battery containing two boilers of 600 horsepower each. Two compound condensing Russell engines are also in use, operating two Siemens & Halske 400-kilowatt generators. There are also a handsome marble switchboard, air compressors and pumps sufficient to make the plant a complete one in every respect.

When this road is completed through to Lorain it will be a model line in every respect. Manager Thomas Wood of Sandusky is to be congratulated upon the carefulness which has been displayed in the construction of the line, and for the manner in which the patrons of the road are taken care of. The officers of the company are: President, Henry A. Everett, Cleveland; secretary, C. H. Stewart, and general manager, Thomas Wood.

The other road mentioned, the Sandusky, Monroeville, Bellevue and Norwalk Traction company, will extend from Sandusky to Monroeville, and there branch, one line going to Norwalk and the other to Bellevue. At the present time the grading all along the line is about completed, and the force of workmen will begin to lay track within the next few days. This road is being built along the highway the entire distance, the promoters taking the stand that they will in that way secure the patronage of the people more readily by passing close to their residences than if they ran through the fields some distance from the houses. Before the road was begun a careful enumeration of the people along the proposed line was taken and the route was varied some to allow it to pass through the most populous territory in the part of the country it taps. It is the notion of the management that an electric road must depend almost entirely upon the local patronage, and that no matter what kind of connection is made with other lines or reaching other cities at a distance, there will be very few passengers. Hence, it has been their plan to secure the most populous route through their territory. This line will be about 21 miles in length, and besides the towns named, will pass through a number of smaller ones. F. H. McMasters & Co. of Philadelphia have the contract for the construction and for furnishing the entire equipment.

The line has been constructed carefully with reference to the grade, which does not exceed four per cent. in any place, and is less than that wherever it was possible to make it so. Seventy-pound standard steel rails will be used, and the track will be standard gauge. It will be ballasted with stone and made as strong and durable as any steam railway. In the larger places along the line the track will be laid on concrete girders, Hevener patent. This work has already been done in Norwalk, Monroeville and some of the other towns. The remainder of the track will be laid on heavy oak ties.

The power station will be located at Monroeville, near the point of the highest grade. It will be equipped with two engines and two generators with a capacity of about 500 horsepower each. The boilers will be of sufficient capacity to operate the machinery.

The American standard rail joint, manufactured by the Chrisholm-Moore Manufacturing company of Cleveland, will be used. These joints are made in such a manner as to hold the rails firmly together without any possibility of getting loose, and at the same time protect the electric connections from the devastation of tramps and the elements. Ten standard interurban cars, equipped with four 40-horsepower motors, have been secured for the road. These will be used for the beginning, and later on it will be fitted out with whatever the amount of business requires. This the management preferred to find out before a complete outfit of cars is purchased. The cars will be modern in every particular and will contain all the conveniences found upon any road. It is hoped to have the road completed and in operation by November 1st.

The officers of the company are as follows: President, Clark Rude, Sandusky; vice-president, J. Lancaster Dailey, Philadelphia; treasurer, James McLain, New York; secretary, W. E. Guerin, Sandusky. President Rude will also be the general manager of the company after it is completed. Passing through a densely populated portion of the country and having access to a number of large towns, this line will prove a success without doubt.

O. M. C.

The Electric Light and Power company of Carroll, Iowa, has commenced work on a hot-water heating plant.

Modern Switchboard Practice.

By Frank C. Perkins.

Part II—Polyphase Low tension Switchboards.

It may be of some interest to note the difference in construction of panel switchboards as previously described, of 2,000 volts and those using current at potentials of 100 to 600 volts.

The Westinghouse switchboard of five panels, illustrated in Fig. 8, shows that the general line of construction is the same as for high potential. The generator panels are arranged for multiple running, as indicated in Figs. 9 and 10. The former, for two-phase work, is 65 inches high, two feet four inches wide and two inches thick, of Italian white marble, with one-half inch bevel edges; the latter is for three-phase work, of the same size and construction, and has mounted upon it, as indicated, a pilot lamp and shade near the top, two keyless sockets and lamps and three round-pattern alternating-current ammeters, having scales at least 25 per cent. in excess of full-rated loads of the generator in whose circuits they are placed. A three-pole, double-throw, quick-break switch is seen on the diagram. These switches are called the washer type, and are manufactured with blades and jaws of lake copper and are designed to stand the wear and tear of severe and frequent use. An alternating-current and direct-current combination rheostat is shown mounted in the center. The face plate only is seen on the switchboard panel, connection being made from it to the rheostat, which is either on the back of the board or placed in a convenient place away from the board. Two concentric wheels are noticed, the one controlling the exciter direct-current rheostat, the other operating the alternating rheostat, both being placed in the same iron framework.

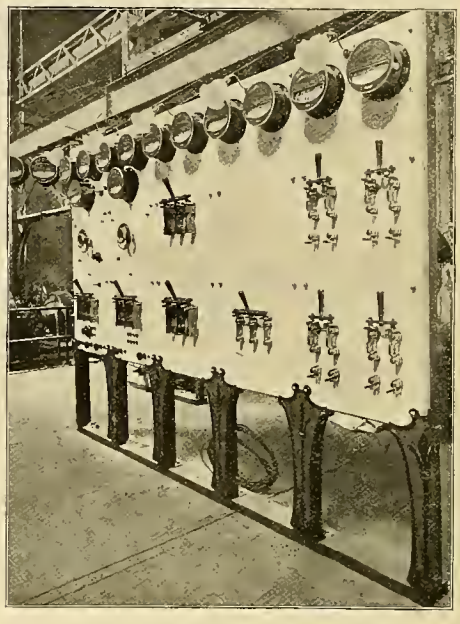


FIG. 8. MODERN SWITCHBOARD PRACTICE.—FIVE-PANEL WESTINGHOUSE POLYPHASE SWITCHBOARD.

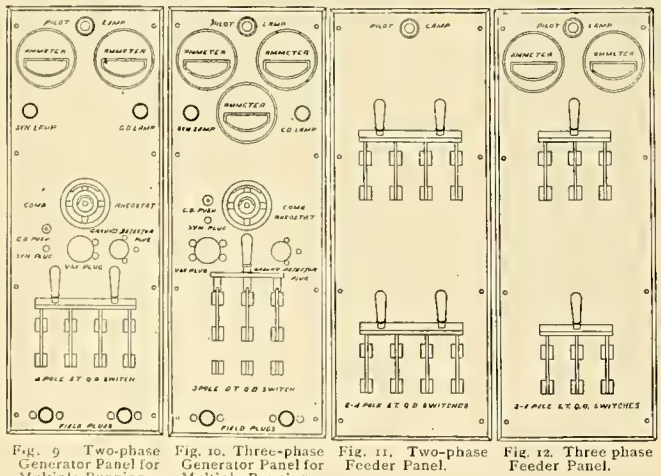


Fig. 9 Two-phase Generator Panel for Multiple Running. Fig. 10. Three-phase Generator Panel for Multiple Running. Fig. 11. Two-phase Feeder Panel. Fig. 12. Three phase Feeder Panel.

MODERN SWITCHBOARD PRACTICE.—WESTINGHOUSE PANELS.

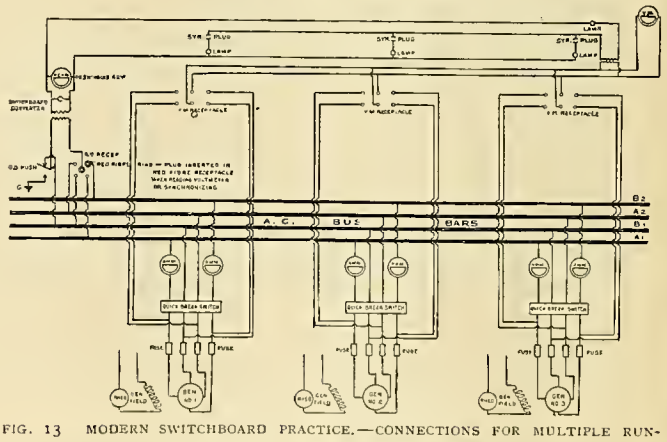


FIG. 13 MODERN SWITCHBOARD PRACTICE.—CONNECTIONS FOR MULTIPLE RUNNING OF TWO PHASE GENERATORS.

Two field plugs, a ground-detector push-bottom, a ground-detector receptacle and plug are indicated on the diagram, as well as the synchronizing socket, plug and eight-point voltmeter receptacle and plug. Two switchboard transformers are used and two transformer fuse blocks. The voltmeter is usually mounted on a swinging arm, such as shown in the illustration (Fig. 8).

The two-phase and three-phase feeder panels, as will be seen in Figs. 11 and 12, are simple in construction, the former having mounted thereon merely a pilot-lamp bracket and shade and two four-pole, single-throw, quick-break switches, while

the latter has two three-pole, single-throw, quick-break switches, and two round-pattern alternating-current ammeters in addition.

The connections for two-phase and three-phase multiple running of low-voltage polyphase generators are shown in Figs. 13 and 14. Below the bus-bars are indicated the generators, field windings, main switches and ammeters, while above the bus-bars may be seen the connections to the ground-detector lamp, switchboard converters, voltmeter and synchronizing plugs. Fig. 14 shows the connections in detail for running in multiple three 440-volt, three-phase generators.

It is often deemed important that the generator and feeder panels be equipped with wattmeters. In case such a practice is found necessary, indicating wattmeters are supplied for the generator boards and integrating wattmeters are preferred for the feeder panels. It is also frequently suggested that an ammeter be placed in the generator field, and when this is done, the instrument can

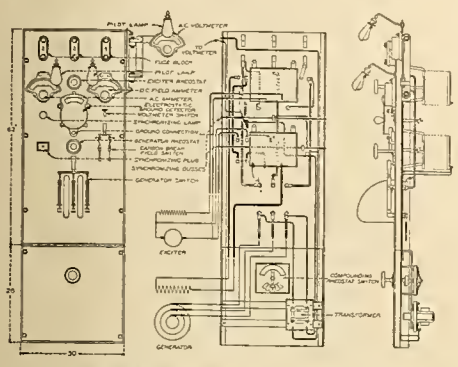


FIG. 15. MODERN SWITCHBOARD PRACTICE.—MONOCYCLIC ALTERNATING-CURRENT GENERATOR.

usually be mounted without difficulty on the panel desired.

Rotary panels for the alternating-current side of two-phase and three-phase rotary converters are usually somewhat simpler in construction than generator panels, having fewer pieces of apparatus mounted upon the board, but somewhat more than on the feeder panels. Usually the rotary panels are provided with pilot-lamp bracket shade, two keyless sockets and lamp, and two or three round-pattern alternating ammeters, depending on whether it is a two or three-phase board. The rheostat mounting is similar to the generator panel, as are also the two synchronizing receptacles and plugs, but usually there are provided three or four fuse holders for starting the motor. The necessary switches are a three-pole and a four-pole, quick-break switch for starting the motor, depending on whether it is a two-phase or three-phase panel.

The General Electric polyphase panel is constructed on the same lines for low voltage, 100 to

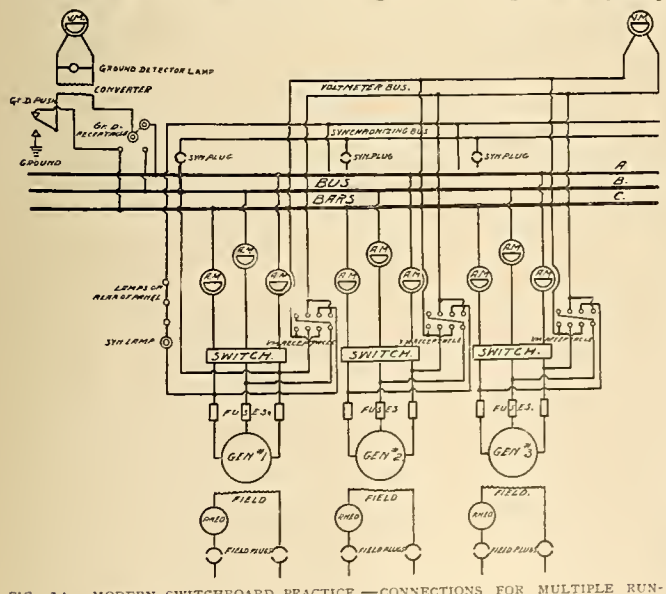


FIG. 14. MODERN SWITCHBOARD PRACTICE.—CONNECTIONS FOR MULTIPLE RUNNING OF THREE-PHASE GENERATORS.

600 volts, as for 2,500 volts. This design is used with compounding rheostats and switches and fuses arranged for a capacity of 130 amperes, and up to 2,500 volts. Fig. 15 illustrates clearly the connection of the switchboard panel of General Electric design for a monocyclic alternating-current generator. The pilot lamp and alternating-current voltmeter is shown at the top on a swing bracket. The exciter rheostat is also seen near the top, between the direct-current field ammeter on the right and the alternating-current ammeter switch on the left. The synchronizing lamp and carbon-break field switch are all indicated in the diagram, while the rear and side elevations show the connections and arrangement of rheostats, bus-bars for synchronizing and generator main-switch connections. The low-tension instruments are used direct, while the large sizes and high-tension instruments are operated in connection with transformers.

[*To be concluded.*]

The Desirability of Using Storage Batteries in Medium-size Stations.[1]

By L. G. White.

The idea seems to be quite prevalent among central-station men that the storage battery is useful only for the purpose of storing energy, generating it during light-load periods, and storing it until such time as it may be used to the best advantage. The storage battery is, indeed, a very valuable addition to any direct-current station for this purpose alone, but I shall endeavor to point out to you some other features of the storage-battery system which I think are as fully important to the medium-size station as the one mentioned.

One of the most valuable features of the storage-battery system is its ability to maintain an even pressure on the bus-bars, to which it may be connected; even though the load may vary greatly, and the demands may be very sudden, such as are occasioned by the starting of direct-connected electric elevators and other heavy motor work, the battery will maintain a fairly even pressure at the bus-bars of the station. It does this automatically, and without any effort whatever on the part of the switchboard attendant.

The question of regulation has been a serious one to central-station managers, and is becoming more serious every day. A few years ago the public would accept a very unsteady incandescent light, possibly attributing its unsteadiness to the belief that electricity was then in its infancy; but now, possibly thinking that the infant has had time to grow and mature, they demand a bright, steady light with uninterrupted service. It is possible that the extensive adoption of the Welsbach gas lamp, giving a very steady light, though it be of a ghastly color, has had the effect of making the public more critical in the matter of electric lighting; but whatever the cause, the fact remains that your customers demand a steady light, which means good regulation; and I think most station managers are now striving to attain this end.

I think that the medium-size station will find this one feature of the storage systems fully as important to them, if not more so, than the feature usually considered by the larger stations: that is, the ability of the battery to carry enormous peak loads of comparatively short duration. The larger stations, with their large, direct-connected units, do not experience the difficulties encountered by the smaller stations in the matter of regulation, but even they find it convenient to depend largely on the battery for regulation.

The incandescent-lamp manufacturers have brought their lamps to such a point that there is but little left to be desired in the way of efficient lamps; but in order to get good results from these high-efficiency lamps it is necessary to have really good regulation. The better the regulation, the better are the results from the use of the high-efficiency lamps.

Another feature of the storage system which should appeal strongly to the medium-size station is, that it affords a reliable reserve in case of an accident to your generating apparatus. Should an engine break down or a dynamo become disabled, the battery is usually ready to take up the load without any interruption to the service, and will usually carry it until some provision can be made to relieve it, thus saving an "out," the one thing of all others most dreaded by station managers.

I will recite an experience of one night in which the battery played an important part. It was a Saturday night, in early spring, and the load was heavy, as is usual on Saturday nights at that time of the year, when our deep well began raising a liberal quantity of sharp sand. It did not take this sand long to cripple all of our boiler-feed pumps; in fact, they were useless before we realized what the trouble was. We found it impossible to get any water into the boilers by means of the feed pumps; so, after anxiously watching the water disappear in gauge glasses, the fires were banked, and the engines stopped, as the steam failed. The entire load was thrown on the battery; although it was much in excess of its rated capacity, it carried the load nicely. We then began filling the boilers from the city mains, which, unfortunately, only had a pressure of 40 pounds at this time. Then we fired up again, and as soon as steam pressure would permit, we cut in our most efficient units, and immediately began charging the battery with all that could be spared from the line. We ran the engines until the water was again out of sight in the gauge glasses, then repeated the same cycle of operations. This sort of performance was kept up from 10:30 p. m. until about 9 a. m. the following day, at which time we succeeded in getting one of the pumps in service again, it having been found necessary to fit the pump with an entirely new set of valves, and to regrind all of the valve seats. So far as I know, not one of our customers knew that we had troubles of our own that night.

Another way in which the battery has proven itself useful, and has made a direct saving of fuel and labor, is by taking care of the loads thrown on the station by sudden storms, which are so prevalent in this part of the country during the summer months. Before the battery was installed it was common practice to run more boiler capacity than would have been required had it not been for the sudden jumps in the load caused by a passing thundercloud, and even then it was frequently necessary to get in another boiler in short order, using boxes, barrels or anything that would make steam quickly, and then, perhaps, after only a few minutes' use, to have to let the boiler cool off again, thus losing a large per cent. of the heat units stored in that boiler.

With the aid of the battery we are able to run both the boilers and engines in the most economical manner, thus making a saving which amounts to considerable in a year's run, and yet the saving is of such a nature that it is difficult to reduce it to dollars and cents, consequently the battery may not get all the credit due it from this source.

During the heavy winter load we find the battery very convenient in keeping up the pressure at the ends of the longer feeders. We connect such feeders as require boosting to an auxiliary bus, and then connect the battery to the auxiliary, and by means of one of the end-cell switches we can raise the pressure on these feeders as high as may be necessary.

Usually that part of the load which requires boosting is so small that we would get very poor efficiency if we were to use a pair of dynamos for this purpose; but, however, should the load on these feeders be heavy enough to warrant it, we would cut in a pair of machines on the auxiliary bus to supply the load, and charge the battery with whatever capacity was left in that pair of machines, so you see we would get an economical load for the machines under all conditions.

A short circuit on heavy lines, especially if they are underground, usually means trouble for the station man, and it is not an uncommon thing to have machines reversed in this manner; this, of course, means a shutdown while fresh machines are started to re-polarize the reversed machines or to burn off the short-circuit. This sometimes requires a number of machines, and always takes an appreciable length of time, during which your customers are saying pleasant things about electric lighting in general, and about your company in particular, or are making frantic efforts to inform you by telephone that there is something wrong with their lights. We have had our usual number of short-circuits since the battery was installed, but not in a single instance has the operation of the plant been affected in the least. In fact, the switchboard attendant usually learns of this kind of trouble first from some of the outside men. We have burned some very heavy copper, and the only indication at the station has been a drop of pressure shown by the recording voltmeters, and that only for an instant.

The cost of maintenance of the battery has been only a very small amount in our case. The entire expense is represented by about five hours' labor per week, and about 200 gallons of distilled water per week. The water we distill in a home-made still, and it costs us very little, indeed. The labor is applied in reading the voltage and specific gravity of each cell about three times per week, and refilling the cells with distilled water, besides keeping the battery room clean. I presume that, sooner or later, we will have to begin making repairs on the battery, but now, after one year's constant use, the plates show no evidence of deterioration.

The condition existing at Columbus at the time our battery was installed was most favorable to the battery, consequently the battery has made a good showing for itself. These are conditions which are natural in all fast-growing small plants, and are to be expected, and must be met, if the plant is to continue its natural growth.

While the storage battery is almost a necessity to some plants, it might be an expensive luxury to other plants, so it would not be well to advise universal use of storage batteries, but I would advise you to study the local conditions existing in each individual plant, and then, should those conditions warrant it, I should advise you to consider a battery instead of generating apparatus for your next increase.

1. Read before the Ohio Electric Light association, at Toledo, O., August 15, 1900. Mr. White is connected with the Columbus (O.) Edison Electric Light company.

The contract for motors and trucks for the Boston elevated road has been let to the Westinghouse and Baldwin companies. There are to be 200 motors of 150 horsepower each, with the necessary controllers and other apparatus. The contract also covers 100 motor trucks and 100 trailer trucks. The motor trucks will have Mr. Gibbs' patent suspension. The delivery is to begin in 60 days and all of the apparatus is to be delivered before January 1st.

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CONVENTIONS AND EXPOSITIONS.

Canadian Electrical association, Kingston, Ont., August 29th to 31st.

Association of Edison Illuminating companies, Saratoga, N. Y., September 4th to 6th.

Street Railway association of the State of New York, Buffalo, N. Y., September 18th and 19th.

Inter Ocean Automobile Meet, Chicago, Ill., September 18th to 22d.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

Hypnotism in Hawaii is certainly up-to-date, for it is practiced by telephone. A Honolulu paper tells of a young man in that city who is "allied with the Young Men's Christian Association" and also "an ardent student of hypnotism" who hypnotized another young man by talking to him over a telephone line. This interesting experiment may give a hint to some of our telephone companies. Why not employ hypnotists as operators and thus convince the subscribers that they are getting good service?

A rather unusual form of benevolence has been displayed in Spirit Lake, Iowa, where Mr. B. F. Stevens has presented to the village his complete electric-light, power and heating plant, said to have been erected at a cost of $30,000. The plant is new and of good material and workmanship. There were no conditions to the gift. This seems to be a case where a community has opportunity to grapple with the municipal-ownership problem under the most favorable conditions possible and at the instance of the central-station proprietor himself. The village plant will have a monopoly of the business and will interfere with no private enterprise. If municipal ownership can ever be a success, it ought to be at Spirit Lake.

A new danger has been added to the hazards of the electric trainman's life. It is due to the inflammable possibilities that lurk in the celluloid collar. A Milwaukee motorman was seriously burned a few days ago while tinkering with a defective motor equipment. He wore one of the celluloid collars aforesaid, and after a flash it was found that the collar had been set on fire. The accident excited some attention from its unusual nature and the fact that it indicated a new, although remote, danger to be apprehended. Laundrymen may have some occasion to rejoice at the news, although with this warning and reasonable care there is no reason to expect that trainmen will be required to divorce themselves entirely from the economical celluloid.

Mercury, or quicksilver, as it is known in commerce, is useful to electrical designers in the few cases where a fluid or mobile conductor must be employed. It is, therefore, of some interest to observe the report, telegraphed from Boston, that there is fear that the world's production of this metal is likely to prove unequal to the growing demand. However, the Associated Press statistics of the supply of quicksilver, given in connection with the report mentioned, are so inaccurate that doubt is thrown on the whole statement. The production of this metal in the United States in 1898 amounted to 31,092 flasks, valued at $1,188,627. In the same year only 81 pounds of quicksilver, valued at $51, was imported. These are the latest government statistics available, and they seem to indicate that the domestic supply, which comes entirely from California, is equal to the demand in the United States. However, it is to be borne in mind that the imports of quicksilver show surprising variations, ranging from 1,552,738 pounds in 1883 to seven pounds in 1894. The average California production is 38,800 flasks (about 2,500,000 pounds), although in the "bonanza" years, from 1875 to 1882, the average annual output was over 64,000 flasks. It is said that there is hope of future increased supplies from New South Wales, where cinnabar ore is found in paying quantities; but as the quantity of quicksilver used in the electrical arts is small, it is not likely that the variation in price will be of serious import to electrical men.

An interesting contract for street arc lighting is that entered into between the city of Springfield, Mass., and the United Electric Light company. The agreement is for five years from May 1, 1899, and provides for the operation of 700 or more 350-watt, 1,200-candlepower arc lamps, to burn all night and every night, for $75 a year a light. The company furnishes all circuits and wire-supporting poles, but the city supplies all lamp-posts and mast-arms. It is stipulated that 350 watts of electrical energy shall be expended at each lamp. To check the service eight recording ammeters—one for each lighting circuit—are installed on a board in the station to which no one but members of the aldermanic committee on lighting streets or their employes have access. The dials from these instruments are collected and filed in the city hall each day. Thus there is an undisputed record of each night's work open for public inspection at all times. Numerous voltmeter tests of individual lights are also made. There were 743 five-ampere, series, enclosed-arc lights on the system on December 10th last, and electricity is relied upon wholly in lighting the streets. The committee speaks of the service as "excellent;" the streets are well lighted at a moderate price, and the company has a steady source of income, giving a fair return on the investment. It is noteworthy that this equitable and satisfactory arrangement was entered into after the city had investigated municipal ownership with care and found it to be inadvisable. It would be well if in all cities the sellers and buyers of street-lighting current would follow the enlightened example of Springfield.

Broken span wires of electric-railway systems seem to have caused an unusual number of accidents and consequent damage suits of late. In Chattanooga a car slipped its trolley, which, as it rose, struck a span wire and broke it. On breaking, the latter fell immediately in front of a bicyclist, who, in endeavoring to avoid it, received a serious injury. The Supreme Court of Tennessee holds (Chattanooga Electric Railway company against Mingle) that, under these circumstances, the injured man was entitled to damages.

Of course, the court says, in agreement with counsel for the company, those who go on a highway may well be held to do so subject to their taking upon themselves the risk of injury from inevitable danger, where carelessness cannot be charged upon anyone. But it does not consider the fall of a guy wire, or span wire, an inevitable danger. If the wire was made of good material, and was properly attached, and then carefully supervised, there was no inevitable danger incident to its suspension above the street. If, however, the wire was imperfectly constructed or attached, or if, properly attached in the beginning, it was neglected for a period of time sufficiently long for expansion or strain upon it to weaken the attachments, then it did become a public menace; and the company, being guilty of the negligence which contributed to this condition, the court holds, was responsible for the damages proximately resulting therefrom.

Such a wire, the court continues, is put up, not to fall, but to retain its safe level above the street. To accomplish the purpose of its erection it is required to be heavy and strong enough to stand the force of the strain, as well as that of an ordinary blow. It is common experience that in propelling a car the trolley will sometimes slip from the wire along which it is passing, and if, in so doing, it comes in contact with a guy wire, it is apparent, the court holds, that the latter should be of sufficient strength and fixity to withstand the violence of the stroke; and, if it fails to do so, it is not an unreasonable inference that there has been negligence in its selection, construction or supervision.

In view of the peril consequent on the displacement and fall of the wires in an electric-railway system, it is essential that a high degree of care be exercised, not only in their construction, but in their continued maintenance in a good and safe condition. If this be not done, then, with the growing network of wires suspended over the streets of towns and cities, those who use these streets in the exercise of a common right will do so in constant peril. Under these circumstances, the court thinks no hardship is imposed upon a company which is using the agency of electricity along overhead wires, when an accident occurs from a wire which has fallen to the street or dangerously near it, in requiring it to repel a presumption of negligence. Besides, it points out, it is within the power of the company at all times to show whether it has exercised due care in the selection of materials and in their erection and subsequent supervision, while to prove an actionable lack in these things would be, in most cases, practically beyond the reach of the person injured.

Ohio Electric Light Association.

The sixth annual meeting of the Ohio Electric Light association was held at Toledo, Ohio, on August 14th, 15th and 16th, in the rooms of the Boody House. The attendance at the meeting was up to the usual standard of previous conventions. Several carefully prepared papers were read and thoroughly discussed, which, with the hospitable entertainment provided by the Toledo Traction company, served to make the meeting a profitable and enjoyable one.

President D. L. Gaskill of Greenville, Ohio, called the meeting to order Tuesday morning. The reports of committees were passed and W. P. Engel of the People's Gas and Electric company, Defiance, Ohio, and F. E. Valentine of the Urbana Electric company, Urbana, Ohio, were admitted as new members. Then President Gaskill delivered his address, in which he briefly reviewed some of the important work of the committees for the year and spoke of the benefits of membership in the association and the effectiveness of the society in looking after legislation and other matters. He considered the municipal-ownership question at some length and summed up the situation as follows:

"Electric plants are not like jack-knives, to be traded off, if not found satisfactory. The history of municipal lighting by the cities themselves has been one of universal failure. In no instance has the city having such a plant been able to make as good showing as if served by a private corporation run on modern business principles. The reasons for this are known to every man present here to-day; and if they were as well known to the public and understood properly, we would not be troubled with people wanting the cities to do their own lighting. I believe it would be better to take the public more into our confidence, and by publication and other means educate them to a true conception of the advantages of economical private control of lighting plants in saving cost to the public and in stimulating inventiveness along every line of advance. We need the enactment of a law regulating cities from going into the enterprises. While we cannot get laws enacted to prevent cities from engaging in municipal lighting, we can, by proper legislation, require them, first, to buy the existing plants at their fair valuation, good will and earning capacity to be taken into consideration. To meet the question of extortionate taxation measures, the selection of better business men to our legislatures is the surest remedy."

Tuesday afternoon was divided between pleasure and business, the association assembling immediately after dinner to hear an address of welcome by Hon. S. M. Jones, mayor of Toledo, whose views on municipal ownership and kindred subjects are well known. Mayor Jones frankly told the association that he believed in municipal ownership, but he would not if he could enforce it vi et armis, but rather would abide God's leisure, and that all would come out right in the end. After the address by the mayor an adjournment was taken until 8:30 p. m., the delegates and their ladies in the meantime being given a boat ride on the historic Maumee, disembarking at Gard Island, where, after a short stay, they returned to the city, being much refreshed by the sail. The two launches were the Novia and the Psyche, the latter being the property of the Toledo Traction company, and the former being a very fast steam launch, which is said to have the reputation of being the fastest boat on fresh water. Returning to the hotel, the party took a trolley ride of an hour, and the gentlemen again assembled at 8:30 p. m., to resume deliberations.

Papers were read at the evening session by A. J. Stahl of La Porte, Ind., and E. J. King, of the Fort Wayne Electrical Works. The subject of Mr. Stahl's paper was "Two Revenues Instead of One: Electricity a By-product." He briefly reviewed the advantages to be derived by combining a heating plant and electrical plant. The paper provoked an animated discussion, which took the form of inquiry after information, and H. T. Yaryan, of the Toledo Heating and Lighting company, was called on to elucidate some of the points developed. Mr. Yaryan stated that, in his opinion, no corrosion whatever takes place in water that is used free from gases and air, and that water circulated for an entire season in this way through his heating system could be cooled off and drunk with comfort and safety, if desired. Experience had demonstrated that consumers would not give up the hot-water heating after once using it, at any reasonable charge placed on its use. He contended that steam never had been and never would be a success for residence heating, and that no difficulty was experienced with his system of house heating in the coldest weather.

The subject of Mr. King's paper was "Induction Integrating Wattmeters." He outlined the conditions that should receive attention in the selection of such meters, calling attention to the errors that exist in different meters on the market at this time. W. J. Hanley and W. P. Engel discussed the paper briefly, and the association then took an adjournment until the next morning.

During the first session on Wednesday a paper was read by J. S. Peck of the Westinghouse Electric and Manufacturing company, Pittsburg, Pa., on "Transformers." This treated of the principles which underlie the action of a transformer, and of those characteristics which are most desirable to the central-station man. Mr. Peck gave examples illustrating the saving which can be made by the use of transformers having low iron loss, and called attention to the fact, which has heretofore received little consideration, that a transformer having a poor regulation, but low iron loss, may be more expensive to the central station than a transformer having better regulation and higher iron loss, not only on account of the poor service rendered, but also due to the fact that the meter reading is reduced at full load by the lower voltage impressed upon the secondary terminals. The paper was followed by lantern slides, exhibited by Mr. Peck, the views being of different classes of electrical machinery, but largely showing the construction of various transformers, and in connection some beautiful views of Niagara Falls and the adjacent power plants. The paper was discussed by M. E. Turner of Cleveland and William F. White of Cincinnati.

After some further discussion the next paper was read by J. H. Perkins of Youngstown, Ohio, on "Station Management," but, as a fuller title, "The Operation of a Combined Lighting and Power Plant." The author treated of the results in the operation of a combined lighting and power plant supplying alternating currents, all machines being of the same type and run in parallel. He took up the results of incandescent lighting, arc lighting, motor work and street-railway service, from the point of view of a plant of the size of the one at Youngstown. From the results there obtained he found that, except for very heavy overloads, the operation is most satisfactory. The solution of the seeming difficulties in regulation he believed to lie in the adjustment of the rotary fields on the street-railway circuits over-compounding at the higher loads, and keeping down the voltage at low loads. He referred to the difficulties in the operation of engines under these circumstances, and suggested remedies. He advised small, poor regulating generators on inductive loads. The result of the experience was that, with a properly designed system of engines, generators and rotaries and switchboard arrangements, this system can be operated with entire satisfaction in a combined lighting and power plant.

The discussion following was interesting, and developed a suggestion from Mr. White of Cincinnati that, in buying an alternator, either single-phase or two or three-phase, from which it is intended to supply any motor service, the question should be carefully considered as to whether one wants to buy an inductor alternator. A motor load, on account of the power factor of such induction motors as are now on the market, has a very bad effect on the regulation of any dynamo. F. G. Schmidt of Sandusky made some remarks and Mr. Peck concluded the discussion by saying that this reactance seemed to have little effect upon the regulation with lamp load. For example, if the reactance of the alternator is 28 per cent. with a lamp load, the effect of this is to add but four per cent. to the drop in voltage. With an inductive load, however, the effect of this reactance rapidly increases. Thus, with a load having even as high as 0.8 power factor, the reactance would add about 17 per cent. to the drop in the generator, while with a lower power factor, which is the condition usually obtained when starting alternating-current motors, the effect may be considerably increased, so that the total effect of the reactance may be to cause as high as 20 per cent. or 25 per cent. increased drop on the generator.

Wednesday afternoon a paper was read by Captain James M. Andrews of the General Electric company, Schenectady, N. Y., the subject being "Choice of Periodicity of Alternating-current Apparatus." A brief discussion followed. The next paper was by L. G. White of the Columbus Edison company, Columbus, Ohio on "The Desirability of Using Storage Batteries in Medium-size Stations." Mr. White illustrated his lecture with a number of charts. During the short discussion following, Mr. White called attention to the fact that a large part of the money realized from guarantee on storage battery was spent in traveling expenses and inspection, and a company maintaining its own plant would save that outlay.

M. E. Turner of Cleveland gave an informal talk on the subject of the application of the two-rate method of charging for current. W. F. White of Cincinnati then read a very exhaustive paper on "Electricity vs. Gas," or "Shall We Keep Abreast of the Times, or Shall We Retrograde, in Methods of Street Illumination?" The convention then went into executive session to consider some matters of routine, during which the report of A. W. Field, as secretary-treasurer, was submitted, with the report of the auditing committee. At 5 p. m. an adjournment to Thursday morning was taken, after a very busy day, and a band concert was given in the Boody House by the Toledo Traction company's Centennial band of 40 pieces, composed entirely of employes of that company, under the management of A. A. Atkinson.

There was a profusion of entertainment for the ladies and others during the three days' session. The following is a brief outline of courtesies proffered by the Toledo Traction company, which was the host: Tuesday afternoon, boat ride on the Maumee and Lake Erie to Gard Island and trolley ride at 7:30 p. m.; Wednesday, tally-ho ride for the ladies, at 10 a. m., to Ottawa Park and golf links; 2 p. m., launch ride for the ladies, to Perrysburg and up the Maumee River, in opposite direction from former boat ride; band concert at Boody House at 5 p. m.; Wednesday evening, trip to and entertainment at the Casino, compliments of Toledo Traction company, for association and ladies; Thursday afternoon, visit to East Toledo, via trolley cars, to the plant of the Edward Plate Glass company's works at Rossford.

At the closing session on Thursday morning the following-named officers were elected: President, Ernest J. Bechtel, Toledo, Ohio; vice-president, Samuel Scovil, Cleveland, Ohio; secretary-treasurer, J. H. Perkins, Youngstown, Ohio; executive committee, D. L. Gaskill, Greenville, Ohio; Emil G. Schmidt, Sandusky, Ohio; George Matt, Lancaster, Ohio; E. H. McKnight, Middletown, Ohio; George Hayler, Van Wert, Ohio; finance committee, W. F. Raber, Mansfield, Ohio; S. M. Rust, Piqua, Ohio; E. F. Gwynn, Delaware, Ohio; advisory committee, Samuel Scovil, Cleveland, Ohio; A. W. Field, Columbus, Ohio; H. C. Fogle, Canton, Ohio.

The recommendation of the executive committee was received and approved that Put-in-Bay be selected as the place of the next annual meeting, the time to be arranged later by the executive committee. It was ordered that the proceedings of the meeting be published in pamphlet form for distribution to members. H. W. Hillman of Schenectady, N. Y., was unable to be present, and his paper on "Arc Lighting" was read by Mr. W. F. White of Cincinnati. Following the reading and discussion of this paper a pleasant surprise was in waiting for Thomas H. McLean, of the Toledo Traction company, in the shape of a handsome silver loving cup, inscribed as follows: "To Thomas H. McLean, from the Ohio Electric Light association and their guests, August 14, 15 and 16, 1900, Toledo, O." The presentation was made in graceful terms by D. L. Gaskill, the retiring president of the association. The gift was made in appreciation of the efforts of Mr. McLean in entertaining the delegates. Mr. McLean responded in appropriate terms. After an informal discussion as to the best means to increase membership, the convention adjourned sine die.

The following-named gentlemen were in attendance at the convention:

Adams, H. E., Illinois Electric company.....Chicago, Ill.
Andrews, Capt. J. M., General Electric company.....Schenectady, N. Y.
Atkinson, A. A., Toledo Traction company....Toledo, O.
Bechtel, Ernest J., Toledo Traction company and Toledo Consolidated Electric company.....Toledo, O.
Bissell, F., F. Bissell company.....Toledo, O.
Blinn, A. C., Sandusky Electric Light company.....Sandusky, O.
Boole, Perry R., Electric Appliance company.Chicago, Ill.
Clapp, G. N., Middletown Gas and Electric Light company.....Middletown, O.
Dickinson, A. F., Geneva Electric Light and Power company.....Geneva, O.
Engel, William P., People's Gas and Electric company.....Defiance, O.
Espy, Thomas, Kenton Gas and Electric company.....Kenton, O.
Field, A. W., Columbus Edison Electric Light company.....Columbus, O.
Froehlich, Fred H., Edward Ford Glass company.....Toledo, O.
Gaskill, D. L., Greenville Electric Light and Power company.....Greenville, O.
Grace, V. C., Robert L. McOnat .....Indianapolis, Ind.
Guenther, J. J., Shelby Municipal Lighting Plant.....Shelby, O.
Gwynn, E. F., Delaware Electric Light, Heat and Power company.....Delaware, O.
Hamilton, C. M., F. Bissell company.....Toledo, O.
Hanley, W. J., General Electric company..Cincinnati, O.
Hayler, George, Jr., Van Wert Electric Light and Power company.....Van Wert, O.
Hein, Frank, Fremont Electric Light company and Fremont Gas company.....Fremont, O.
Hillman, H. W., General Electric company.....Schenectady, N. Y.
Hopkins, W. A., Jr., The Ernest-Hopkins company.....Columbus, O.
Howe, W. M., Toledo Traction company.....Toledo, O.
Hubbell, W. F., Wauseon Electric Light Plant.....Wauseon, O.
King, Elton J., Fort Wayne Electric Works.....Fort Wayne, Ind.
Lang, Albion E., Toledo Traction company....Toledo, O.
Lutz, Charles R., Citizens' Electric Light company..Logan, O.
McKnight, E. H., Bowling Green Electric Light and Power company.....Bowling Green, O.
McLean, Thomas H., Toledo Consolidated Electric company.....Toledo, O.
Matt, George, Lancaster Electric Light company.....Lancaster, O.
Merrill, J. L., General Electric company..Cincinnati, O.
Morganthaler, P. C., Fort Wayne Electric Works.....Fort Wayne, Ind.
Nagel, W. G., W. G. Nagel & Co.....Toledo, O.
Packard, W. D., New York and Ohio company.Warren, O.
Paradis, E. J., W. G. Nagel & Co.....Toledo, O.
Parton, E. K., Perkins Electric Switch Lever company.....Chicago, Ill.
Payne, M. O., Central Stations for Hot Water Heat.....La Porte, Ind.
Pearl, Allen S., Central Electric company....Chicago, Ill.
Peck, John Sedgwick, Westinghouse Electric Manufacturing company.....Pittsburg, Pa.
Perkins, J. H., Youngstown Gas and Electric company.....Youngstown, O.
Perkins, Frederick B., Edward Ford Plate Glass company.....Toledo, O.
Plaisted, J. M., Columbus Electric Light and Power company.....Columbus, O.
Pool, L. A., Piqua Electric company.....Piqua, O.
Porter, William M., Lea Electric Manufacturing company.....Elwood, Ind.
Raber, W. F., Citizens' Electric Railway, Light and Power company.....Mansfield, O.
Rodgers, C. E., Tiffin Edison Electric Illuminating company.....Tiffin, O.
Rost, S. M., Piqua Electric company.....Piqua, O.
Schmidt, Emil G., Sandusky Electric Light company.....Sandusky, O.
Smith, W. S.,.....Toledo, O.
Stahl, A. J., Central Stations for Hot Water Heat..La Porte, Ind.
Stewart, H. T., General Electric company..Columbus, O.
Turner, M. E., Cleveland Illuminating company.....Cleveland, O.
Valentine, F. E., Urbana Electric company....Urbana, O.
Van Fleck, Clyde, Oil Refinery .....Toledo, O.
Walton, Allyn B., National Arc Lamp company.....Lorain, O.
Wellman, H., Ohio Valley Electric Railway...Ashland, Ky.
White, William F., Cincinnati Edison Electric company.....Cincinnati, O.
Wood, W. L., General Electric company....Boston, Mass.
Yaryan, H. T., Toledo Heating and Lighting company.....Toledo, O.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

Lightning entered the central office of the telephone exchange at Morris, Minn., and started a fire which ruined the switchboard. A new one will be necessary.

The Kandiyohi County Telephone company of Willmar, Minn., has been incorporated, with $10,000 capital stock. The incorporators are P. J. Haley, A. F. Hanscom, J. M. Spicer of Willmar, J. O. Lundberg and H. B. Eddy.

The Wisconsin Telephone company is rebuilding its system in Madison, Wis. There will be a new pole line, with an extensive use of copper wire. The underground system will be extended 22 blocks more in the residence district.

The Circuit Court gave judgment against the Little Wolf River Telephone company in an action for damages from placing poles in front of the plaintiff's property. On the question of the company's right to erect the poles, the court held for the plaintiff. The decision will compel the company to remove its poles or secure permission to have them remain where they are by purchase.

A local exchange is projected for Virginia, Minn.

The city attorney of Minneapolis has filed a petition for a reargument in the case of the Northwestern Telephone Exchange company and the city of Minneapolis, lately before the Minnesota Supreme Court.

Several wires of the People's Telephone company in Superior, Wis., were out of order recently. It was found that the lead cable containing them had been perforated by a bullet, which had cut several wires in two.

J. C. Bonnell succeeds F. S. Holmes as manager of the Iowa Telephone company's office at Iowa City, Iowa.

The stockholders of the Mutual Telephone company of Des Moines, Iowa, have decided not to do anything toward changing the present conditions of the company until some time in the fall.

The Henry County Telephone company will build a toll line from New London, Iowa, to Mount Union.

The Pocahontas (Iowa) Telephone company has filed articles of incorporation, with $10,000 capital stock.

The Rocky Mountain Bell Telephone company will remove to new quarters at Great Falls, Mont., and will put in a central-energy system.

Business men of Excelsior, Minn., want the Mississippi Valley Telephone company to extend wires from Minneapolis to that place.

The Standard Telephone company and the Home Electric company at Dubuque, Iowa, are having constant trouble over the arrangement of poles. The telephone company was given permission to replace a line of poles owned by the Home company, but when work was started disputes arose over the portion of the poles assigned to each. The telephone company has finally stopped work until it can be assured of being able to prosecute it without further interference.

The Monroe (Wis.) Telephone company has installed a new switchboard.

The Baraboo (Wis.) Telephone company will inaugurate a plan of giving the market reports from neighboring cities for the benefit of its farmer patrons. They can be secured by calling the central office.

The Northwestern Telephone Exchange company has connected with Hastings, Minn., on the long-distance line.

Twenty-five of the striking operators of the Sunset Telephone and Telegraph company's office in Seattle, Wash., have returned to work, and the others will be taken back as vacancies occur.

The Fairmont Telephone company is building a line between Blue Earth and St. James, Minn.

The Leon (Iowa) Telephone company is building a number of farmers' lines in all directions.

The exchange at Storm Lake, Iowa, has been rebuilt, and now has 90 connections. It is expected to have all-night service soon.

The Bell Telephone company of Winnipeg, Man., is about to rebuild its exchange there and install a central-energy system.

The Martelle (Iowa) Telephone company has completed a line to Anamosa, Iowa.

Farmers between Randolph and Imogene, Iowa, propose to have a telephone line between those places.

The Central Union Telephone company of Rock Island, Ill., has cut over on to a new switchboard. The new system is a modern central-energy exchange.

All the members of the United Brotherhood of Electrical Workers employed by the Rocky Mountain Bell Telephone company at Butte, Mont., have struck because the company will not acknowledge their right to determine the competency of a workman employed by the company. They threaten to call out all the men on the system in Montana, Idaho, Wyoming and Utah. The company threatens to discharge every union man in its employ on the whole system, unless the strikers yield. The strikers say that Butte is the only place where the company uses union labor, and its threat does not mean much.

The Onawa (Iowa) exchange is now completed and in running order.

An attempt was made lately to rob the Northwestern Telephone Exchange company's long-distance toll booth in the Saulpaugh Hotel at Mankato, Minn. The slide contained about $48, but the robber was frightened away before securing anything.

The National Automatic Telephone company will install 15 telephones for St. Thomas, N. D., at once.

A toll line is being built from Laurel, Mont., to Silesia and Rockvale, to Joliet and Carbonado, and to Clarke Fork and Gebo, thence to Bridger.

A local company has made a proposition to buy the local exchange at Mount Ayr, Iowa, owned by the Clearfield and Mount Ayr Telephone company. If the proposition is not accepted a new exchange will be built.

A local exchange is being built for Ruthven, Iowa.

The new exchange at Beresford, S. D., is about ready for operation.

The Seymour Telephone company is an applicant for a franchise to build and operate a local exchange for Mystic, Iowa.

B. F. Leiser is canvassing Melrose, Minn., with a view to establishing a local exchange there.

The Inland Telephone company is building a toll line between North Yakima and Ellensburg, Wash.

The Douglass County Telephone company of Superior, Wis., has made connections with the Mesaba Telephone company, connecting with Two Harbors, Minn.

The new telephone company of Ada, Minn., plans to extend a toll line from Red Lake Falls, Minn., to Moorhead and Crookston, Minn.

Whitewater, Wis., has nearly 150 telephone subscribers now, as against 44 a year ago in May.

The Nicollet and Brighton Telephone company is planning to carry out its original designs. The company has been quiescent since spring.

Mr. McQuay contemplates a local exchange for Rockford, Iowa, if he can secure a franchise.

The Greene and Western Telephone company has built a toll line into Dodge Center, Minn.

The Duluth Telephone company of Duluth, Minn., has cut over a new switchboard for its system. The new system is the latest model, with flashlight and central-energy system.

The Mutual Telephone company of Corning, Iowa, has begun operating its new exchange. The Iowa company at once reduced its rates 50 per cent. R.

Notes from Ohio.

The Board of Education of Columbus is dividing its patronage between the local Independent telephone company and the Central Union company.

The Simplex Interior Telephone company of Cincinnati will have an exhibit at the fall festival and exposition in that city.

The Home Telephone company of Findlay, Ohio, will commence work upon the construction of its system this week. The cables will be placed underground, and the plant will be completed by February 1st, if possible.

It is said that the telephone war at Ravenna is growing warm. A great many of the Bell patrons ordered their instruments out, and the company is now rebuilding the plant. The Home Telephone company has secured all the grocers and many of the other business men, nearly all of whom are patrons of the new company.

The United States Telephone company has filed two suits in the Common Pleas Court at Piqua, asking for restraining orders to prevent the collection of judgments secured in the court of Justice Frank Hardy, by Doctors Jesse Funderburg and Lois Alff, for $187.50 and $166.50, respectively. The judgments were secured for alleged medical services rendered an employe of the company, by its request. The company denies that it was ever served with summons in the cases and that it is indebted to the physicians for any amount.

The Portsmouth (Ohio) Telephone company now has its exchange completed and 450 telephones connected up, with 150 more to connect. Judge James M. Thomas was in that city a few days ago, making arrangements for connections with the United States Long-distance Telephone company's lines. Frank B. Finney, at a recent meeting of the directors of the company, was re-elected president and all the other officers were re-elected. Mr. Finney will manage the business for a time, at least.

The Union Telephone company of Glouster, Athens County, has been incorporated, with a capital of $15,000, to construct and operate a plant in that town. The incorporators are B. W. Pickering, L. R. Andrews, Des Autle, Alex Nelson, A. B. Allen and L. H. Embry.

Another incorporation formed the latter part of last week was that of the Bluffton Telephone company of Bluffton, Allen County. The capital stock is placed at $18,000, and the incorporators are Amos Geiger, Frank M. Haller, H. O. Brentley, James M. Brailey and W. H. Harper, Jr. The company will build and operate an exchange and toll lines at Bluffton and in that vicinity.

The telephone wires and poles in many sections of Ohio were badly injured by storms last week. At Circleville, Mount Vernon, Fostoria and other places the damage was quite severe. O. M. C.

The New Home Telephone company of Columbia, S. C., is just starting operations, with 125 telephones installed. A number of new connections are to be added in the near future at the rate of 20 a day.

American Telephone and Telegraph Company.

Boston, August 18.—During the last week the Boston banking house of Kidder, Peabody & Co. has taken over a large block of the four per cent. bonds of the American Telephone and Telegraph company, which mature July 1, 1929, and is placing them on the market for the Bell concern.

The bonds now floated are similar to the issue of $6,000,000 collateral trust bonds, maturing on the same date, which the Western Electrician reported several months ago as placed by the same Boston banking house. This block of bonds is offered at 99 and interest. The first block sold over the counter at prices ranging from 98 to 100. How many have been taken at this time by the banking concern is not stated, but it has been surmised to be about $4,000,000 worth. The total authorized when the directors voted on the matter was $20,000,000, however, and it is possible that more than $4,000,000 of the balance is to be put out now.

The company, since its rejuvenation, has been strengthened in assets, is capitalized at $100,000,000, has placed $10,000,000 cash in its treasury, as one result of the new issue of stock under the absorption plan which transferred the old Bell concern's assets to its successor, and is expanding its business materially. Back of the bonds are definite collateral securities, and at 99 they net the purchaser a little under 4.1 per cent.

Apropos of the new certificates to cover the recently authorized issue of 50,000 additional shares of New England Telephone and Telegraph company stock, it is stated that the second half will be ready for delivery November 16th. The first half were deliverable on and after August 16th. B.

Large Pacific Combination Reported.

A special telegraphic dispatch from San Francisco states that one of the largest combinations of capital ever effected on the Pacific coast is about to go into operation. All the telephone companies in California, Oregon, Washington, Nevada, Idaho and Arizona, it is said, have been consolidated under one gigantic corporation called the Pacific States Telephone and Telegraph company, which has a franchise granted in Oregon, and which will have its headquarters in Portland. This company is capitalized at $15,000,000. Of this $10,000,000 has been issued to stockholders in the old corporations, and $5,000,000 is held in trust to provide for future extension and improvements.

The companies said to be entering the combine are the Sunset Telephone and Telegraph company, Pacific Telephone and Telegraph company, Oregon Telephone and Telegraph company and Inland Telephone and Telegraph company. This does not mean that any opposition companies are bought out, for all four of the combination companies are sub-lessees of the American Bell Telephone company, and have hitherto been affiliated.

GENERAL TELEPHONE NEWS.

An Independent telephone company is a possibility at Orangeburg, S. C.

P. G. Farrow has sold the Linton (Ind.) Telephone company's plant to the Home Telephone company of Bloomfield, for $15,000.

The Raleigh (N. C.) Telephone company expects to begin business about October 1st. The city now has three telephone companies, including the one named above.

On Tuesday, September 4th, a meeting of the stockholders of the Spartanburg (S. C.) Citizens' Telephone and Telegraph company will be held to consider the advisability of issuing $50,000 of bonds.

The Huntinghurg Telephone company of Huntingburg, Ind., is out with an interesting circular which extols the merits of the telephone in general and the advantages of its own service in particular. A list of connections with towns in the neighboring counties is given, together with the officers of the company and other interesting reading matter.

In order to protect telephone users from paying rent to two or more telephone companies, in order to get the use of all the instruments in town, the Kinston (N. C.) Telephone company and the town of Kinston have made a contract whereby the company agrees to allow any future companies to connect their system with the Kinston Telephone company's system for use of all subscribers of each company.

A directory of 336 pages has recently been published by the New Long Distance Telephone company, which operates in Indiana and has its headquarters in Indianapolis. The book is said to be the most comprehensive telephone directory ever published in Indiana. It contains a complete list of the subscribers of the New Telephone company of Indianapolis and gives the names of the business and professional men in the exchange towns and toll stations throughout the state with which the New Long Distance Telephone company is connected.

National Telephone Equipment Company.

As is well known by the Independent telephone interests of the United States, the Detroit Switchboard and Telephone Construction company of Detroit, Mich., during a period of four years manufactured switchboards and general telephone apparatus for the Detroit Telephone company and the New State Telephone company. This company also owned the patents of and installed the system at New Orleans for the People's Telephone company. These three companies mentioned, operating in the aggregate about 20,000 telephones, did exclusively an exchange business, and the Detroit Switchboard and Telephone Construction company acted solely as a manufacturer devoted exclusively to making apparatus for these companies. When, however, these operating companies were bought by the Erie Telephone company and the Cumberland Telephone company (Bell interests) last April, the Detroit Switchboard and Telephone Construction company finding itself, so to speak, without customers, decided at that time to continue business under the same management as a telephone manufacturing company, soliciting trade from the Independent telephone interests. However, the company was at this time still controlled by the same interests that had affiliated themselves with the Bell, viz., the Erie Telephone company. Consequently, after a trial of several months, finding that the feeling of the Independent interests was so strong against any company or individual in sympathy with the Bell interests, the Detroit Switchboard and Telephone Construction company decided to abandon the attempt to manufacture telephone apparatus.

About this time W. F. Richardson, who had been purchasing agent of the Detroit Switchboard and Telephone Construction company for several years, but had resigned all connection with the company, conceived the idea of continuing the business under an entirely different management and backed by capital with no Bell affiliations, in other words, as an entirely Independent enterprise. Mr. Richardson's purpose was to separate the proposed new company absolutely from any suspicion of affiliation with the Bell company, but at the same time to organize a new company to get the benefit of the exploiture of apparatus well known and thoroughly tried, as had been the apparatus of the Detroit Switchboard and Telephone Construction company in the various exchanges operating under its system.

Meeting with every encouragement from Detroit and Michigan capital in the promotion of the company to be operated with a policy as above outlined, in June, 1900, the National Telephone Equipment company was incorporated, with the following-named gentlemen as its directorate: President, Edward H. Parker; vice-president and treasurer, Hugh O'Connor; director, William C. Sterling, Jr. Mr. Richardson was appointed secretary of the company. The company is capitalized at $100,000, of which $65,000 is paid in.

A glance at the names of the gentlemen organizing this new company will show that the National Telephone Equipment company starts business under very favorable auspices, and with a substantial backing. The gentlemen interested are all men who have made a success in their respective lines. This gives assurance of the permanency of the new concern, which is of value to Independent companies purchasing their equipment, in that they can rely, at all times, upon being able to get additional parts of the same system for extension or repairs.

President Edward H. Parker is secretary and managing director of the Detroit Sugar company and is very prominently identified with some of Detroit's most successful business enterprises. Vice-president and treasurer, Hugh O'Connor, is secretary, treasurer and manager of the Michigan Wire Cloth company, said to be one of the most influential and extensive industrial enterprises in Michigan. He is also prominently identified with many of Detroit's large business and financial institutions. W. C. Sterling, Jr., is well known throughout the entire telephone trade, through his extensive operation in telephone and telegraph poles. The Sterling yards at Monroe cover acres, and his firm has yards in various sections of the pole-growing country.

Secretary W. F. Richardson starts his new enterprise thoroughly equipped for its management. He will have charge not only of the National Telephone Equipment company's factory, but the disposition of its apparatus as well. Mr. Richardson has been, generally speaking, in the electrical business for 10 years. His experience has been largely in the supply business. It was these qualifications which so well equipped Mr. Richardson for the position as purchasing agent for the old Detroit Switchboard and Telephone Construction company, which work occupied his attention over a period of three or four years. Mr. Richardson is possessed of an extensive acquaintance with the electric fraternity of the United States, and his experience will be valuable to him in his management of the new company.

Fig. 1. Cabinet-making Department. Fig. 3. General Store Room. Fig. 2. Cabinet Assembly Room. Fig. 4. Instrument Store Room. Fig. 5. Switchboard Assembly Room.
NATIONAL TELEPHONE EQUIPMENT COMPANY.

Fig. 6. Shipping Room. Fig. 8. Factory Building. Fig. 7. Finishing Room. Fig. 9. Instrument Room. Fig. 10. Machine Shop.
NATIONAL TELEPHONE EQUIPMENT COMPANY.

The present purpose of the National Telephone Equipment company is to prosecute its manufacturing in the old factory of the Detroit Switchboard and Telephone Construction company, at 330 and 332 Lafayette avenue. A view of this very substantial plant is presented in Fig. 8. This factory has a very complete equipment. When running full blast employment is given to as many as 200 hands. The plant is thoroughly equipped not only for the manufacture of the metallic portions of the switchboard and other telephonic apparatus, but a portion of the plant is devoted to the manufacture of the company's own cabinet work. Of the accompanying illustrations Fig. 1 shows the machinery devoted to cabinet making, while Fig. 2 gives an excellent view of the assembly of the cabinet parts. Fig. 3 is a view in the general store room, and Fig. 4 shows the telephone store room. The switchboard-assembly room is pictured in Fig. 5. In Fig. 6 is shown the shipping room, in Fig. 7 the finishing room, and in Fig. 9 the instrument room. A clear idea of the machine shop, on the top floor of the factory, is given in Fig. 10. Adjoining this department are the laboratory and experimental rooms.

MANUFACTURERS AND DEALERS.

The Electric Appliance company, Chicago, has just issued its new telephone catalogue, No. 15. It is very complete and up-to-date, and is well arranged and handsomely printed. It should be in the hands of everyone interested in telephones and telephone-line construction.

The Eureka Electric company of Chicago reports an ever-increasing demand for its high-grade apparatus. Among some of the company's largest installations made recently may be mentioned a thousand-capacity equipment for the County Telephone and Telegraph company of Waterloo, Iowa, also an equipment for the central office of the Niagara Falls (N. Y.) plant. The company has just furnished a large transfer equipment for Fulton, Mo., and one similar in design and size for McPherson, Kan. It has contracts on hand calling for an entire new equipment for the Tri-city company of Clinton, Iowa, as well as an entire new outfit and equipment for Maquoketa, also Fulton and Lyons. This company says it has in operation at the present time over 700 high-grade Eureka metallic Express switchboards.

Two Revenues Instead of One or Electricity a By-product.[1]

By A. J. Stahl.

When the kerosene lamp superseded the tallow dip quite a number of people bought lamps and used oil that cost one dollar per gallon, because of the greater convenience and better light. When the gas plant was built in the city people used gas in place of the kerosene lamp, for the same reason. Afterward, when it was possible to have light by pushing a button, people paid larger bills for lighting their places of business and homes because of the greater convenience and more satisfactory light from electricity.

But a few years ago people sent a messenger, or went themselves, to deliver messages, feeling they could not afford to patronize the telephone, but when its convenience was fully understood, they felt they could not be without it, and a town of any size cannot be found to-day that does not have its telephone and electric-light plants. People advance in all directions, and especially in the direction of having things comfortable and convenient. It is that seeking after comfortable and convenient things, even though it entail some additional expense, that will cause every town and city to have and patronize a central-station heating plant. When patrons of the Yaryan hot-water plants are so well pleased as to say "they have no comfort like it," "no luxury they enjoy so much," that they "would pay an increased price for a home situated on the hot-water line," "that they would not do without it for twice the money charged," that they "would dispense with telephone, electric light, and gas for fuel, rather than to be without the hot-water heat from the central station;" when so general and universal satisfaction is given it will follow that, "once a customer, always a customer," and it is safe to predict that every town will have its central heating plant.

The amount of heat lost by the various buildings to the outer air is the same, whether supplied to the buildings by fuel burned in them, or at a distance and carried to them in water or steam. Inasmuch as there are as many heat units in a ton of good soft coal as in a ton of hard coal, if the soft coal is burned in an economical furnace, it will heat as much space as an equal amount of hard coal; hence, it follows that a ton of hard coal burned in numerous stoves and furnaces connected to many chimneys will warm no more space than a ton of soft coal burned in the economical furnace of a boiler and delivered to the buildings through hot-water radiators. There will be some loss in transmission to the various buildings of a central-station plant, probably 10 to 15 per cent.; hence, it will take from one and one-tenth to one and one-seventh tons of soft coal to equal a ton of hard coal in heating effect when burned for heating purposes only.

A coal-gas plant that sold gas only would make some money in the larger cities; but if they wasted the by-products, tar and coke, they would be failures in smaller cities. In the same manner, the heating plant that wasted the power that could be produced with the heat, by first putting it through an engine in the form of steam before using it to warm the buildings, would not be profitable in the smaller cities, although in the larger cities it might be able to pay interest on investment in buildings, ground, boilers, station apparatus and pipe line, and for the wages of superintendent, fireman, and for the fuel.

Power, as we all know, is produced by the presence of heat in water; by the expansive force of water when heated, and not by the obliteration of heat units. If the latter occurred, inventive genius would have found a way ere this to utilize more than is commonly supposed to be taken out of the steam in its transmission from the boiler to exhaust. It is my opinion that if the heat lost by radiation from the steam-pipe line and the cylinder and parts of the engine were correctly measured, the difference in the amount of heat between that in the exhaust and what was in the live steam would be accounted for. Grant that as much as 10 per cent., the commonly supposed amount, of the heat of the live steam is lacking in the exhaust, we still have 90 per cent. of the heat absorbed by the boiler to catch and transmit to warm buildings in the central-station plants, having first utilized the heat for power. We, therefore, can have the electricity, produced by first putting the heat through an engine, as a by-product, taking but 10 per cent. more fuel for our heating and electric plant than as though we burned coal for heating only. The electricity only costs that 10 per cent. of the fuel bill, and interest on the investment in engines, dynamos and lines; for the investment in buildings, ground and boilers, as well as wages of engineer and firemen, and the fuel, have been paid by the heating plant.

You will notice in that way of working we are sure to obtain two results from the investment in buildings, ground and boilers, and the wages of engineer and firemen, and from the fuel bill. Sale for the electricity produced can be made, not only for lighting, but for power. Such a combination would make it possible to sell power at so moderate a price as to secure a considerable day load, and so keep the electric part of the plant busy and earning something 24, instead of about six, hours a day. The power load would cost a trifle, and add considerably to the gross income.

Heating plants are sure to be built in every town, and electricity is the natural thing to be associated with it, and, as it will be a by-product, can be sold cheaply. As the gas plant cannot afford to waste the coke and tar, neither can the heating plant afford to, nor will it, waste the power that can be produced by first putting the heat through the engines before using it to warm buildings.

1. Read before the Ohio Electric Light association, at Toledo, O., August 14, 1900.

International Association of Municipal Electricians.

The fifth annual meeting of the International Association of Municipal Electricians is to be held in Pittsburg, Pa., on September 25th, 26th and 27th. The headquarters will be at the Monongahela House and all sessions of the association will be held in the banquet hall of the hotel. Papers on the following-named subjects will be read and discussed: "Benefits to be Derived from Our Association," by Captain William Brophy, chief electrician wire department, Boston, Mass.; "Contact Points," by Frank C. Mason, superintendent of police telegraph, Brooklyn, N. Y.; "Trials and Troubles of Instituting and Enforcing Municipal Inspection and Control," by M. G. Canfield, superintendent fire-alarm telegraph, Grand Rapids, Mich.; "Automatic Fire-alarm Systems," by Charles Burger, manager Boston Thermostatic and Automatic Fire Alarm company, Boston, Mass.; "Advantages and Disadvantages of Carrying High and Low-potential Conductors Upon the Same Poles;" this subject will be presented by an able electrician for general discussion.

The social features of the convention include a trolley ride on special cars over the Consolidated Traction, United Traction and the Monongahela Street Railway companies' lines on Tuesday evening, carriage rides over the boulevards and through the parks, for the ladies, Wednesday afternoon, and theater parties and inspetcion of some of the large iron and steel mills in the evening. Thursday afternoon and evening there will be an excursion on the steamer Mayflower, down the Ohio River to Davis' Island Dam, seven miles and return, then up the Monongahela River, 45 miles and return, during which time there will be a banquet served and a musical programme carried out. Arrangements will also be made for members to visit the plants of the Westinghouse companies and the Standard Underground Cable company.

The association has issued a very attractive and handy booklet for the use of members and visitors. It is bound in a stiff cover and its 47 pages contain the programme, lists of officers and committees and considerable interesting data concerning Pittsburg and its various industries. The following-named gentlemen are officers of the association: President, William Brophy of Boston, Mass.; vice-president, G. F. MacDonald of Ottawa, Ont.; treasurer, Adam Bosch of Newark, N. J.; secretary, George H. F. Cottell of Boston, Mass.; financial secretary, Burt C. McAllister of Bradford, Pa.; executive committee, Morris W. Mead of Pittsburg, W. Y. Ellett of Elmira, N. Y., J. W. Aydon of Wilmington, Del., F. G. Boyd of Baltimore, Md., and F. C. Mason of Brooklyn, N. Y.

Canadian Electrical Association.

The Canadian Electrical association has issued an attractive little booklet containing the programme, list of papers to be read and other information concerning the tenth annual convention of the association, which is to be held at Kingston, Ont., on August 29th, 30th and 31st. The headquarters of the convention will be at the Hotel Frontenac, while the sessions will be held at the city hall. Appropriate badges have been provided for the members. The papers to be read are as announced last week. In addition to the searchlight excursion among the Thousand Islands, tendered by the mayor and citizens of Kingston, on Wednesday evening, the social features will include the annual banquet Thursday evening, at the Hotel Frontenac, excursions the following afternoon and a spectacular band concert Friday evening, introducing an electrical musical fantasy of the Battle of Paardeberg, with electrical effects and fireworks. The following-named gentlemen are officers of the association: President, A. A. Dion, Ottawa; vice-presidents, E. E. Cary, St. Catherines, and P. G. Gossler, Montreal; secretary-treasurer, C. H. Mortimer, Toronto.

Tesla's Latest Scheme.

As noted in this week's patent record of the Western Electrician, a patent has been granted to Nikola Tesla on the method of insulating conductors which consists in freezing water or other mixture by artificial means around the conductor to be insulated and maintaining the insulator in its frozen condition. Much has been said about the revolutionizing character of the invention by the daily press. Just how the system which requires the maintenance of a set of refrigerating plants along a transmission line is to be superior to present systems is not pointed out.

American Awards at the Paris Exposition.

The list of awards to American exhibitors at the Paris Exposition was made public on August 17th. The United States secured 1,981 awards, of which 220 were grand prizes, 486 gold medals, 583 silver medals, 422 bronze medals, 270 honorable mentions, and a long list of gold, silver and bronze medals for collaborators.

In Group IV., which comprised machinery, the following-named companies received grand prizes: Worthington Pumping Engine company, Batcheller Pneumatic Tube company, Brown & Sharpe Manufacturing company, Pratt & Whitney company, E. W. Bliss company, Niles Tool Works company and J. A. Fay & Egan company. The companies awarded gold medals in this group were as follows: Ball Engine company, William Sellers company, George F. Blake Manufacturing company, Tinius Olsen & Co., Otis Elevator company, Rand Drill company, Charles A. Schieren & Co., Crane company, Ingersoll-Sergeant Drill company, Shaw Electric Crane company, Simonds Manufacturing company, Chicago Pneumatic Tool company, Morse Twist Drill and Machine company, Cincinnati Milling Machine company, Hendy Machine company, Warner & Swasey, Norton Emery Wheel company, Bement Mills company, E. C. Atkins & Co., Gisholt Machine company, Jones & Lamson Machine company, F. E. Reed company, Deering Harvester company, Bullard Machine Tool company and Pond Machine Tool company.

Grand prizes in Group V., appertaining to electricity, were awarded to the American Steel and Wire company, E. C. Acheson, Rowland Telegraphic company, Western Electric company and the John A. Roebling's Sons company. Gold medals in this group were awarded to the following-named companies: Bullock Electric Manufacturing company, Lorain Steel company, Western Electric company, Alvin Manufacturing company, National Carbon company, Tiffany Glass and Decorating company, C. J. Toerring company, Ward Leonard Electric company, Helios-Upton company, Holophane Glass company, Hart & Hegeman Manufacturing company, Edison Phonograph company, Weston Electrical instrument company and Mica Insulator company.

Among the companies mentioned as receiving awards in the liberal-arts section were the Brown & Sharpe Manufacturing company and the Ferracute Machine company. In the civil-engineering and transportation section, in a long list of names, appear those of the Boston Transit Commission, Boston Terminal company, Baldwin Locomotive Works, Pressed Steel Car company, J. G. Brill company, Standard Electrical company of California, American Steel and Wire company and the American Electric Vehicle company. The mining and metallurgy list contains the following-named companies: American Steel and Wire company, Ingersoll-Sergeant Drill company, M. C. Bullock Manufacturing company, Rand Drill company and the John A. Roebling's Sons company. The Automatic Electric Clock company of Chicago received an award in the varied-industries group.

Prospective Improvements in South Africa.

In an article entitled "Trade in South Africa," in a recent consular report, United States Consul-general J. G. Stowe of Cape Town speaks as follows concerning prospective improvements in that locality:

"The colony of Natal (north) has suffered much destruction, and it will be necessary to rebuild and re-equip the coal mines with new machinery, and the present high prices for imported coal will be an incentive for Natal to increase production. The docks at Durban show a wharfage of 5,000 feet, and more will be constructed. Pietersmaritzburg, the capital, proposes to borrow about $375,000 for the installation of an electric street railway, while throughout the whole colony the telephone lines will be improved. Expressions of a desire to substitute conduits for overhead trolley are noted.

"In Cape Colony, after the war, many of the cities will build new waterworks and cold-storage plants, and municipal improvements of various kinds may be expected. New lines of railway, ordered by Parliament before the war, will be completed.

"Johannesburg, built as were some of the 'boom' cities of the United States, will be largely reconstructed. The old single-horse railways will disappear, a better system of telephones must be instituted, the water supply and sewerage system will be modernized, the electric-light service extended, and there will be extensive development of mining."

Is Electricity a Medicine?

The question has been raised in Minneapolis as to whether electricity, administered as a cure for disease, becomes a medicine. The State Board of Medical Examiners of Minnesota contends that those administering electrical treatment for bodily ills should be licensed the same as any other class of medical practitioners. The matter will probably be tested in court soon.

Losses From Electrical Fires.

In the printed proceedings of the thirty-fourth annual meeting of the National Board of Fire Underwriters considerable space is devoted to fires resulting from electrical causes. The electrical committee of the board consists of Henry H. Hall, chairman; J. H. Washburn, James Nichols, R. Dale Benson and H. F. Atwood. The report is as follows:

The attention of your committee has been especially directed to losses from electricity, in regard to which the gravest apprehensions are entertained. The quarterly fire report of the electrical bureau of April 10, 1900, carries the listed fires from this cause up to 2,650. The Chronicle fire tables for 10 years back show the number of fires from the same cause and resulting losses as follows:

	No.	Loss.
1890	121	$ 1,245,971
1891	116	2,294,206
1892	163	2,966,536
1893	238	3,204,587
1894	217	3,222,492
1895	249	1,852,601
1896	363	2,238,270
1897	469	5,057,350
1898	366	4,999,730
1899	750	6,428,815
Total ten years	3,052	$33,510,558

When it is considered that electricity is a cause of fire operating for the most part out of sight, behind walls and under floors, and that the evidence of it, like the evidence of an incendiary, is often destroyed by the fire, so that the probability is that the danger has been underestimated rather than magnified, your committee believes that the subject should have your careful consideration. On April 26th, by special circular, your chairman requested each member of the board to give him a schedule of fires from electricity since January 1st last. The replies, up to the time of this writing, had not generally been received, but enough data had come to hand to show that companies are suffering severely from this cause. A blank was also sent by your committee to cities of 20,000 population and over to ascertain whether ordinances on the subject were in force, and whether they embraced the national electric code in their provisions. It is intended to follow this matter up with a view of inducing municipal action where such has not been taken. It will be remembered that for years the electrical bureau has done much efficient work on these same lines in the West.

Electrically Operated Plate-glass Works.

A plant that was visited and inspected with considerable interest by the delegates to the convention of the Ohio Electric Light association at Toledo recently was that of the Edward Ford Plate Glass company, located at Rossford, about five miles from Toledo. This plant is said to be the only plate-glass works in the country that is operated by electricity.

The boiler plant comprises a battery of eight 500-horsepower Sterling boilers, equipped with Playford & Murphy stokers. The generators consist of four 1,000-kilowatt and one 350-kilowatt revolving-field type, three-phase, alternating-current machines, generating at 580 volts. These are driven by a McIntosh & Seymour 27 by 54 by 42-inch compound engine, revolving at 122 revolutions a minute, and a Russell 30 by 60 by 30-inch cross-compound engine, with a speed of 120 revolutions. A motor-generator set, consisting of a 300-kilowatt induction motor, direct-coupled to a 150-kilowatt, 125-volt, direct-current generator on one side and a 150-kilowatt, 330-volt, three-phase, alternating-current generator on the other side, is also provided. A 100-kilowatt, 125-volt, direct-current generator, coupled to a 150-horsepower Ball engine, is used for lighting purposes.

The grinding shed of the glass works contains 20 200-horsepower and 24 100-horsepower induction motors. These motors are said to be the first of their type to be operated successfully at variable speeds. There are also in this building four transfer cars, operated by General Electric 125-volt, direct-current motors. The pumping station is equipped with four 50-horsepower induction motors, direct-coupled to four Stilwell-Bierce triplex pumps. The machine shop, pot house, plaster house, mix house, and all the smaller places are operated by induction motors, ranging from five horsepower to 50 horsepower in size. Transfer cranes are equipped with 125-volt, direct-current motors. The equipment is of the General Electric company's manufacture throughout, and was installed by Frederick B. Perkins.

Examinations for Civil Service Positions.

The examination for the position of physicist in the United States Geological Survey, which the Civil Service Commission announced for August 21st and 22d, has been postponed to September 21st and 22d. An examination for electrical expert and draftsman in the Bureau of Equipment, Navy Department, at a salary of $1,600 a year, will be held September 18th, 19th and 20th. An examination for assistant mechanical draftsman in the Bureau of Construction and Repair, Navy Department, at a salary of $4 a day, will be held September 18th and 19th. These examinations will take place in any city where the commission has a local board of examiners. Persons who desire to compete should at once apply to the United States Civil Service Commission, Washington, D. C., for application forms 304 and 375, which should be properly executed and promptly forwarded to the commission.

Universal Cord Spool.

The two accompanying cuts, representing a new incandescent-lamp cord spool, tell their own story almost without words. This Universal cord spool, as it is called, is a very neat and exceedingly simple device, through which the length of an incandescent-lamp cord can be quickly adjusted. The manufacturer claims it may be quickly attached to any lamp cord, always hangs straight, cannot slip and there is no loop to dangle about or no socket to be removed from the lamp end of the wire. This useful little device, which is protected by a patent allowed A. Meyer, president of the Crescent Manufacturing company, 52 Jackson boulevard, Chicago, Ill., and manufactured by that company, is made of hardwood, in natural, green or cherry finish.

The application of the device is exceedingly simple: To shorten the length of a cord of any drop light, it is only necessary to slip the cord into the notch at the end of the device, wind as much cord about the spool as desired, and then slip the cord into the notch at the other end of the spool.

The feature of the device which will recommend it to factories and other establishments, where a great many lamp cords are in service, is its extreme simplicity and applicability to cord of practically any size or quality. When the cord is in place it is, too, practically a lock, in that it is not possible for the cord to slip and allow the lamp to fall or its height to get out of adjustment.

Solid-wire Joint Controversy.

The statement in last week's issue of the Western Electrician that F. W. Maxstadt had brought suit against the American Electric Fuse company of Chicago for alleged infringement of a patent issued to Mr. Maxstadt on August 14th for a solid-wire joint has brought forth a statement from Frank G. Jones, president of the American company. Mr. Jones states that he and Mr. Maxstadt were formerly equal owners of the American Electric Fuse company and then manufactured what was known as the American improved joint. This joint was found to be an infringement on patents owned by the C. McIntire company of Newark, N. J., and after the latter company had brought suit an agreement was reached whereby the American company was made the sole licensee of the American joints under the McIntire patents. Meanwhile, continues Mr. Jones, Mr. Maxstadt had assigned all his rights in the American company to Mr. Jones, and on June 11th applied for the patent now in suit on what Mr. Jones asserts is the identical joint manufactured by the American company. Mr. Jones adds:

"The right of the American Electric Fuse company is resting on two grounds: First, it was the original manufacturer of the American improved joint, having made it for over a year before Maxstadt's patent was applied for, though, at that time infringing on the rights of the pioneer patent of the McIntire company; second, it is expressly licensed by the McIntire company, and under the original and pioneer patents, to manufacture this joint, so that a suit against it is in fact a suit against the McIntire company.

"Our company will continue to manufacture and sell the American improved joint, to all its customers and to the trade, at the same prices as heretofore, and will protect all its customers against any suits or other damage.

"The C. McIntire company, owner of the original patents, will begin suit against Mr. Maxstadt, at once, if he manufactures a single joint, and will also sue for damages any person or company using or selling any joint manufactured by any other company than the C. McIntire company of Newark, N. J., or our company. Our company will force the pending case to an immediate hearing, and will collect full damages for the filing of the suit."

Death of Colonel J. J. S. Wilson.

Colonel John James Speed Wilson died at the Alexian Brothers' Hospital, Chicago, on August 19th, at the age of 65 years. Colonel Wilson was an old telegrapher, commencing his telegraphic career as manager at Little Fort, now Waukegan, Ill. When only 16 years old he superintended the Hotchkiss lines between Chicago and Madison, Wis., and in 1851 took charge of the office at Springfield, Ill. During the war Colonel Wilson was given charge of the military-telegraph system in his district, and in 1861 was commissioned colonel of volunteers by Governor Yates. He entered the service of the Western Union Telegraph company in 1866, and for a long number of years was superintendent of the first district of the central division of the lines of that company, with his headquarters at Chicago. Colonel Wilson is survived by a widow, a daughter and a son, the latter, Charles Wilson, being general manager of the Bell Telephone company of New York.

Merchandise on Electric Railroads.[1]

In some senses the most interesting feature of the last few years' development in electric railroads, whether in public streets and highways or on rights-of-way through private property, has been the large proportion of what may be called long-distance or interurban lines; and coincidentally with this phase of development, or as a result of it, has been the introduction of freight and express cars. A railroad track of any kind, light or heavy, broad or narrow, when laid through a territory before dependent on wagon roads alone, becomes a great improvement the moment it is finished, and the need of the people of such territory for a common carrier—a company offering conveyances which will carry anything susceptible of transportation—is at once apparent. Whatever purpose the road may have been built for, some demand for merchandise transportation at once arises.

In view of these obvious conclusions, it is somewhat surprising that freight or express cars have not been introduced on street and country electric lines much more rapidly than they have. But whatever may have been the past attitude of such companies, it is evident that within the last few months the opportunities of doing useful and profitable service by running freight and express cars have been much more generally recognized, and reports that this department is to be fostered by this or that company are now heard frequently. In making inquiries as to the extent of this movement we have not secured much definite information; and some that we have secured is not in shape for publication; but some of the notes which we have received are, nevertheless, worth putting on record, and we give them below. Taking a half-dozen cities at random we shall see that the prospects of a considerable development are worth attention.

Anderson, Ind.—The Union Traction company, operating electric lines between Anderson, Alexandria, Elwood, Marion, Muncie and Indianapolis, runs express cars on a number of its lines, and the express department is growing rapidly.

Birmingham, Ala.—The Birmingham Railway and Electric company has been doing some freight business on its interurban lines for two years or more, and the receipts from merchandise have been $1,000 a month and higher.

Buffalo, N. Y.—In Buffalo we find the Buffalo, Hamburg and Aurora line about to open for business with freight cars, which will make probably three trips every day.

Chicago.—The Chicago and Milwaukee line has been doing an express business for about a year between Evanston and Waukegan, and it is believed that a good demand will be developed, although the business is yet small.

Cleveland.—Cleveland, as is well known, is the diverging point of a number of long electric lines. The Cleveland and Chagrin Falls electric road has carried freight and express for three years, and the business is still increasing. East of Chagrin Falls this line does not compete with any steam road and the business is likely to be enlarged. We judge that the company intends to make "rates which will move the traffic."

The Cleveland and Eastern, which has 55 miles of line, carries all kinds of freight, including coal, feed, lumber and other heavy merchandise. The business has been running but a few months, but it is increasing rapidly. The company has three freight stations and will soon have two more. Most of the country through which this line passes has never before had convenient communication with markets. The road has only three or four cars of its own which are devoted to merchandise, but its income from this department has been about $3,000 a month.

The Electric Package company of Cleveland does express business over four different roads centering in that city, its functions being the same as those of the old express companies. This concern has been running two years, and its business is increasing.

Dayton.—The Dayton and Xenia Traction company, with 32 miles of line, has begun freight and express business since the beginning of the present year. The volume of traffic is constantly increasing.

Detroit.—The Detroit, Rochester, Romeo and Lake Orion railway, operating 55 miles of line and building 40 more, has lately begun to carry merchandise on a small scale, but expects to increase the business rapidly. There are many towns on the line which have no other good connection with Detroit, and the public demand for freight accommodations is very strong. The Detroit, Ypsilanti and Ann Arbor railway, 54 miles long, has been doing for some months all of the freight business that it is prepared to handle, and, indeed, has not been anxious to stimulate that business at present. Packages are loaded in the open street in Detroit and distributed anywhere along the line, as required. The Detroit and Northwestern road has 31 miles of single track and 29 miles which is double track. About 21 miles of this is on private right-of-way, abutting on the highway. This road is doing a small freight business and has recently hauled 100

1. From the Railroad Gazette.

carloads of logs from points along the line, delivering them to the Pere Marquette railroad. The road also carries milk, as well as package freight, and has freight houses at Detroit, Farmington, Northville and Pontiac, presumably very small, but sufficient for present business. This freight business has only begun on this road within three or four months, and the road is not yet prepared to handle what comes to it. There are six suburban electric railroads running out of Detroit, all of which we believe do some freight business, which is a great convenience to the country merchant, who can telephone in and within two or three hours get his goods at his store door.

Youngstown.—The Mahoning Valley railway, operating 38 miles of line, has five freight stations and has been doing a light merchandise business most of the time for three years. The experiment was intermitted for a time, but there is a strong demand for its resumption, and the company now intends to extend the freight service to towns which have not before been accommodated.

BOOK TABLE.

COMPOUND ENGINES. A series of lectures by F. R. Low, reprinted from the columns of Power. New York: The Power Publishing company. 1900. Pp., 52, with 37 diagrams. Price, 50 cents.

This neat pamphlet is a very clear exposition of the theory of the compound engine, and the matter is presented in such a manner that it can be readily understood by the practical steam engineer. The subject is introduced with a brief but comprehensive outline of the laws of expansion of steam, and the gains and losses attending expansion. Then follows a discussion on cylinder condensation, effects of changing the cut-off, economy to be gained by compounding, etc. The next chapter treats of the combining of diagrams from compound engines in very clear terms, while the last chapter is devoted to receivers for tandem and cross-compound engines. The diagrams form a valuable and instructive feature of the work.

CORRESPONDENCE.

London Letter.

London, August 7.—The foundation stone of the new municipal electric station in the East End of London was laid last week by Mr. John Harris, chairman of the Whitechapel District Board of Works. For some months past, thanks to the erection of a temporary station, the main thoroughfares in this part of the metropolis have had the advantage of electric lighting, arc lamps having been erected in such arteries as Whitechapel Road, Commercial road, Commercial street and High street. But these busy, teeming arteries, wherein the stream of traffic is almost unceasing, stand less in need of bright illumination than do the side streets connecting with the courts and alleys that belong to Whitechapel's "dark corners." Beyond question, then, will the completion of the installation come as a boon and a blessing to all who dwell in, or are called by business to, these populous regions. But there was a further cause for congratulation in last week's ceremony, in that it also saw the opening of a new refuse destructor, built in accordance with the most modern, scientific principles, adjoining the site of the electricity-supply station. By utilizing the heat produced in cremating the refuse to generate electricity at this station, a practical economy will be effected. Some particulars of the new electric works may be interesting. The boiler house, 24 feet below the ground's surface, will contain eight water-tube boilers, each capable of producing 5,500 pounds of steam per hour, while the coal bunkers adjoining this section will accommodate 720 tons of fuel. A large octagonal chimney shaft, 216 feet in height above the London clay and 185 feet above the ground level, is also to be built. Externally the supply station will be faced with red bricks, relieved by dressings of Bath stone, while, with glazed and molded brick work, the interior promises to be by no means unornamental, notwithstanding the strictly utilitarian character of the building. When completed the works will have cost $525,000.

One of the most serious obstacles to men of comparatively small means in the way of adopting electric lighting for domestic purposes is the first cost of installation. In several towns in the north of England a system of assisted wiring is being adopted. It is considered that if the cost were spread over a period of three years, a new class of customers would speedily be reached. In a small town, where electric lighting is controlled by the municipal authorities, this plan will probably work well. The proposal is to empower each householder desirous of taking the light to obtain and submit to the Town Council tenders for wiring from three tradesmen. One of the tenders will be accepted by the council, who will pay the tradesman, afterward recouping themselves for the outlay by means of small installments received from the consumer at regular intervals during the period mentioned. The plan, which is a modification of the hire-purchase system, has much to recommend it. It will insure the prompt settlement of the tradesman's bill and make it easy for the consumer. The wires and fittings, of course, will remain the property of the Town Council until the last installment is paid.

English manufacturers are beginning to realize the tremendous growth of the iron, steel and engineering industries in the United States and the great need there is for them to bestir themselves if they are to retain their hold on the home and neutral markets for iron and steel goods of all descriptions. They know that in no branch of the engineering industry is this need more pressing than in the electrical engineering. After a long spell of comparative stagnation, the electrical engineering industry in this country has entered upon a period of booming trade, and orders are in hand which would provide work for treble the number of people now engaged in the industry. This period of boom has long been foreseen by electrical engineers, and is due chiefly to the rapid change from horse to electric traction in the tramway systems all over the country. The British Electric Traction company, which deserves great credit for its pioneer and development work in connection with this change, is interested in no fewer than 57 companies and undertakings, in which electricity is already used or is about to be used for traction purposes. On account of the inability of British electrical engineering firms to supply the necessary plant and machinery, a very large number of orders in connection with these developments are going to the United States, and doubtless in some cases to Germany. In the face of these facts the Associated Chambers of Commerce, it is said, is about to institute an inquiry as to whether the financial and technical management of the industry in this country is to blame for the unsatisfactory state of affairs, or whether the inability of English manufacturing firms to cope with the present demand is due to external causes.

The Southeastern and Chatham and Dover Railway companies made arrangements months ago with Marconi's Wireless Telegraph company for the installation of the latter's apparatus on their boats running between Dover and Calais, but the General Postoffice prevents it from being carried out. According to Mayor Flood Page, managing director of the Marconi company, the installation would be used only for the business purposes of the railway company, and would not exist for a system of public messages. Perhaps some day official red tapeism may be so modified that the company will be able to get a Postoffice license.

The Metropolitan and District Railways are to be commended for their decision to go into the question of adopting electricity on the Inner Circle. The fumes at several underground railway stations during the last few weeks have been detestable. At the ordinary half-yearly meeting of the company, held last week, the chairman, J. S. Forbes, said that the experimental electric train between Kensington and Earl's Court had worked with highly satisfactory results since May 21st. It had been established that electric traction could pull a heavier load than the ordinary locomotive and also that it could pull it quicker. In view of the importance to the Metropolitan and District companies of adopting electricity as their motive power, a committee of three members of each board had been appointed to inquire into the question with respect to the working of the Inner Circle. The three objects in view were the purity of the atmosphere, the capacity for carrying more weight, and, thirdly, more economy.

At the Crystal Palace an exhibition is being given of the Reno inclined elevator, which is intended to take the place of the ordinary elevators, or lifts, as they are called here. The system, it is understood, has been in operation for some years in New York, Philadelphia and Chicago, and is said to be much appreciated. This moving electrical stairway will be especially useful for stores, restaurants, public buildings and underground railways. The ordinary elevators are not popular with ladies, and these will find the Reno inclined elevator an agreeable substitute. Five of these elevators are also in operation at the Paris Exposition.

As already announced in this column, experiments in wireless telegraphy are about to be made between Ilfracombe and the Mumbles, on the Welsh coast, a distance across the Bristol Channel of about 25 miles. For this purpose a pole 115 feet high—really three poles, skilfully spliced—has been erected at Ilfracombe by the postal-telegraph employes, and a similar pole has been fixed at the Mumbles. It is understood that the system of Sir W. H. Preece, invented before that of Marconi and improved recently, will be tried.

The Central London railway, or, as it is popularly called, the "Twopenny Tube," has so met a public demand as to compel the directors to consider the practicability of a quicker service. Over 90,000 passengers per day were carried last week. The new line is like a new toy. London has gone wild with it, and not only Londoners, but people from all over the world. Even Americans express surprise at the perfection of the thing, and they crowd into the "tuppenny tube" just for the sake of being jammed into the cars, to hold on to the straps as they do in the elevated road in New York. Home sickness drives them down to the bowels of the earth, because down there London has provided for them a thing that reminds them of their up-to-date home. The revolution in rapid transit has come, and if the crowds that besiege the new line are an indication, then it has not come too soon.

W. H. B.

New York Notes.

New York, August 18.—Electric traction was put permanently in operation on the Lexington avenue branch of the Brooklyn Rapid Transit company's elevated system last Monday.

The first test of a very much needed improvement in telephone service was made the past week when the steamship Auguste Victoria of the Hamburg-American line reached her wharf and a telephone pay station on board was immediately put in operation, connecting with the shore. The wire is run out through a port hole and a plug connection made with a line running to the nearest central office. The telephone pay station on board did a rushing business. It is probable that all the big passenger-steamship lines will adopt this plan of telephone connections while vessels are at wharf.

General George W. Wingate, representing the Brooklyn Union Elevated Railroad company, purchased Wednesday at public auction in the Real Estate Exchange in Brooklyn the Brooklyn Elevated Railroad company for $174,837.03. The sale was conducted by William Wills, receiver of the Brooklyn Elevated Railroad company. The old company was merged into the Brooklyn Union company through reorganization proceedings, but it was alleged by the receiver that certain properties had not been acquired by the new company at the time of the sale in foreclosure proceedings of the first and second mortgages. This property was valued at $174,837.03, the amount bid by General Wingate. As soon as the certificate of sale is filed the old Brooklyn Elevated Railroad company will be wiped out of existence.

A preliminary statement of the Brooklyn Rapid Transit company's report for the year ended June 30, 1900, has been issued. The report shows an income of $11,768,550 and expenses, including fixed charges, of $11,241,778, leaving a surplus of $526,772. Last year there was a deficit of $201,881. The expenses are divided as follows:

Maintenance of way	$ 415,729
Maintenance of equipment	882,183
Operation of power plant	964,665
Operation of cars	3,551,476
General expense	494,530
Damages	797,790
Taxes	736,721
Net fixed charges	3,398,684
Total	$11,241,778

Sidney Dillon Ripley is conducting a fight in the village of Hempstead, L. I., in the interest of the owners of automobiles. A number of the city people who are there for the summer brought automobiles with them. The horses belonging to the countrymen do not take kindly to the machines, and some have been scared by them. The horse owners protested against the speed at which the automobiles were run, and the village trustees of Hempstead have started out to cut it down. They have prepared an ordinance which provides that automobiles and other horseless vehicles must not travel through the village at a greater speed than six miles an hour, and when passing another vehicle, the speed must be reduced to three miles an hour. Mr. Ripley has addressed a communication to the trustees in which he says this ordinance will effectually banish the horseless vehicles from the village. It is unjust discrimination, he says, as bicycles and horsemen are permitted to go along at a considerably greater speed. Mr. Ripley is being backed up by many of the citizens of Hempstead.

M. L. G.

New England News.

Boston, August 18.—The Boston Elevated Railway company filed affidavits this week denying infringement in the suits brought against it by the General Electric company in the United States Circuit Court here, for alleged infringement of patent on controllers, which the Boston Elevated has adopted for its new elevated cars. Among the affidavits is one by President Bancroft of the elevated road. The Sprague company, which was awarded the contract to equip 60 cars, after the competitive tests made last spring, and later was given an order for 40 additional, has given bonds to defend the Elevated company in any litigation over the patent rights claimed by the Sprague people.

The first spadeful of earth was turned August 14th in East Boston on Section B of the tunnel

which is to run 18 feet below the harbor bottom from "the island ward" to the old city of Boston proper. Like the subway now in operation in Boston, the new tunnel will be utilized for transit by means of electric cars. The contractors will receive approximately $1,000,000 for their work on this section, the steel material being supplied. It is to begin near the water front in East Boston and will end nearly 4,500 feet distant on the other side of the channel, about June 15, 1903.

At the annual meeting of the Boston Electric Light company the directors were re-elected, with the exception that Isaac T. Burr succeeds Dexter N. Richards. The treasurer and clerk, Samuel S. Sias, was also re-elected.

The Montville Street Railway company, which connects the cities of New London and Norwich, Conn., in a statement of its earnings, shows gross receipts from June 5th to August 12th of $19,500 and estimated net receipts during the same period of $12,000. This earning is nearly equal to the five per cent. annual interest charge on the company's $250,000 bonds. B.

From the Buckeye State.

Columbus, Ohio, August 18.—The Chillicothe Construction company of Chillicothe, Ohio, has been incorporated, with a capital stock of $10,000, to manufacture and deal in electrical equipment and to purchase and construct electric-railway, light and power plants. The incorporators are O. F. Dilman, James M. Tomlinson, Sam K. Pine, Y. K Centone and James K. Newcomer.

The Citizens' Electric Light and Power company of Sandusky has been incorporated, with a capital stock of $100,000. The persons whose names appear as incorporators are John Sherwin, J. B. Hanna, B. Mahler, H. A. Everett, W. H. Price, James B. Hoge, and George A. Stanley. This company will be intimately connected with the Sandusky and Interurban Railway company and will, in all probability, furnish power for part of the line when completed from Hurn to Lorain. The plant may also furnish light for the city of Sandusky, or a portion of it.

The city electrician of Cincinnati has been instructed to have all permits to companies for stringing electric wires stamped with a condition that the wires must be properly insulated to prevent injury to shade trees.

The financial managers of the Urbana, Mechanicsburg and Columbus Electric Railway company inspected the proposed route of the road a few days ago and express themselves as very well pleased with the prospects.

The Ohio Valley Electric Railway company has been incorporated in Kentucky for the purpose of building an electric railway from Huntington, W. Va., to Ironton, Ohio. The company places its capital stock at $1,000,000. Thomas J. Kyan and Henry Cato of Huntington are among the prominent men whose names appear upon the articles of incorporation.

Electrician Harlan of the Ohio Valley Electric Railway company is making a trip among the manufacturers of Ohio and other states for the purpose of buying machinery for the road.

The Salem (Ohio) electric-light plant was damaged by lightning during a storm one day last week.

The lines of the traction company at Hamilton, Ohio, are being extended to the east end of town on the Grand boulevard.

It is stated, upon good authority, that the National Traction company will begin work on its line in Clark County next week. Franchises have been secured through Franklin, Madison and Clark counties, but the town of London, in Madison County, has demanded that the road carry passengers through the corporation free if granted a franchise. The road will enter Columbus over the right-of-way on West Main street. It will enter Springfield over the tracks of the Columbus, London and Springfield road, if the council of that city refuses to grant it a franchise.

The managers of the Toledo, Fremont and Norwalk railway say that cars will be running on the road between Fremont and Toledo within a few days. Detailed arrangements have not been made in regard to stations and some of the other minor points, but all are anxious to get the line in operation, and these matters can be looked after later on.

New Albany, Ind., will advertise a 40-year franchise for a street railway, to be sold to the highest bidder. If there are bids for the franchise, and it is sold, the council has made arrangements to pass an ordinance granting the franchise.

It is said that a syndicate has been formed in New York to build a number of electric roads in Northern Ohio. A line from Toledo to some Michigan point is said to be one of the schemes. A. E. Townsend is said to be one of the officers of the company which will build the roads, and the proposed line from Barberton to Massillon will be taken into the plan should the capitalists take hold of it.

A meeting of the directors of the Dayton and Xenia Traction company was held at Dayton a few days ago, but they declined to say what matters were discussed. It is probable that the meeting had something to do with the proposed extension from Spring Valley to Wilmington, however.

The Toledo, Bowling Green and Fremont Electric Railway company has made a proposition to the Findlay Electric Railway company to extend its line to Galatea, if the Findlay road will build to the same point, and there form a junction.

The City Council of Columbus has voted to give the Columbus Railway company a franchise to extend its lines on Mount Vernon avenue.

A company of Dayton capitalists has asked the Warren County commissioners for a franchise for an electric road from Dayton to Lebanon. O. M. C.

Canadian Intelligence.

Ottawa, August 18.—The Cataract Power company of Hamilton, Ont., has made a proposition to the council of that city involving the construction of an electric railway from Hamilton to the cities of Galt and Guelph, Ont.

It is reported that the British Columbia gold mines, Summit Camp, B. C., have purchased the waterpower at Cascade. The power is being developed by the Cascade Water and Light company. The falls are capable of developing 20,000 horsepower. The principal owners of the British Columbia mines are James Ross and C. J. McCuaig, Montreal.

The city of Montreal, Que., is to have opposition electric street railways. The city attorneys, to whom the question of the legality of granting authority to the Montreal Belt Line company to lay tracks in the city streets was referred, have communicated to the road committee of the City Council their opinion that there is no legal obstacle to the granting of such authority. The city has no power to grant a monopoly to any company; therefore, the Montreal Street Railway company cannot claim exclusive privileges.

R. J. Parke, consulting engineer of Toronto, has been engaged by the Municipal Council of St. Mary's, Ont., to prepare plans and specifications for the reorganization and combination of the present municipal arc-lighting plant and the incandescent-lighting plant recently acquired by the town from the Reesor company. A new power station will be erected and a completely new engine and boiler plant purchased and installed.

Up to the present time the city of Montreal, Que., has been behind the American, and even other Canadian cities, in the matter of automobiles. It is now announced, however, that within a comparatively short time Montreal is to be supplied with these vehicles, and the manufacture of the horseless carriage will be carried on in that city. A. J. Corrivean states that he is now completing arrangements for a system of automobiles to be operated in the streets on much the same principle as cabs are now run. American capitalists, who are now operating a large factory in the United States, are interested in the enterprise.

The Granby smelter at Grand Forks, B. C., with a capacity of 1,000 tons per day, has started operations. The smelter is electrically driven. The power is generated by a duplicate set of 16-inch turbine wheels. A dam was built across the north fork of Kettle River, and a flume, one mile long, carries the water to the power house, where 1,200 horsepower is developed at low water. The saving, as compared with steam power, is estimated at from $50,000 to $75,000 per annum. A portion of this power will ultimately be transmitted to the various mines of the Miner Graves syndicate. W.

Northwestern Notations.

Minneapolis, August 18.—The council of Whitewater, Wis., has contracted with the Electric Light company for a renewal of the electric street-lighting contract for 12 years, at $80 per light per annum, for 2,000-candlepower arcs.

Thomas Lowry of the Twin City Rapid Transit company says the company will undoubtedly build to Lake Minnetonka in time, but the talk of using the old line and grade of the Great Northern railway to Excelsior is erroneous.

The Western Union Telegraph company is building new wires from Helena, Mont., to Ogden, Utah. A line is being built from Havre, Mont., to Everett, Wash., for the use of the Great Northern railway.

Application has been made by two companies to St. Andrew's municipality, Man., for permission to build an electric line from Winnipeg to Selkirk. Both applications were refused until they could give proof of being in a financial position to carry on the work.

Suit has been filed in the United States Circuit Court against the Twin City Rapid Transit company by Benson Bidwell for an accounting and an injunction to restrain the company from lighting its cars according to the present methods. Bidwell claims to have the original patent covering the method of lighting and operating street cars from the same current wire. Similar suits have been filed in Grand Rapids, Indianapolis and San Francisco, and will be started in many other cities.

The new electric-light plant at Pipestone, Minn., has been completed and put in operation. The new plant, rebuilt since the fire, is a very complete system.

Chicago capitalists have been granted a franchise at Ripon, Wis., for electric-car lines to the north and south shores of Green Lake, and to the south shore of Markesan. The lines are to be ready for operation by spring.

The Electric Railway company of Chippewa Falls, Wis., is erecting a new car barn on the South Side.

The city solicitor of Des Moines, Iowa, is considering the right of the Street Railway company to haul freight over its lines. The charter states it is to transfer passengers, but permission has been secured at various times to haul freight, and one company, which has been absorbed, had the right to haul a certain amount of freight. The question was raised by a complaint from the Teamsters' union, which claims the company is hauling trains of four or five cars of brick from the yards north of the city to the Northwestern road.

The rebuilt electric-light plant of the city of Indianola, Iowa, will be operated all night, when completed.

The new electric-light plant at Centerville, S. D., of G. Norgren & Co. has been completed and put in operation.

The W. H. Walker Milling company of Alden, Minn., may put in an electric-lighting plant and furnish lighting for the village.

Talk has been revived at Eldora, Iowa, of a municipal electric-light plant.

The Hughes Electric company has been granted a new franchise at Bismarck, N. D., for electric lighting and heating. The franchise is for 25 years, and is more complete and definite than the old one.

The consolidation of the street-railway lines of Dubuque, Iowa, under one management has been effected, under the title of the Union Electric company. The capital stock is $1,000,000. Improvements will be made, to cost $100,000.

Application has been made to the council of Two Rivers, Wis., for a franchise for an electric-car line, to run from that place to Manitowoc.

The power house of the Iron River (Wis.) Water, Light and Power company was recently damaged by fire, the loss being $2,000. The dynamos were ruined; one pump and one engine were badly damaged. New machinery has been ordered.

E. T. Kirk and others have applied to the council of Walla Walla, Wash., for a 25-year franchise for an electric-light plant.

The Mora Milling company of Mora, Minn., has bought the plant of the Morrison Electric company. The power station will be removed at once to the mill power house.

The council of Two Rivers, Wis., has declared null the contract recently made for an electric-light and water system, on the ground that the contractor had not lived up to the provisions of the ordinance.

The street-railway lines of Duluth and Superior have been consolidated under one management, to be known as the Duluth-Superior Traction company of Connecticut. Thomas Lowry of Minneapolis has a controlling interest in the new company. It is proposed to improve the system throughout, at a cost of at least $500,000. The system will be conducted on the plan of the Minneapolis and St. Paul systems. R.

PERSONAL.

F. S. Terry of Newark, N. J., one of the oldest and most widely known men in the electrical business, was in Chicago last week and renewed acquaintances with many old friends.

ELECTRIC LIGHTING.

The municipal plant at Spencer, N. Y., has been destroyed by fire.

The electric-light plant of Iron River, Wis., has been destroyed by fire.

The Shelby (Ala.) Iron company will put in an electric-light plant at its works.

The City Council of Springhill, N. S., has decided to erect a municipal electric-light plant.

H. M. Geiger has contracted to build the municipal electric-light plant at Lawrenceburg, Ind.

Wrightsville, Ga., has voted in favor of the proposed issuance of $15,000 in bonds for an electric-light plant.

The Iowa Falls (Iowa) Electric Light and Power company has increased its capital stock from $15,000 to $40,000.

Nelson, B. C., will sell, September 15th, $15,000 in bonds for extending the electric-lighting system. J. Houston is mayor.

J. D. Wallace, engineer, Champaign, Ill., is in charge of plans for the Neoga, Ill., light plant. Bids will probably be asked soon.

The Omaha (Neb.) Thomson-Houston Electric Light company has purchased the South Omaha Water and Light company's plant.

The Susquehanna Valley Electric company of Sidney, N. Y., has been incorporated, with $200,000 capital, by H. B. Oakman, C. F. Lehman and C. C. Higgins.

The Mora (Minn.) Electric Light company has sold its plant to the Mora Milling company, and it will be moved, so as to be run in connection with the mill.

An execution for $5,000 and several smaller claims has caused the sale by the sheriff of the Littlestown Electric Light, Heat and Power company of Littlestown, Pa. It is thought very probable that the Littlestown borough will buy the plant and light its own streets.

Bids will be received by the city clerk of Kenton, Ohio, until September 3d, for lighting the streets, alleys, squares, other public places and public buildings of the city, with not less than 110 electric lights

of 2,000 candlepower each. The bids are to be for the term of five years.

On account of deficient electric lighting the Board of Aldermen, Wilmington, N. C., decided to allow no more bills for service until the contract between the city and the Wilmington Gas Light company had been signed, sealed and delivered.

A corporation will be organized in Corunna, Mich., to be known as the Shiawassee Light and Power company. The incorporators will be the present members of the Corunna Electric company and H. A. Sprague of Portland. The corporation will be capitalized at $20,000 and work will be commenced at once on the new plant, which will be located at Shiawassee.

A proposition to establish a municipal electric-lighting plant has been voted down at two municipal elections in Howell, Mich. At the charter election, in March, 1900, it was defeated by a majority of 53, and on June 29th another election was held and the question of establishing a municipal electric-lighting plant was again submitted to the voters. This time it was defeated by a majority of 23 in a total vote of 649. The Michigan law requires that a proposition of this kind shall receive the affirmative vote of two-thirds of all the electors voting to be adopted.

ELECTRIC RAILWAYS.

The Chattanooga (Tenn.) electric railway has decided to extend to Sherman Heights.

F. C. Ayres is interested in a proposed electric line in the suburbs of Montgomery, Ala.

T. Higgins of Neenah, Wis., has applied for electric-railway franchises at Two Rivers, Wis.

J. B. Crearer, F. H. Fitch and A. G. Mosely of Denison, Texas, are interested in a plan for a road between Denison and Sherman.

The Elevated Railway Construction company of St. Louis has been incorporated. J. L. La Prelle and C. W. Sargent are interested.

The citizens of Brightwood and vicinity have petitioned the Washington (D. C.) Traction company not to increase the fare to that suburb to 7½ cents.

A. S. Macdonald and W. G. Henshaw of Oakland, Cal., have secured a franchise for an electric road in Contra Costa County for an electric road from Point Richmond to the Alameda County line.

Farmington, Mo., has given a franchise for an electric railway to W. E. Stevenson & Co. of Indianapolis. A. N. Fisher of Indianapolis states that the road will be extended to neighboring towns.

The Intermontane Street Railway and also the Asheville and Weaverville Electric Railway companies have, after considerable delay, been granted franchises for extensive additions to their lines at Asheville, N. C.

The Chicago City Railway company recently had 14 newsboys arrested for contempt of court in violation of the injunction issued some time ago forbidding traffic in transfers. The case was continued to September 4th.

The stockholders of the Schuylkill Traction company, at a meeting at Girardville, Pa., decided to increase their capital stock from $1,000,000 to $2,000,000. The company decided to build an electric road from Pottsville to Shenandoah.

The Charlottesville City and Suburban railway of Charlottesville, Va., has recently been purchased by a syndicate, represented by R. P. Valentine. Mr. Valentine will be president of the company, and the management of the road will be begun by him soon.

G. R. Lovejoy, county treasurer at Mount Clemens, Mich., is interested in a proposed electric railway from Lenox to Sanilac Center, 44 miles long and connecting at various points with the Grand Trunk, Michigan Central and Pere Marquette railways.

The Citizens' Railway, Light and Power company of Newport News, Va., recently floated by Alexander Brown & Sons of Baltimore, Md., is planning an extensive scheme of improvement, which includes the building of large car sheds and repair shops. The site for these buildings has been secured. This company will extend the Peninsular railway line to Hampton and Phoebus.

The Shah of Persia has had a representative in this country for some time investigating electric-railway systems preparatory to putting in an electric road between Teheran and a port on the Caspian Sea. This representative is John Marsdon Ward, an Englishman, who has for 15 years been attached to the personal service of the shah, and who has introduced the telephone and other modern appliances into the Persian capital.

The Asheville and Weaverville Electric Railway and Power company of Asheville, N. C., is busy building eight miles of new road and developing the waterpowers at Reams Creek. The company has a 99-year charter and a franchise for 30 years. Grading has been begun on the new road, and it is expected the line will be completed within the next six months. The road will handle passenger and freight traffic, the equipment consisting of six passenger cars and eight freight cars. At the waterpower plant will be installed a 120-kilowatt and a 150-kilowatt generator. Don. J. Barnes is president of the company.

The Kenosha Street Railway company was incorporated at Kenosha, Wis., recently, with a capital stock of $25,000. The incorporators named are J. M. Kehlor, F. J. Gottfredson and G. R. McDowell. The company contemplates building and operating a street railway in the city under what is known as the Haynes & Clausen franchise, granted some time ago. This franchise is now owned by B. J. Arnold of Chicago, who is president of the newly organized company. W. L. Arnold is vice-president of the company. It is probable that the capitalization will be considerably increased soon.

On August 13th a second head-on collision occurred between two electric cars on the suburban line at Providence, R. I., at the same spot that one occurred on June 11th. The collision was due to disobedience of orders by one of the motormen. It is a rule of the road that when two cars are running in the same direction, a short distance apart, the foremost one shows a red flag to warn all cars which it passes at turnouts that it is being followed by another car. One of the motormen in the collision disregarded this signal by running out from a switch on to the main track immediately after a car carrying a red flag had passed. No one was hurt.

Since the collapse of the dam at Austin, Texas, the Austin Rapid Transit Railway company, which rented its power from the municipal plant at the dam, has been operating its road with mules. The company waited for some time for negotiations to rebuild the dam, but has now decided to build its own power house, and is pushing the work with all possible speed. The plant is going up just west of the city waterworks' new pumping station. The building is to be of corrugated iron. Two Aultman and Taylor 175-horsepower boilers will be put in. A McIntosh & Seymour high-speed engine belted to two 80-kilowatt generators will be used temporarily, until a direct-connected, high-speed unit is installed.

AUTOMOBILES.

H. L. Goehring, a Pittsburg attorney, and James Scott, an officer of the Carnegie company, were badly hurt by the explosion of the gasoline tank on their automobile, August 18th, at Pittsburg, Pa.

R. P. Davidson of the Northwestern Military Academy, who started to run from Chicago to Washington, D. C., on a gasoline automobile gun carriage with three cadets, was obliged to give up the trip on account of a number of accidents to the machine.

The Chambersburg (Pa.) Omnibus company, having a charter to run automobiles over the streets of the city, has purchased an electric brake from the Baltimore Automobile company, and expects to put a full line of its "autocarettes" in service over regular routes in the city.

The Maryland Automobile Manufacturing company has filed a certificate of incorporation at Cumberland, Md. The following-named incorporators are also directors: F. Brooke Whiting, Howard H. Dickey, A. A. Doub, J. P. Rowan and Charles T. Lowndes. The capital stock of $10,000 is divided into 100 shares. The shops of this company will be located at Westernport, Md.

PUBLICATIONS.

"Some Words of Wisdom" about paint for the man that pays the bills and the man that owns the roof is a recent publication of the Joseph Dixon Crucible company, Jersey City, N. J., relating to Silica-graphite paint.

The Crest Manufacturing company, Cambridgeport, Mass., has issued some circulars descriptive of its gasoline motors for automobiles, tricycles and all power purposes. One circular is devoted to a description of the Crest sparking plugs.

The Jeansville Iron Works company of Jeansville, Pa., has issued an advance sheet illustrating its steam and electric sinking pumps, for use in mines. These pumps are said to be very reliable in operation, and although they occupy small space, are yet of design and material to produce strength.

The "Pan-partisan Pocket Manual of Politics and Finance," 1900, published by Calderwood & Heffron, Minneapolis, Minn., is a volume of valuable facts and figures. It contains considerable authoritative and non-partisan political and other information and is issued in a convenient pocket shape. It is supplied by the publishers at a nominal sum.

"You Needn't Worry" about burnouts of your central-office apparatus if you are protected by the Burns' combination office terminal, is the statement introducing a circular recently issued by the American Electric Telephone company of Chicago. The circular contains a description of the device and the advantages claimed for it and mentions the Burns individual station metallic-circuit protector and a combined carbon lightning-arrester fuse and high-potential current arrester.

ELECTRICAL SECURITIES.

The Electric company of Philadelphia, owner of 53 per cent. of the stock in the Altoona Edison company, has secured an injunction against the issuing of additional stock to the highest bidder. The court held that the majority stockholders have a right to a majority of new stock at a fair market value, so as to preserve their control, and that the tendency of auctioning stock is to give the minority an unfair advantage over the majority.

SOCIETIES AND SCHOOLS.

Secretary Thomas R. Mercein has issued the journal of proceedings of the summer convention of the Northwestern Electrical association, held at Waupaca, Wis., June 26th to 28th. The publication contains the papers read and a full account of the convention proceedings.

The August bulletin published by the University of the State of Missouri, Columbia, Mo., contains information regarding the university's school of engineering. The courses and degrees are described, and the requirements for admission are given. H. J. Waters is dean of the school of engineering.

The electrical engineering department of the North Carolina Agricultural and Mechanical College at Raleigh is being provided with a completely equipped building, containing a great variety of electrical machinery, including arc, alternating and other types of dynamos, about 10 in all. The equipment, it is said, will be one of the best in the South.

McKim, Mead & White, architects, have filed plans for the proposed Columbia University Hall, to be erected on the hill at Amsterdam avenue and the Boulevard, between One-hundred-and-sixteenth and One-hundred-and-twentieth streets, New York city. It is to be a five-story edifice, 175.2 by 260 feet, of brick and limestone, and will cost $900,000. The sub-structure foundations were laid about four years ago, and the architects filed a statement with Commissioner Brady setting forth that at present only the first story is to be completed and that the construction work on this story will afford data for the construction engineers to base calculation upon as to the stability of the entire proposed structure. The single story will cost $100,000 to erect.

MISCELLANEOUS.

Charles Schurig, city electrician at Omaha, Neb., is after the careless line-wiring contractors and house movers who cut wires and leave them hanging over live wires so as to endanger life. He has had one arrest made.

Recent hot weather in London is said to have created an opening for electric fans. The London Daily Mail says that London is the most backward of all great capitals in provision for meeting heat. Although "suction" ventilating fans, driven by electricity, are quite well known, it is stated that there are few, if any, electric fans of the "cooling" type in use in England.

Under date of Birmingham, England, July 13, 1900, United States Consul Marshal Halstead reports that at the annual general meeting of the Electric Construction company in London, the chairman announced that the company had sent to Paris, at a moderate expense, over 20 leading employes, in order that they might see in the exposition what is being done in the electric-machinery world abroad.

The General Electric company is building a new building at its works, which will be for a restaurant for its employes. The company already has a restaurant at its works, but it is becoming too small for the increasing force of workmen. It was thought best to have a restaurant on the grounds, so that so many would not have to go outside the yard for their lunch. The new restaurant will accommodate 500 people during the noon hour.

A recent United States consular report says that steam power is to be superseded by electricity to a very considerable extent in the government dockyard at Kiel, Germany. After experimenting with electric-power transmission on a comparatively small scale, the administration has now decided upon a bolder scheme, whereby all the machine tools, etc., installed in the different workshops are to be electrically driven. To this end, a power plant having a capacity of 3,500 horsepower is to be erected. This plant will also supply electrical energy for driving the powerful dockyard pumps.

A school has been established by the government at Fort Monroe, Va., for the purpose of instructing members of the regular army in the application of electrical machinery used in the army. The rules, published by direction of the secretary of war, provide that applicants must be under 25 years of age, unmarried, qualified as a gunner, a student of a correspondence school or the owner of electrical books, and no applicant will be recommended unless he has sought, for a year or more, to become practically familiar with one or more classes of electric machinery, or with some portion of the elementary literature on electricity.

The Treasury Department has issued a statement with reference to the cancellation of bonds covering goods shipped in transit to Mexico, to the effect that the privilege accorded prior to the act of March 1, 1805, covering merchandise destined for the so-called free zone, having been restored by the act

approved May 21, 1900, bonds covering merchandise destined for any place in the republic of Mexico may now be canceled by certificate of inspection and exportation, issued by the collector at the frontier port and a landing certificate, given under the hand and seal of the collector, or other chief revenue officer at the foreign port.

TRADE NEWS.

The Electrical Supply and Construction company of Columbus, Ohio, has changed hands. The new management consists of John Cashatt, president; William H. Simonton, secretary; Mark Simonton, treasurer and general manager.

The Westinghouse Electric and Manufacturing company will shut down from August 24th to September 5th, for the purpose of making improvements and repairs in the plant, taking stock and repainting the entire interior of the works at East Pittsburg, Pa.

The Bullock Electric Manufacturing company has removed its general and executive offices from Cincinnati, Ohio, to the St. Paul building, New York city. The advertising and general sales departments are included in the change. Vice-president Joseph S. Neave will remain in Cincinnati in control of the factory.

The Buckeye Electric company of Cleveland, Ohio, manufactures a special cellulose filament that is said to be attracting much attention on account of its ability to maintain an average of 16 candlepower for an average burning period of 600 hours. With the final decrease in candlepower the power consumption is found to be proportionately decreased. At the Chicago office of this company, No. 1537 Monadnock building, a large stock of standard voltages is carried, for the convenience of the western trade. A catalogue and price-list will be sent on application.

One of the most profitable postoffices in the United States is that at Scranton, Pa. The volume of business is unusually large and is steadily increasing, the figures for the first six months of the present year showing more than double the business for the same months in 1893. This is due, principally, to the rapid growth of the International Correspondence Schools. Seven years ago the schools' postage was barely five per cent. of the total, but now one-third of Scranton's postage is paid by the International Correspondence Schools. Their postage has increased from an average of less than $400 to over $5,000 a month.

At a recent meeting of the stockholders of the Consolidated Railway Electric Lighting and Equipment company, in New York, the following-named directors were elected: Walter Lüttgen, Norman Henderson, C. G. Kidder, George W. Knowlton, Thomas J. Ryan, Isaac L. Rice, John N. Abbott and August Treadwell, Jr. This company is a consolidation of several concerns engaged in making electric-lighting apparatus for steam-railroad cars, the electricity being generated from the car axle while the car is in motion and furnished from a storage battery while the car is stationary. Power is thus furnished for fans also.

The Crocker-Wheeler company, in order to handle its increasing business in Pittsburg and vicinity, has established a sub-office in room 607 Empire building, under the management of Francis B. DeGress. Mr. DeGress has been associated with the Crocker-Wheeler company for many years, and is an engineer of wide experience in factory equipments, both electrical and mechanical. The patrons of Crocker-Wheeler apparatus around Pittsburg will doubtless appreciate having a representative of the company so near at hand.

Under the laws of the state of Indiana, papers of incorporation were granted, July 27th, to the Belden-Larwill Electric and Manufacturing company of Fort Wayne, Ind. The capital stock of the new company is $100,000, and following is the list of officers: President, S. M. Foster; vice-president, M. C. MacDougal; secretary, O. H. Larwill; treasurer, C. A. Wilding, and general manager, E. H. Belden. The company reports a very satisfactory business now, and in anticipation of heavy fall orders, is increasing its manufacturing facilities as rapidly as possible. It is now in a position to establish desirable agencies in the principal cities in this and foreign countries.

Considerable trouble has been experienced by carbon-brush manufacturers in the past, in producing a carbon brush absolutely self-lubricating and of long life, without blackening or gumming the commutator. A brush has just been put on the market by the Speer Carbon company, St. Marys, Pa., which is claimed to be absolutely self-lubricating and of long life, and to be superior in every respect to anything that has been produced heretofore. The manufacturer guarantees the following points of superiority: That it will last many times longer than any other brush made, that it will take a high polish and constantly lubricate the commutator without gumming, that the resistance of the brush is very low, and conveys the current without loss, that it wears very smooth and will not crumble or chip and that it will not cut or scratch the commutator.

BUSINESS.

The Electrolysisproof Conduit company of Chicago booked an order a few days ago for 180,000 feet of its conduit. The order is said to have been placed by one of the largest telephone companies in the field.

The Camp Engineering company, 18 South Canal street, Chicago, is offering for sale some second-hand engines, pumps, boilers, etc., which have been replaced by other apparatus and which have been put in first-class condition. The engines range in size from four to 200 horsepower, and the boilers are of the vertical and horizontal types.

Goldsmith Bros., Chicago, one of the largest dealers in platinum in the United States, report a phenomenal business during the summer months. This firm pays $16 an ounce for scrap platinum, and has done business with many of the electrical concerns throughout the United States. They will be glad to hear from anyone wishing to dispose of scrap platinum. The firm also makes a specialty of purchasing old incandescent-lamp bases, for which they pay the highest market prices.

The Sprague Electric company reports an unusually large and steadily increasing business along all the lines of its manufactures. The Lundell fans have had a big sale and the sales in the interior-conduit department have exceeded all previous seasons. The company has just issued a revised edition of the bulletin describing the Greenfield flexible steel-armored conductors. It contains additional illustrations and prices. Among other orders received for motors and generators is one from the Cooke Locomotive and Machine company of Paterson, N. J., for a standard 300-kilowatt, split-pole generator of the belted type.

The Central Electric company of Chicago says it is in receipt of the following communication from one of its old customers: "Please enter our order for 7,000 feet No. 14 rubber-covered wire, 400 feet No. 2, 970 feet No. 4, 310 feet No. 6, and 150 feet No. 8, as per your favor of the 7th inst., providing the same is Okonite wire and of the same quality as this sample of insulation which I have cut from some Okonite wire we put in here nine years ago," another convincing argument, says the company, that the best is always the cheapest in the long run. The Central Electric company reports that its sales of Okonite wire are constantly on the increase.

Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, report their general business as very good. They are receiving many orders from jobbers in New York, Boston, Providence, Pittsburg, Cleveland and Detroit for their Parallel clamps, which are said to be very desirable for use on drill, planer, milling machines and shapers. They are also receiving many orders for their Gardner die stocks and recent shipments have been made of several complete shop equipments to the extreme Northwest. Several rush orders for Gardner grinders have been received from England. The firm's new catalogue will be sent free to any address upon application.

The Manhattan General Construction company of Newark, N. J., says that although the month of July is usually a poor month for arc-lamp business, its orders for that month this year exceeded those for any one month in its experience, extending over the last seven years. The Manhattan series alternating-current system is being adopted very rapidly, and attention is called to the following, which are a few of the orders closed recently: Evanston (Ill.) Electric Illuminating company, 211 lamps; Fairport (N. Y.) Electric company, 60 lamps; W. M. Sheehan & Co., Wappinger Falls, N. Y., 52 lamps; Hagerstown (Md.) municipal plant, 117 lamps; town of Phillipi, W. Va., 20 lamps; Urbana (Ill.) Light, Heat and Power company, 78 lamps; Hamilton (Ont.) Electric Light and Power company, 200 lamps. In addition to shipping 350 series alternating-current lamps to the Northern Ohio Traction company of Akron, Ohio, the Manhattan company has received an order for 350 multiple alternating-current enclosed-arc lamps.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 14, 1900.

655,703. Device for Registering Electric Currents. Victor G. Fuller, Toulon, Ill. Application filed December 16, 1899.

In combination with the timing mechanism, a combined winding lever and switch arm, a dog thereon whereby it is connected with the winding mechanism and a cam trip for disengaging the dog from the winding mechanism as the circuit is closed.

655,716. Telegraphic Relay. Isidor Kitsee, Philadelphia, Pa., assignor to Charles E. Wilson, Philadelphia, Pa. Application filed May 20, 1899. Renewed December 21, 1899.

In telegraphy a static relay consisting of a vibrating diaphragm, partially or wholly conducting in electrical contact with a circuit containing a generator of electricity and a receiving device, in juxtaposition to a conductor, electrically connected to the battery circuit and the aerial conductor, in combination with a conductor connected to the ground.

655,747. Electro-medical Vacuum Apparatus. George W. Winckfield, Alameda, Cal., assignor of one-fourth to George C. Fabens, Alameda, Cal. Application filed November 29, 1899.

A vacuum cap composed of sections detachably connected, and an electrode clamped between the sections.

655,762. Insulated Hanger for Arc Lamps. George Cutter, Chicago, Ill., assignor to the George Cutter company, Chicago, Ill. Application filed May 4, 1900.

In an insulated hanger, the combination with a holder or support for the lamp; of an insulator supporting the lamp holder; a hood covering the insulator; and devices for securing the insulator in position in the hood, the devices being arranged to act as supports for the lamp holder in case the insulator becomes broken, and to extend through the hood so as to permit of their insertion and withdrawal from the exterior of the hood.

655,763. Annunciator. William M. Davis, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing company. Application filed December 15, 1899.

In an annunciator, the combination with an electromagnet, of a segmental pole-piece in the form of a sleeve section, a core for the electromagnet projecting beyond the same and partially surrounded by the sleeve section a pivoted armature arranged in juxtaposition with the core, and a target lever secured to the armature.

655,769. Storage Battery. George A. Ford, Cleveland, Ohio. Application filed September 5, 1895.

A storage-battery element consisting of a series of porous pans and a series of conductors on the pans, each of the conductors having a series of vanes at an angle to the plane of the pan, and active material between the vanes.

655,772. Telephone Toll Apparatus. William A. Foss, Cleveland, Ohio, assignor to the American Toll Telephone company, Cleveland, Ohio. Application filed February 26, 1900.

A machine of the character indicated, comprising a clockwork that includes an escapement having its anchor provided with an arm or lever, means for winding up the clockwork, a movable part within the machine and arranged to be engaged by a coin or check of a predetermined size and provided with a member arranged to engage and detain the anchor arm or lever, and means whereby the coin engagable part is actuated, through the medium of the coin or check, in the direction required to release the anchor arm or lever.

655,777. Electrical Sign and Signal and Apparatus for Operating Same. Anatole Heiny, San Francisco, Cal., assignor of two-thirds to Joseph E. Artigues and Diminique G. Lucien, San Francisco, Cal. Application filed September 26, 1899.

A sigoboard comprising a plurality of panels each containing incandescent bulbs arranged in spaced order and in parallel rows at intervals apart across the panel, conducting strips connecting the bulbs in separate groups composed of individual bulbs in the separate rows and by different combinations adapted to form different letters or characters, the conducting strips terminating at binding posts on the panel, a plurality of contact pieces corresponding in number with the conducting strips of the individual panel and connecting electrically each conducting strip with a source of electricity in open circuit, a selecting device comprising mechanism actuated by an individual key lever for each letter or character to be formed and circuit-closing means controlling the circuit through each contact piece and an operating key by the movement of which the circuit is closed and the generator thrown upon the selected contact pieces that go to form the letter or character represented by the individual key so actuated.

655,779. Control of Electric Furnaces. William S. Horry, New York, N. Y., assignor to the Union Carbide company, Niagara Falls, N. Y. Application filed February 21, 1899. Renewed January 15, 1900.

A system of electric-furnace regulation comprising an electrically controlled motor geared or attached to the movable member or element of the furnace, electro-mechanical motor-controlling devices in operative position to the furnace circuit and adapted to automatically start and reverse the motor to keep the amperes constant in the furnace, means for switching current into the motor by hand to run it in either direction, and means for permitting and preventing the control of the motor by the electro-mechanical devices.

655,780. Electric Furnace. William S. Horry, New York, N. Y., assignor to the Union Carbide company, Chicago, Ill. Application filed August 15, 1899.

Means for regulating an electric furnace having a movable element and a motor for working it, which means comprise regulating relay apparatus responding to the furnace circuit, and devices worked by the relay for imparting motion from the motor to the movable element, the devices arranged to respond only to predetermined variations in the furnace circuit thereby keeping the furnace current approximately constant.

655,783. Electrolytic Apparatus for Decomposing Metallic Salts. Carl Kellner, Vienna, Austria-Hungary. Application filed March 3, 1896.

Apparatus described comprising an external vessel for containing an electrolyte, suitable anodes, a mercury cathode suspended above the bottom of the vessel by suitable means, a chambered structure dipping into the cathode, means for moving the structure through the cathode and means for placing one or more chambers of the chambered structure in communication with the external vessel.

655,808. Electric Arc Lamp. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric company, Cleveland, Ohio. Application filed July 10, 1899.

In an electric-arc lamp the combination with a clutch and a magnet, of a movable coreless coil disposed within the field of force of the magnet so as to be actuated by the fluctuations thereof, and connected with the clutch, the movable coreless coil included in circuit with the coil of the magnet.

655,809. Signaling Apparatus and Circuit Therefor. Alfred Stromberg and Androv Carlson, Chicago, Ill., assignors to the Stromberg-Carlson Telephone Manufacturing company, Chicago, Ill. Application filed April 26, 1899.

A magneto generator for telephone signaling combining an armature normally disconnected from the signaling circuits, an electrically actuated sigoal receiver connected with the sigoaling circuits, a contact, a coacting switch sprine normally eneaging the contact and maintaining the signaling circuit closed, a driving shaft passiog through an opening in the switch spring, a second contact mounted upon the shaft connected with the armature circuit, and automatic means for securing the longitudinal movement of the shaft whereby the contact is moved to establish connection with the switch spring and disengage the spring from the contact.

655,810. Telephone-exchange System. Alfred Stromberg and William M. Davis, Chicago, Ill., assignors to the Stromberg-Carlson Telephone Manufacturing company, Chicago, Ill. Application filed April 26, 1899.

In a telephene-exchange system, the combination with two telephone lines extending from substations to an exchange, of telephooe switch hooks at each of the substations for openiog and closiog the telephone line at each substation; a centralized battery normally iucluded in circuit with the telephone lines; a line indicator for each of the telephone lines, each normally iocluded in circuit with the battery, whereby upon the completion of the circuit at either of the subscribers' stations the iodicator correspoodiog to the station is operated, which station thus becomes the calling station; a cord circuit for forming a continuatien of one of the telephone lines; means for effectiog a connection between the cord circuit and telephone line without disconnecting the line indicator correspooding to the line from circoit; a jack switch, and a connectiog plug united with the cord circuit for effecting the connection of the cord circuit and its connected telephone line with the remaining telephone line, the jack switch being adapted upon the insertion of the said connecting plug to disconnect the indicater from the telephone line. (See cut.)

655,811. Telephone-exchange System. Alfred Stromberg and William M. Davis, Chicago, Ill., assignors to the Stromberg-Carlson Telephoue Manufacturing company, Chicago, Ill. Application filed July 13, 1899.

The combination with two united telephone lines, of switching apparatus for uniting and disconnecting the same, an indicator associated with the united telephone lines, an auxiliary alarm circuit and apparatus jointly controlled by the iodicater and switching apparatus for controlling the alarm circuit.

655,838. Method of Insulating Electric Conductors. Nikola Tesla, New York, N. Y. Application filed June 15, 1900.

The method of insulating electric conductors, which consists in reducing to and maiotaining in a frezen or solidified condition the material surrooding or contiguous to the conductor by the action thereon of a cooling agent maintained in circulatioo through one or more channels.

655,849. Telephone Bell Cut-out. Luther F. Cobb, Providence, R. I. Application filed January 6, 1900.

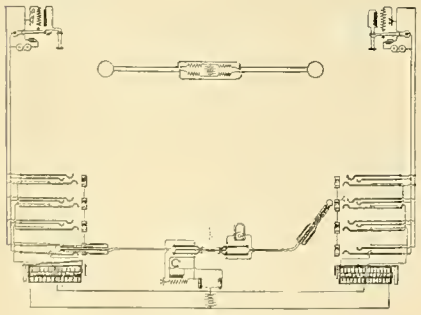
A cut-out employing a revolving disk and electromagnetic release is described.

655,852. Electric Motor. Patrick J. Collins, Scranton, Pa., assignor to the Collins Electric Vehicle company, Scranton, Pa. Application filed December 1, 1899.

An electric motor consisting of a hollow field frame having inwardly projecting pole-pieces at its opposite sides, a partition extending across the interior of the frame transversely to the pole-pieces and forming part of the magnetic circuit, the partition having pole-pieces opposing the pole-pieces upon the sides, and an armature between each pair of opposing pole-pieces.

655,883. Receptacle for Secondary Batteries. Joseph Middleby, Jr., Malden, Mass., assignor of one-half to George E. Hatch, Quincy, Mass. Application filed April 24, 1900.

A receptacle for the cells of a secondary battery, comprising a box adapted to contain the cells and a pneumatic cushion on which the cells are supported, for the purpose set forth.



NO. 655,810.

655,905. Wire Joint and Method of Manufacturing Same. Francis W. Maxstadt, Chicago, Ill. Application filed June 11, 1900.

As a new article of manufacture, a wire joint formed from a single sheet-metal blank having a central ioternal ridge and longitudinal edges bent in opposite directioos toward each other into permanent contact with the ridge to produce parallel closely adjacent tubes which receive, and contact throughout their interior surfaces with the wires to avoid intermediate air spaces.

655,916. System for Individual Service on Electrical Party Lines. William Torst, Jr., Los Angeles, Cal., assignor of one-nalf to William P. Mooney, San Pedro, Cal. Application filed September 25, 1899.

A system for individual service on electrical party lines comprising the combinatien with the central station and the service machine connected therewith by a metallic service circuit; of an electrical cut-out on the circuit; a magnet for operating the cut-out; a metallic circuit connecting the magnet with the service circuit through the cut-out; a switch in the connection between the magnet and the cut-out; a supplemental conductor connected with one line of the service circuit; a key connected with the supplemental conductor and arranged to open and close the switch and to electrically connect the supplemental conductor with the magnet wire at the iostants only of respectively opening and closing the switch; and independent means for opening and closing the service circuit.

655,920. Manufacture of Carbon. William J. Burke, Scranton, Pa., assignor of one-half to Henry A. Kaufhold, Scranton, Pa. Application filed December 16, 1899.

As a new article of manufacture, carbon for electrical and other purposes manufactured from impalpably powdered anthracite coal.

655,968. Voltaic Cell. Eugene M. Fishell, Cleveland, Ohio, assignor to the National Carbon company, Cleveland, Ohio. Application filed January 20, 1900.

In a voltaic cell, a porous carbon cup consisting of a head, having extending from it integrally two cootinuous walls, one within the other, there being alined openings through the two walls and a sleeve integral with the walls and connecting the openings.

655,970. Manufacture of Paper for Electric Printing. William Friese-Greene, London, England. Application filed March 13, 1900.

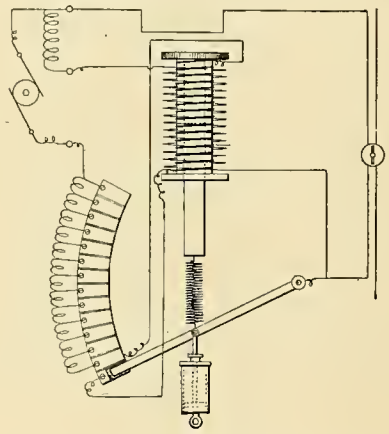
The method or process of makine paper suitable for electric printing, which coosists in treatiog paper with an extract of marine algæ.

655,992. Indicating Device for Telephone Receivers. William R. Rathvon, Florence, Colo. Application filed November 28, 1899.

A visual telephone indicating device, consisting of an indicator constructed as a disk or plate provided with a hook for supporting the indicator upon a movable part of the receiviog instrument, and a flexible connection secured to the indicator at one end aod its other and free end adapted to be connected to any suitable part of the receiving instrument.

656,004. Automatic Resistance-reducing Device. George H. Whittingham, Baltimore, Md. Application filed December 4, 1897.

In an automatic resistance-reducing device, the combination of a resistance having contact plates; a controlling shoe movable over the contact plates; a magnet; a heavy-current circuit including the magnet and resistance but operative through both only at the initial movement of the controlling shoe; a small-current circuit direct from the main line and including only the magnet and field; and a spring or equivalent device to store power interposed in the connection between the movable controlling shoe and the armature or core of the magnet, whereby when starting the heavy current passes through the magnet only for the brief period required to draw its armature or core and the current is thereby automatically broken, and the resistance is then gradually cut out by the action of the stored power. (See cut.)



NO 656 004

656,011. Lock. Henry G. Carleton, New York, N. Y., assignor to the Carleton Electric company, New York, N. Y. Application filed November 15, 1899.

In a lock, the combinati n w th one of the engaging parts, of a withdrawing mechanism including an actuating device and suitable mechanical connections between the device and the part, a normally inoperative controller for the withdrawing mechanism, and suitable electrical devices for causing the controller to remain inoperative.

656,012. Electric Launch. Jacob C. Chamberlain, New York, N. Y. Application filed March 27, 1899.

In an electric boat, the combination with an electric motor completely inclosed in the boat structure, and located beneath the floor thereof of ventilating pipes communicating with different portions of the motor casing and extending forwardly and rearwardly therefrom to points outside of the boat structure.

656,029. Electric Automatic Controller and Indicator for Railways. Vito Leto, Newark, N. J. Application filed September 14, 1899.

In a controller, indicating and signaling apparatus for railway trains, the combination with an instrument carried by the train provided with distance-indicating dials, and a dial for telegraphic messages; of a station instrument having dials correspondine to those on the train instrument; a telegraph transmitter comprising a rotary wheel having numbers thereon corresponding to those on the telegraphic indicating dial, a pointer or lever for retating the transmitter wheel, and electrical devices operated by the transmitter wheel for moving the pointer of the telegraphic dial indicator.

656,076. Method of Electrostatically Measuring Currents in Working Circuits. George L. Addenbrooke, London, England. Application filed May 7, 1900.

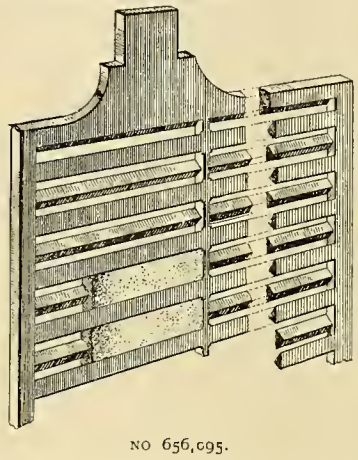
The herein described method of electrostatically measuring electric currents in a working circuit, which comprises the setting up of an electrostatic instrument with suitable connections to the circuit, testing, comparing by standard, and calibrating the instrument and taking a deflection reading therefrom upon a suitable adjusted scale; then making measurements of the current in the circuit under working conditions by a deflection reading or readings upon the scale as adjusted; and finally retesting or calibrating the instrument by a further reading or readings upon the scale as first adjusted.

656,077. Manufacture of Incandescent Materials for Electric Lighting. Georg Alefeld, Darmstadt, Germany, assignor to Ludwig Wilhelm Gans, Frankfort-on-the-Main, Germany. Application filed June 15, 1899.

The within described method of making incaodescents adapted to incaudescent electric lighting, which consists in first forming a body of the desired shape from one or more of those oxides of the earthy metals which become conductive and luminous at elevated temperatures.

656,091. Electrically Operated Railway Gate. George D. Burton, Boston, Mass., and George W. Steiner, New York, N. Y. Application filed April 22, 1899.

In an electrically controlled railway device, the combination of a swingiog gate, solenoids having cores connected to the gate, and a circuit switch lever having a movable switch blade adapted to direct the electric curreot from one solenoid to the other.



NO 656,095.

656,095. Plate for Secondary Batteries. John B. Conrad, Chicago, Ill., assignor to the Hewitt-Lindstrom Motor company, Chicago, Ill. Application filed March 9, 1900.

The herein-described plate for storage batteries composed of a frame and two oppositely facing series of noointersecting individual aod distinct bars, each bar being triangular in cross-section and connected at its ends to the opposite sides of the frame, all the bars in both series being parallel but alternate bars being members of opposite series and disposed on opposite faces of the plate and facing in opposite directions, and the apices of all the bars pointing inwardly. (See cut.)

656,100. Electricity Meter. Paul Eibig, Berlin, Germany, assignor to Martin Behrendt, Berlin, Germany. Application filed January 20, 1900.

In an electricity meter the combination of a motor having an oscillating armature with a motor having a rotating armature.

656,105. Circuit-breaker. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed December 1, 1899.

In a circuit-breaker, the combination of means in the main circuit of the instrument for producing a magnetic field, the armature movably supported in the field and carrying a coil whose plane is normally substantially parallel to the lines of force of the field, means for normally restraining movement of the armature, and for permitting such movement under abnormal conditions, means for effecting a circuit through the body of the armature independent of its coil, and a normal short circuit around the last-named circuit.

656,115. Incandescent Lamp. Christian Hoelscher, Warren, Ohio. Application filed April 30, 1900.

The combination with a socket having a main terminal and two auxiliary terminals, of a lamp having a plurality of filaments therein, a central contact for constantly engaging the main terminal, and two other contacts for engaging either or both of the auxiliary terminals when the lamp is turned axially, the filaments being connected to the contacts of the lamp.

656,127. Dynamo-electric Machine. John D. Spence, Somerville, Mass., assignor to Charles L. Cotton, Dedham, Mass. Application filed May 12, 1899.

In a dyname-electric machine, an armature, a plurality of field poles, exciting coils therefor, a magnetic shunt for shunting poles of opposite polarity, a shunt coil encircling the magnetic shunt and in circuit with an armature winding to reduce the shunting power of the magnetic shunt, and a neutralizing coil normally of slight effect also encircling the magnetic shunt and adapted when excited to neutralize or counteract the effect of the shunt coil.

656,128. Method of Regulating Dynamo-electric Machines. John D. Spence, Somerville, Mass., assignor to Charles L. Cotton, Dedham, Mass. Original application filed May 12, 1899. Divided and this application filed January 22, 1900.

The method of regulating dynamo-electric machines having a magnetic shunt, to produce a current of substantially uniform electromotive force at varying speeds, which consists in varying the strength of the field inversely and in proportion to the variations in speed, by the inductive influence on the magnetic shunt of a neutralizing current, increasing the current directly as the speed increases.

656,133. Truck, Wheel and Armature Exchange for Street or Other Railway Cars. William H. Cornner, Anderson, Ind. Application filed November 23, 1899.

Means for facilitating car repairs, comprising a pit having an interrupted track therein, a track extending over the pit and having a section vertically movable in guides over the interrupted portion of the first-named track, transverse bars extending the full width of the track, working in slots of supporting framework for the track, and arranged to be moved in under and support the end portions of both rails of the vertically movable track section, and to be moved from under the same to allow the section to be lowered, together with supplementary vertical guides, and a transverse armature-supporting bar working in the guides, and having a central pivoted motor or armature rest.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, SEPTEMBER 1, 1900. No. 9

Electric-launch Service at Jackson Park.

At the close of the World's Fair at Jackson Park, Chicago, a few of the electric launches which rendered such popular and efficient service during the exposition were retained by the park commission for regular use. These were kept in service for a time, but the batteries soon began to give out and the launches were abandoned. This summer the South Park commissioners decided to start up the launches again. A contract was made for the overhauling and maintenance of the batteries for a term of years, and along with this several other important changes were made. The contract was made by the Haschke Storage Battery company of Chicago and carried out under the personal supervision of J. E. Haschke, consulting engineer of the company.

One of the mechanical and electrical curiosities of the old launches was the controller. A more complicated mechanism for accomplishing a simple operation would be hard to imagine. The contacts of the motor circuits were made and broken in large mercury cups, of which there were 40 on each controller. About $40 worth of mercury was required on one controller. The mercury contacts were operated by 25 electromagnets, the electromagnets being controlled by a small controller in the bow of the boat, operated manually by the helmsman. The electromagnets were mounted on a 40-pound marble slab. Altogether, the controller weighed 150 pounds, so that the throwing out of the old controller made an appreciable reduction in launch weight. The present controller is simply a reverse switch and a rheostat. There are only two speeds on the controller, one for slow speed with some resistance in circuit and one for full speed with no resistance in circuit, the batteries being in both cases arranged 30 cells in series, two sets in parallel.

For charging, the two sets of cells are thrown in series, making 60 in all. The charging arrangements at Jackson Park are rather unusual. The only current available is from the arc-lighting plant of the South parks at Washington Park, a mile away. The charging is done after 11 o'clock at night, after the lights in the parks are put out. For this purpose two arc machines are run in parallel. The arc dynamos used are 9.6-ampere Brush machines. All three of the launches are put in series to charge and some artificial resistance is also introduced into the circuit. Each launch-charging circuit has a quick-break, arc-circuit switch for cutting the launch out, if necessary. The main charging circuit has a no-load cut-out, so that, if the arc-dynamo attendant stops the machines without opening the circuit the circuit will be opened automatically and prevent short-circuiting the battery. The charging station is on the lagoon, and consists of covered-over slips into which the launches are run.

The launches are the same in external appearance as formerly during the World's Fair. Fig. 1 shows one of the launches as it appears in service on the lagoons. Fig. 2 (page 130) shows the interior seating arrangement of a launch and Fig. 3 illustrates the arrangement of controlling handles in the bow. The motor is under the raised portion of the floor near the midle of the boat that is indicated in Fig. 2. The pilot wheel is in the bow, directly in front of the operator. The lever of the controller, which is at the right, and the reverse lever have a horizontal movement. Between the pilot lever and controller is a knob which, when pulled out, opens the controller circuit. At the left is the handle of a pump which operates an air whistle.

The motor is slow speed and directly connected to the propeller shaft. On the first speed, with 30 cells in series and some resistance in circuit, the speed is four miles an hour and the current taken is 27 amperes. On the second or full speed, with 30 cells in series and no resistance in circuit, the speed is six miles an hour and the current taken is 32 amperes. It is also possible (though it is never done in regular service) to put 60 cells in series. This will give a speed of 14 miles an hour, with a current of 52 amperes. The latter speed on the small lagoons in the park seems like a much greater speed than it really is, and causes a great swell, throwing high waves on the bank.

The batteries are arranged under the seats, and for recharging they are uncovered by lifting off the seats. The seating capacity of a launch is 30 persons, though only 25 people are allowed in a boat at one time.

In overhauling the storage batteries, which were of the Julien type, their weight was reduced 700 pounds. The positive plates were replaced with the Haschke plate, which is made of chemically pure sheet-lead, perforated with very fine holes, formed by being placed in a gas vat, filled with granulated carbon and a heavy, thick electrolyte, and then passing a current, creating an electrolytic action, assisted by the gas. The Haschke company claims to be able, by its process, to form a good positive plate in six hours. The old negative plates were considerably sulphated and were depolarized electrochemically. Each positive element is encased in a double sheet of the Haschke insulation, which is an electrochemically treated cardboard. The 60 cells on each launch are rated at 120 ampere-hours. On a test made July 10th, six days after the launches had been put in operation, over 60 miles was covered by one launch on one charge of the battery.

The launches are well patronized and are run from 2 p. m. to 11 p. m. every day, except Saturday, when the service begins at 10 a. m. The circuit of the Jackson Park lagoons is made each trip, and it is a delightful ride. The fare is 10 cents, and a round trip occupies about 20 minutes.

FIG. 1. ELECTRIC-LAUNCH SERVICE AT JACKSON PARK.—A TYPICAL BOAT.

At the plant of the Niagara Falls Hydraulic Power and Manufacturing company, situated on the edge of the gorge, below the falls, a serious accident happened recently, through the breaking of a steel derrick which was lowering a 16-ton armature over the edge of the cliff to the power house. The armature fell some distance and crashed through the roof of the Cliff Paper company's incline railway and lodged between the tracks. Part of the derrick fell through the roof of the Cliff mill. A new armature had to be ordered from the General Electric company. The loss is estimated at between $20,000 and $30,000.

Association of Edison Illuminating Companies.

The sixteenth annual meeting of the Association of Edison Illuminating companies will be held at the Grand Union Hotel, Saratoga, N. Y., on September 4th, 5th and 6th. This meeting will be the twenty-first convention of the association. The sessions will be held in the morning and afternoon of each of the three days mentioned, and will be executive sessions, according to the usual custom of the Edison companies' conventions. On Friday, September 7th, the delegates and guests will be taken by special train to visit the works of the General Electric company at Schenectady. The association of Edison Illuminating companies is composed of about 70 electric-light companies throughout the country, which were the original licensees of the Edison Electric Light company. As there is but one company operating in a city, the relations are

FIG. 2. ELECTRIC-LAUNCH SERVICE AT JACKSON PARK.—SEATING ARRANGEMENT.

entirely mutual and the purpose of the convention is to afford the different members an opportunity for discussing rates, methods of operation, different systems of lighting and other topics that are of important and common interest.

At the Saratoga meeting it is expected that the following papers will be read and discussed: "Some Notes on Electric Elevators," by Arthur Williams, New York; "Systems and Apparatus for Light and Power Distribution," by C. P. Steinmetz, Schenectady, N. Y.; "Polyphase Distribution," by G. Semenza, Milan, Italy; "Electric Elevators and Electric Hoists," by John F. Gilchrist, Chicago; "The Electrical Features of the Paris Exposition," by W. C. L. Eglin, Philadelphia, Pa.; "The Year's Improvements in Meters and Measuring," by C. D. Haskins, Schenectady, N. Y.; "Residence Rates in Detroit," by Alex Dow, Detroit, Mich.; "Arc-lighting Systems," by Walter Fish, Lynn, Mass.; "Distribution from Transmission Circuits," by D. L. Huntington, Spokane, Wash.; "The Past, Present and Future of the Incandescent Lamp," by John W. Howell, Harrison, N. J.; "Efficiency of Electric Distributing Systems," by F. Torchio, New York; "Results in the Application of the Maximum Demand Rate System," by C. S. Knight, Boston, Mass.; "Twenty-five Cycles vs. Sixty Cycles for Union Lighting Station," by C. F. Stott, Buffalo, N. Y.

The following-named gentlemen are officers of the association: President, J. W. Lieb, Jr., New York; vice-president, William Chandler, Sault Ste. Marie, Mich.; secretary, Wilson S. Howell, Newark, N. J.; treasurer, W. S. Barstow, Brooklyn; executive committee, J. W. Lieb, Jr., New York, chairman; Samuel Insull, Chicago; Alex Dow, Detroit; George R. Stetson, New Bedford, Mass.; W. H. Johnson, Philadelphia; Charles L. Edgar, Boston; William Chandler (ex officio), Sault Ste. Marie, Mich.; W. S. Barstow (ex officio), Brooklyn; Wilson S. Howell (ex officio), Newark, N. J.

International Association of Municipal Electricians.

The committee having in charge the work of arranging for the fifth annual meeting of the International Association of Municipal Electricians, to be held in Pittsburg, September 25th to 27th, is making every effort to make the convention a success. Morris W. Mead, superintendent of the Pittsburg Bureau of Electricity, is chairman of the executive committee, and he is assisted by Elmer G. Loomis, chairman of the committee on arrangements, and other members of that committee.

At a recent meeting of the committee on arrangements, Mr. Mead stated that at least 300 delegates, accompanied by their wives and daughters, will attend the convention. It was decided to form a ladies' reception committee, of which Mrs. H. P. Ecker will be chairman. Arrangements have been made with the American Bell Telephone company and the Pittsburg Central District and Printing Telegraph company for the free use of those companies' telephones to the delegates and their friends and also with the Western Union and Postal Telegraph and Cable companies for the free services of their wires. It is expected that the railroad companies will grant a 1 1-3 fare from all points on the certificate plan. The Western Pennsylvania Exposition of Industrial Arts will open at the time of the meeting, and special arrangements will be made for the delegates to attend in a body.

Opposition to New Interurban Road at Columbus.

The officials of the Columbus, London and Springfield Electric Railway company, on the night of August 18th, says the Columbus (Ohio) correspondent of the Western Electrician, executed one of the most successful coups upon their adversaries that the people of Columbus have beheld for some time. For months past, the local street-railway company has defiantly fought all the new railways seeking entrance into the city, and has persistently antagonized the efforts of the Columbus, London and Springfield interurban company, although the latter was granted a franchise some time ago. On Saturday night, August 18th, the officials of the new road determined to carry their well-matured plans into execution. They had been granted the privilege to form their loop around the state capital and in the heart of the city, but how to overcome the difficulties that were sure to beset them, was their supreme concern. However, as the clock struck 12, a gang of 500 workmen suddenly appeared on the scene and began a terrific onslaught on the principal thoroughfares. It was then Sunday and too late for injunctions, and by noon the next day there were at least 12 squares of street that were graded ready for the ties. By this time, counsel for the old road and for a few of the private individuals who were in opposition, were scurrying to and fro, trying to block further work, but to no avail. The local company hauled out a number of old cars and placed them at the intersections of the new road with its lines, to prevent the new company from putting its crossings down, and was successful on that point. August 20th the local "kickers" succeeded in getting out an injunction, and arguments were presented by both sides before Judge Williams on the following Friday afternoon, who requested counsel for the contending parties to submit their briefs on Saturday. The decision of the judge will be handed down some time this week.

Snakes Give Fire Alarms.

Kearney, N. J., has a fire-alarm system that acted very queerly recently. The fire department received numerous alarms, but most of them of a very broken and indefinite character, and the firemen could not tell from which boxes they came, neither could they discover any fire. After the department had been chasing false alarms for several days and had vowed dire vengeance on the practical joker who was tampering with the circuit, three milk snakes were found in a switchbox of the alarm circuit in the cellar at the fire department. They got tangled up with the mechanism, and, in their efforts to get free, turned in alarms that aroused the fire department at all hours of the day and night.

Progress in Arc Lighting by Alternating-current Lamps.[1]

By H. W. Hillman.

At your last meeting, held in Cleveland, in August, 1899, one of the most important discussions was on the subject of illumination by alternating-current arc lamps, and, until recently, this subject has always appeared to include a difficult problem. We can all remember the illumination test which was conducted by the local company on the first day of your convention at Cleveland. That test demonstrated that the light from the alternating lamp properly constructed is satisfactory in all respects to the public, city authorities and central-station managers.

A few months later, the Georgia Electric Light company of Atlanta installed a circuit of alternating lamps for the purpose of making a comparison in the matter of light with their 10-ampere open arcs. After three months' operation, a formal inspection was made by the city authorities and representatives of the lighting company, with the result that the light from the alternating lamps was not only greatly favored, but the alternating system was adopted for illuminating the streets of Atlanta. Such experience, together with results of many other tests, encourages us to believe that so far as the subject of light is concerned, arc lighting by alternating lamps has made considerable progress in the last 12 months. Much has been said about the large installations, such as Hartford, Woburn and other stations, which are operating several hundred arc lamps.

It is interesting to dwell for a moment on some of the features in connection with the new arc system of a small electric-lighting plant. The Fort Plain Gas and Electric company of Fort Plain, N. Y., has furnished commercial and street lighting for the last 12 years. The old equipment consisted of a high-frequency alternator with belt-driven arc machines. About a year ago a series alternating system, with one 50-light transformer, one 25-light transformer, 42 arc lamps and 45 100-candlepower incandescent lamps was introduced. The service is two-phase, a transformer being installed on each of the phases. Notwithstanding that one is a 50-light and the other a 25-light transformer, the two phases are balanced on the commercial circuits within three volts. The system has been operated for about 12 months, without any expense whatever for repairs. Only a half day, once a week, is required to trim the lamps. The space occupied at the station for the arc-lighting system is only four by 15 feet. Notwithstanding that the primary voltage from the transmission line is quite variable, the current of the arc system remains perfectly steady, because of the excellent regulation of the transformers. Fig. 1 illustrates a simple arrangement for automatically switching off the lamps at daybreak. A battery circuit energizes two magnets—the circuit being closed at the proper time by an ordinary alarm clock. When these magnets are energized, a weight is released, which opens the primary switches of both transformers, thus opening the street-lighting circuits. As current is taken from a distance, and there is no generator in the station to require attention, the device referred to above makes it unnecessary to have any attendance whatever at the station. The arrangement has been in service for more than a year and has never yet failed to operate.

Referring further to small stations, the series alternating system offers wonderful flexibility for arc lighting. Notwithstanding the comparatively small size, a 25-light transformer has an efficiency of 95 per cent. The transformers are also made for 35, 50 and 75 lights.

A station manager was recently considering a system for 200 lamps, and desired sufficient spare ca-

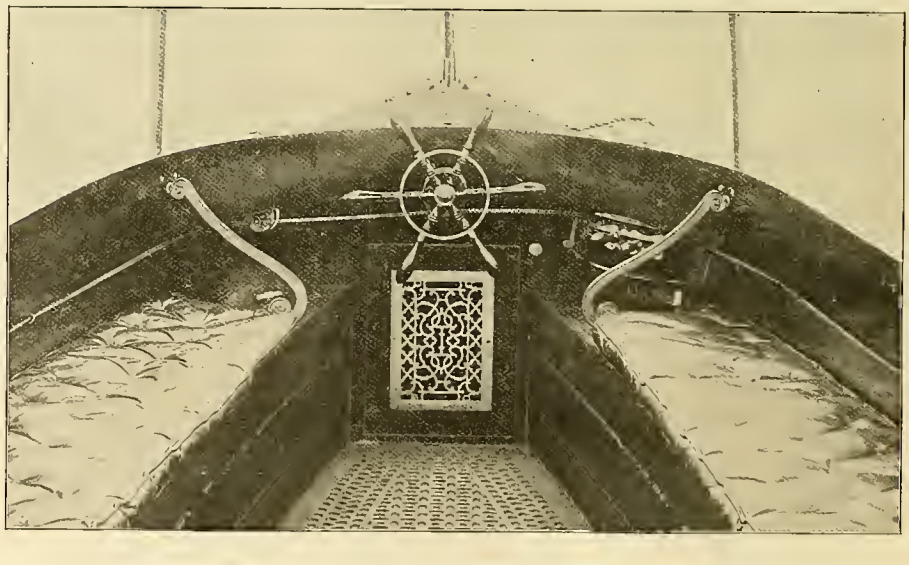


FIG. 3. ELECTRIC-LAUNCH SERVICE AT JACKSON PARK.—STEERING WHEEL AND CONTROLLER HANDLES IN BOW.

1. Read before the Ohio Electric Light association, at Toledo, O., August 16, 1900.

pacity for 225 lights. At first glance, two 100-light transformers and a 25-light size would be suggested, but the conditions of load, as well as the size of the circuits, led to an arrangement of three 75-light transformers. For a time each transformer will be operated with about 65 to 70 lamps, and the multi-circuit arrangement employed for operating two circuits of 35 to 37 lamps each.

Station practice frequently requires the adoption of a transformer to operate at half load temporarily, and later to be connected for the full rated capacity. The constant-current transformer possesses an advantage in this respect, as the primary coils may be connected so as to operate at half load with practically full-load power factor and efficiency. (See Fig. 2.)

The question has been frequently asked, if the transformers can be operated on two and three-phase circuits. Many such systems are now in actual use, and are operating satisfactorily. Of course, great care should be exercised in the installation, with a view to properly balancing the system. Occasionally it happens that only two transformers are wanted, and they are for use on a three-phase service. In such cases a special primary winding can be furnished for a regular three to two-phase transformation. Fig. 3 shows the connections of two constant-current transformers for balancing the load, on a three-phase circuit. Fig. 4 indicates the

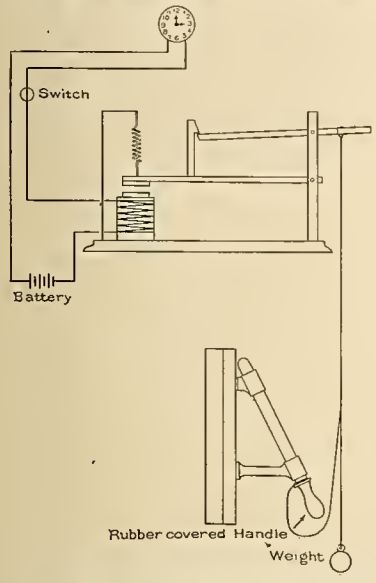


FIG. 1. ARC LIGHTING BY ALTERNATING-CURRENT LAMPS. —AUTOMATIC SWITCH FOR OPENING CIRCUIT.

connections of the same transformers operating as single-phase transformers on a three-phase circuit.

Perhaps some of the Ohio stations are so situated that economy in space would be an attractive feature. The accompanying illustration (Fig. 5) shows a modern arc plant where six 50-light transformers, with an aggregate capacity of 300 lights, require but 140 square feet of floor space at the station, or an equipment of less than half a square foot per lamp. The old arc-lighting system demanded 1,400 square feet for only 225-light capacity. The economy in space is in the ratio of 10 to one, without considering 75 additional lamps, which the plant is now capable of operating.

There exists a universal appreciation of the savings due to the lower maintenance cost of the enclosed arcs compared with open arcs, but insufficient attention seems to have been given to the higher

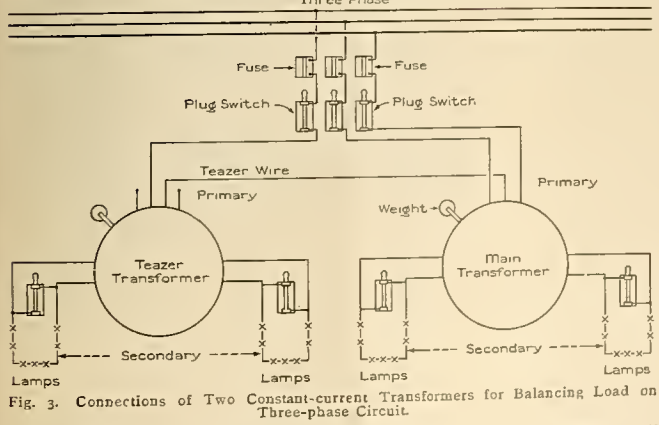


Fig. 3. Connections of Two Constant-current Transformers for Balancing Load on Three-phase Circuit.

efficiency which the series alternating system possesses. It is interesting to consider a 300-light arc system where a large alternator is used for operating incandescent lamps, commercial arcs and the series alternating system. Considering that after 11 or 12 o'clock at night, the street lighting would represent most of the load, the alternator and constant-current transformers would have an average net efficiency of from 85 per cent. to 90 per cent. Comparing this with the efficiency of old-style arc machines, operating from line shafting, it is invariably found that there is a saving of approximately 200 watts per lamp. Operating 4,000 hours per year, the saving represents 800 kilowatt-hours per lamp per year, and at the low cost of one cent per kilowatt-hour for energy, a net saving is effected equivalent to $8 per lamp per year. If representatives of some of the larger Ohio stations should feel one cent per kilowatt-hour is too high, let them use one-half cent, and there still remains a saving of $4 per lamp per year, due to the high efficiency of the series alternating street system.

The small maintenance cost for operating enclosed arcs is beginning to be appreciated. A report from a station where a 100-light transformer and 100

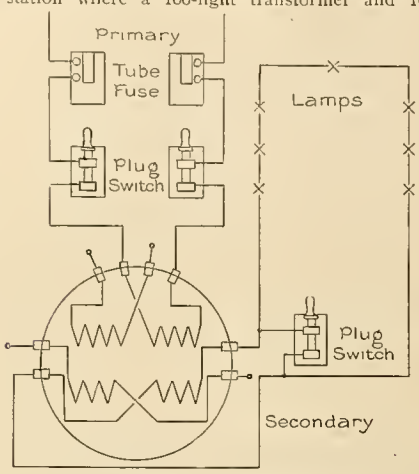


FIG. 2. ARC LIGHTING BY ALTERNATING-CURRENT LAMPS —CONNECTIONS FOR CONSTANT-CURRENT TRANSFORMER.

lamps were operated for over a year states that not a cent has been expended for parts for either the transformers or the lamps. A report on six transformers in operation for more than two years shows that the only expense for maintenance has been a small chain, costing not more than 10 or 15 cents. The exact annual cost of operating enclosed and open-arc lamps has been frequently discussed. The table below may be considered as representative of the annual saving in maintenance, in connection with a station having established a first-class arc-lamp department:

Items.	Open Arcs.	Enclosed Arcs.
Trimming	$ 5.63	$1.28
Carbons	6.57	1.56
Inspector	.94	.90
Repairs	2.00	1.00
Inner globes	....	.60
Outer globes	.08	.14
	$15.22	$5.48
	5.48	
Annual saving in maintenance	$ 9.74	

It is only fair to add that in such cities as Cleveland, Chicago, Pittsburg or Cincinnati, the outer globe will require cleaning frequently, due to the excessive dirt and dust which is known to accumulate in those particular districts. This item would increase the cost of maintaining enclosed arcs, approximately, $1 per lamp per year.

Whether the station be small or large, it is equally essential that a systematic method be adopted for taking care of inner globes, carbons, etc. As the enclosed arcs have two globes, compared with one for the open arc, additional attention must be paid to globes. The design of the enclosed lamp enables the use of the residue of the upper carbon for the lower holder, and advantage must be taken of this feature in order to operate at a low cost. Inner globes should be carefully cleaned, and the residue of upper carbons cut the proper length to be used again. Inner globes ought to be returned to the station and cleaned at each trimming, when the carbon deposit is so slight as to enable a thorough cleansing of the globe. Too much stress cannot be laid upon this point. In the globe-cleaning room of a modern enclosed-arc-lamp department, a scheme has been adopted for brushing out the globe and cleansing it with water at the same time. An upright brush is mounted upon a supporting arm and belted to a motor. The brush is revolved at a considerable speed, to remove the carbon dust from the globe, and at the same time, hot or cold water is passed through the pipes into the globe. A recent trial was made to see how fast the globes could be cleaned by this method. At the start, the globes were in the wagon-box, having been returned to the station. They were taken out, the holders removed, and in an hour and 20 minutes 125 inner globes were cleansed, dried and returned to the wagon-box ready for use the next day. The trimmer not only takes care of 125 lamps per day during this season of the year, but cleans the globes. A device for testing carbons for straightness, diameter and length is provided. A gauge on the table is set for the right length, and 125 carbons may be quickly cut and placed in the holder for the next day's use.

Considering the excellent organization of this lamp department, together with the great care which has been paid to little details, we need not be surprised to learn that the previously cited comparative statement showing cost of operating open and enclosed lamps was based on the result obtained at this station. It may serve as a guide for central-station managers investigating the economy which may be secured by the enclosed-arc street system.

Progress may also be noted in connection with

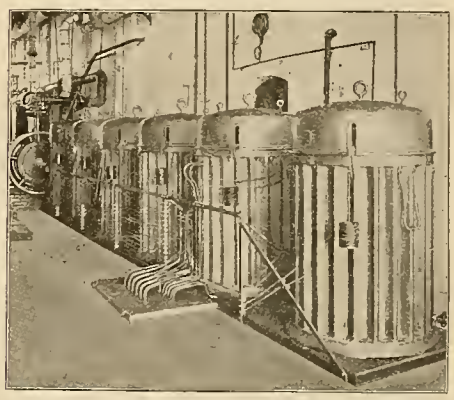


FIG. 5. ARC LIGHTING BY ALTERNATING-CURRENT LAMPS. —A MODERN TRANSFORMER PLANT.

inner globes. In the first installations of alternating enclosed lamps, it was common to use clear globes. It seemed reasonable to believe that more light could be secured from clear glass than from opal. However, the danger from this practice became apparent. A shadow existed beneath the enclosed-arc lamp to a degree almost approaching that of the old-style open arc. This shadow was found to be more annoying, because the arc constantly moves around the carbon, producing a wandering shadow on the ground beneath the lamp. The source of light is the arc only, when using a clear inner globe, while with an opal glass, the entire globe, from the top to the base, is flooded with light; the globe itself becomes a source of light. The shadow is entirely eliminated, a beautiful diffusion is secured, and tests show that the amount of light is greater at a distance with an opal inner globe than it is from a lamp equipped with clear glass. Evidences are not lacking to prove the practicability and value of opal inner globes for enclosed-arc street lighting.

I desire to earnestly appeal to the central-station managers of Ohio to energetically push the arc-lamp department of their business, and particularly the street-lighting branch. Such wonderful strides have been made in interior lighting that this part of the arc-lamp department has become a source of increasing income. In all sections of the country evidences of this fact are abundant.

The street-lighting end, however, has been lax. Particularly is this true where stations are furnishing lights from the old-style arc system. There is no more reason to expect to energetically push street lighting and greatly increase your income with the old-style system, than there was for competing with Welsbachs, and pleasing the merchants,

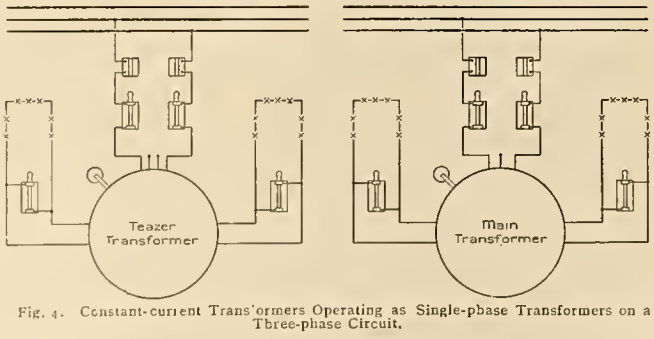


Fig. 4. Constant-current Transformers Operating as Single-phase Transformers on a Three-phase Circuit.

when you had only open arcs available for store lighting. As soon as the merchants saw the great improvement in artificial light, they adopted it exclusively. They had become accustomed to the use of electric light in great abundance, because it is a superior illuminant.

The same argument applies in connection with street lighting. The alderman, who has recently moved into the new residential district, takes pride in referring to the new-style lamps. They harmonize with the residences recently built. They go hand in hand with the new railway line, which has just been extended into that territory; and, al-

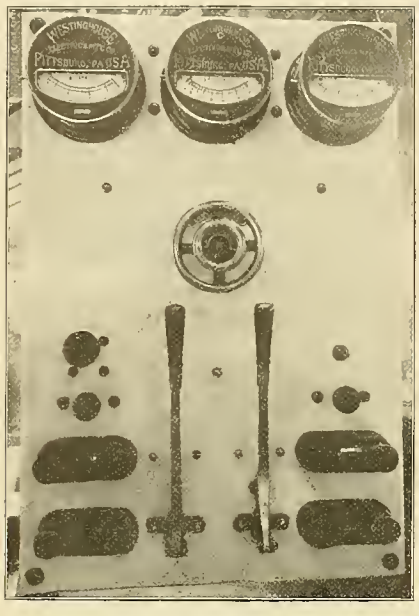


FIG. 16. MODERN SWITCHBOARD PRACTICE.—WESTINGHOUSE 2 200-VOLT SINGLE-PHASE PANEL.

together, the illuminating company occupies a very strong position. In introducing a new system of lighting, with the advantages of steady burning, absence of shadows, neatness of installation, cleanliness of globes and uninterrupted service, the outlook is encouraging. All these superior features popularize the lights among the citizens of any city or town. The interest displayed in this subject by officials and representative business men is not surprising. In a city in the East, which has met with considerable success in introducing the new lighting system, the mayor secured opinions from many prominent citizens whose business takes them on the streets at night, and whose opinions might be considered of much value. Commendatory letters were received from the chief of police, the chief of the fire department, the superintendent of street-cleaning department, the most prominent physicians, the

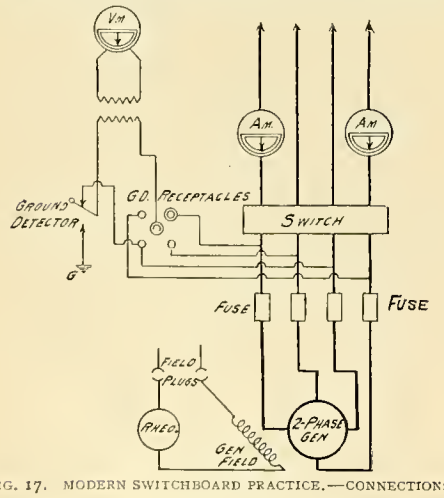


FIG. 17. MODERN SWITCHBOARD PRACTICE.—CONNECTIONS FOR A TWO PHASE GENERATOR.

proprietor of a prominent livery stable and the bicycle-path commissioner.

An arc lamp near a fire hydrant is of considerable value. The good illumination facilitates making connections with a hydrant, and assists the fire department in saving life and property. Such an argument should appeal to the citizens of any community. While arc lamps need not be placed at every hydrant, they should be so located that every hydrant is well illuminated, or if this is impracticable, a series-incandescent lamp should be suspended over each hydrant which is not already lighted by an arc lamp.

These ideas lead us into the subject of candle-power, and strongly suggest the low-energy lamps, or the lamp of smaller illuminating capacity. The minutes of your last meeting contained a few words on this subject by Mr. Hoag, city electrician of Cleveland, who stated that he hoped that the time would come when arc lamps of smaller units would be available for street use, thus affording an opportunity for installing them more freely throughout all sections of the city or town.

Progress has already been made along this line; for example, the 10-ampere open-arc lamp consumes about 480 to 500 watts, while the new series alternating enclosed arc consumes only 425 watts at terminals. Among the 150 stations which have adopted the series alternating system, almost all of them are using the standard 6.6-ampere or 425-watt lamp. This shows conclusively that the low-energy lamp has come to stay, and, in fact, some of the systems installed are adjusted for six amperes and consume only 375 to 400 watts at terminals. As the energy consumed per lamp forms such a large proportion of its cost of operating, the subject becomes a very important one.

To study all the phases of the street-lighting business should be the aim of every central-station manager. At this time, when such great improvement is offered for illumination, there is something wrong if the annual income from the city is not increased. The adoption of low-energy lamps will encourage the use of lights extensively; the economies effected by the new system will increase the profits materially; and, finally, as the public reaches that degree of education where artificial light will be demanded as universally in the street as it is now used among the merchants, mills and factories, your arc-lamp department will be in a flourishing condition. Progress in arc lighting by enclosed lamps will have been substantiated for all time.

Project to Consolidate Wisconsin Electrical Properties.

Articles of incorporation of the Wisconsin Traction, Heat and Light company were filed August 24th with the register of deeds at Milwaukee. The nominal capitalization of the company is placed at $10,000. The incorporation of the company is said to be the initiatory step toward the consolidation of all the electric lines of the state under one management and the connection of all the cities between Chicago and Green Bay by an electric line. The

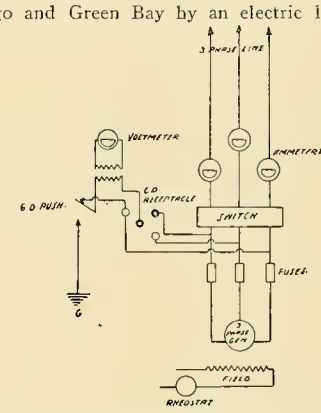


FIG 18. MODERN SWITCHBOARD PRACTICE —CONNECTIONS FOR A THREE-PHASE GENERATOR.

incorporators are Henry C. Payne, Charles F. Pfister, Frank G. Bigelow and John I. Beggs. Speaking of the purpose of the new company, Mr. Beggs is reported as saying:

"The corporation is formed primarily for the purpose of uniting and fostering certain small properties in the Fox River Valley, and that object, for the present at least, will be the sole one. The articles, however, provide for extensions, and there is little doubt but that the lines to which I referred will serve as an important step in the road from Chicago to Green Bay, of which reference has been frequently made.

"While the company is at present in every way distinct from the Milwaukee Electric Railway and Light company, the ultimate purpose, I am free to admit, will be to bring the properties all under one head. Such an undertaking requires time, and the steps toward this ultimate goal will be slow. But it will all tend to secure the best of facilities and to extend the usefulness of the electric service in the state."

Street-railway Bills to Be Recommended.

The street-railway commission of the Chicago City Council has decided to draw up two bills which it will present at the first meeting of the council in the fall, with the request that they be recommended to the Legislature next winter. The first bill to be drafted will be a comprehensive street-railway measure, intended to solve the present problem before the City Council. It is proposed that the city be given power to lease franchises to existing or other street-railway lines, after the expiration of the present franchises for surface trunk lines in 1903. The second bill will give the city power to build a subway or permit private capital to build it, under the city supervision. A referendum clause will be inserted in this latter bill, so that when the city is ready for the subway the council can go before the people and determine by an election whether the subways be built by the city or by a company.

Modern Switchboard Practice.

By Frank C. Perkins.

Part III.

Single-phase Alternating-current Switchboards.

The panel construction for switchboards for all ordinary high-tension, single-phase, alternating-current installations has proven to be the best possible form for future extensions, simplicity of design and neatness in arrangement and economy of space. The Westinghouse design (Fig. 16) shows a single panel, any number of which may be placed side by side when it is desired to operate several machines. The slabs are of polished white marble (Italian), 1½ inches thick, with beveled edges. These marble slabs are supported by a rigid pipe and iron framework, which is secured to the floor and properly braced from the wall, making a solid and substantial construction. The supports are arranged so

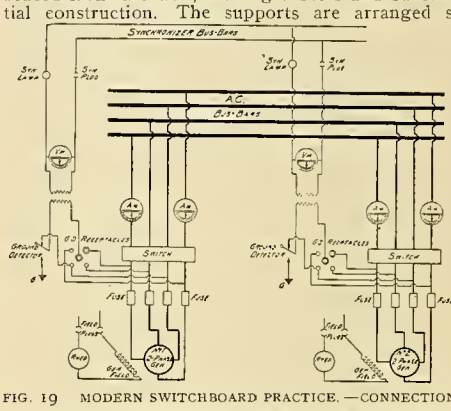


FIG. 19 MODERN SWITCHBOARD PRACTICE.—CONNECTIONS FOR TWO TWO-PHASE GENERATORS RUNNING IN MULTIPLE.

that below the panels a clear space of about two feet is left free.

All the instruments are mounted directly upon the marble slabs, and in this particular type of panel care has been taken to arrange construction so that no charged metal parts are exposed on the front of the switchboard, thus preventing the attendant from accidentally receiving a shock from the front of the board. This is largely accomplished by using a special construction of switch known as the high-potential, non-arcing-type plunger of the single-break form; that is, one porcelain cylinder and plunger are provided in each leg of a circuit, thus giving two breaks in series on a single phase. The

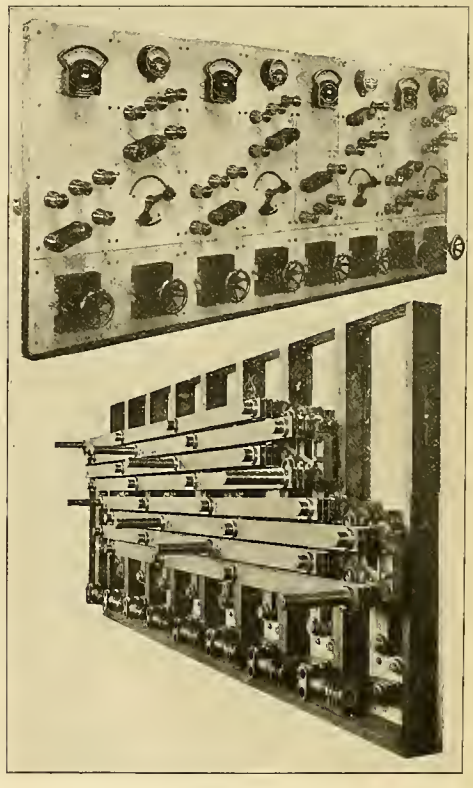


FIG. 20. MODERN SWITCHBOARD PRACTICE —FRONT AND BACK OF BOARD FOR FOUR 270-KILOWATT ELECTROLYTIC GENERATORS.

special conditions studied in the construction of these switches were: First, that an arc is maintained with difficulty when the circuit is quickly broken; second, that an arc tends to expand, and cannot therefore be readily maintained in a confined space; third, that an arc cannot withstand a strong transverse draft of air. The long handle furnishes a powerful leverage and gives ease and certainty of operation, while, being on the opposite side from the switch terminals, it insures absolute safety to the attendant. Each porcelain cylinder has a one-half-inch bore, through which a copper rod or

plunger passes, making the electrical contact between terminals.

In the panels designed by the engineers of the General Electric company the material used for the panel is blue Vermont marble, two inches thick, and divided into an upper panel about five feet high and a lower panel below, in the back of which the switchboard transformer is usually mounted, and frequently the lightning arresters are also placed at the back of the lower panel. The total height of the board is nearly eight feet, and is mounted on an iron framework of steel angle bars, secured to the floor with angle brackets and to the wall with stay rods. By referring to diagram, Fig. 15, the

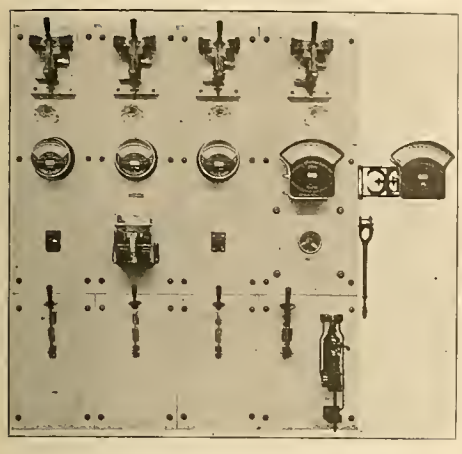


FIG. 21. MODERN SWITCHBOARD PRACTICE.—SIEMENS & HALSKE DIRECT-CURRENT SWITCHBOARD.

arrangement of connections, pilot lamps, fuse blocks, direct-current and alternating-current ammeters and other apparatus may be readily followed. The rheostats, switches, ground detectors and transformer may be noted particularly in the back and side elevations in this diagram.

The necessary apparatus of the Westinghouse type usually installed for controlling one single-phase generator and one single-phase feeder consists of a voltmeter and ammeter placed near the top of the panel, a combination rheostat, with concentric wheels, mounted on the front of the board, the rheostat itself being placed on the back or near at hand, a ground-detector receptacle and plug, a high-potential push-bottom and two field plugs. The two-pole high-potential plunger switch is seen below, with two single-pole fuse blocks, one mounted on each side, while the switchboard transformer is mounted on the back of the board, and is not seen in the diagram.

The connections for controlling one two-phase or one three-phase generator may be seen in diagrams, Figs. 17 and 18. The current capacity per circuit on these panels is from 45 amperes to 100 amperes. Generally, a swinging-arm voltmeter is provided.

Connections for multiple running of two two-

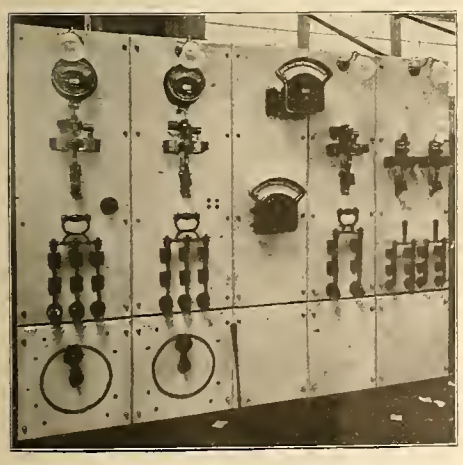


FIG. 23. MODERN SWITCHBOARD PRACTICE.—WESTINGHOUSE DIRECT-CURRENT SWITCHBOARD.

phase generators may be seen in Fig. 19. Above the main bus-bars are simply shown the synchronizing lamps, and synchronizing bus-bars, while below all the various connections of ammeters, voltmeters, switches and other instruments may be traced.

The method adopted in these boards is to use the voltmeter and voltmeter transformer for testing for grounds. A plug receptacle and push-bottom are supplied on each generator panel, by means of which either side of the circuit may be tested for a ground, and under normal conditions, when the voltmeter reading above is required, the plug is inserted in the two sockets of the plug receptacle, which are covered by red fiber rings.

DIRECT-CURRENT LIGHT, POWER AND RAILWAY SWITCHBOARDS

The construction of switchboards by combinations of various panels is particularly well adapted for direct-current, light, electrolytic, power and railway work. The illustrations, Figs. 20, 21, 22 and 23, show the designs and construction of Anderson, Westinghouse and Siemens & Halske engineers, and the method of assembling the generator panels, rheostat panels, load panels, feeder panels and blank panels.

The modern switchboards are usually made up of slabs of white Italian marble or blue Vermont marble, two inches thick, with polished faces and one-half-inch beveled edges. An iron framework is invariably used to support the panels, and is made of steel angle iron. Flat conductor bars are used to connect the different instruments and switches mounted on each panel. One of these bars is allowed for each 300 amperes of current. For very heavy currents a larger unit bar is used (see Fig. 20), a ventilating space being left between successive bars. The bars are usually held in place by nuts, screwed on to the studs of the instruments and switches, the studs being properly threaded. For currents under 200 amperes wire is used instead of strap connections. For all smaller conductors, required to connect the voltmeter, pilot lamp, etc., No. 12 insulated wire is used.

Usually standard adjustable jaw switches are used on boards of this construction having a working potential not to exceed 750 volts.

Frequently the voltmeter is mounted on an arm hinged to the angle-iron framework of one of the end panels. The swinging voltmeter is of particular value to the attendant, when two or more generators are operated in multiple. He can then swing the voltmeter around at right angles, so he can keep his eye upon it while throwing in each additional machine in multiple with the others. A swinging voltmeter is shown on the Siemens & Halske switchboard (Fig. 21).

The railway switchboard (Fig. 22) was planned

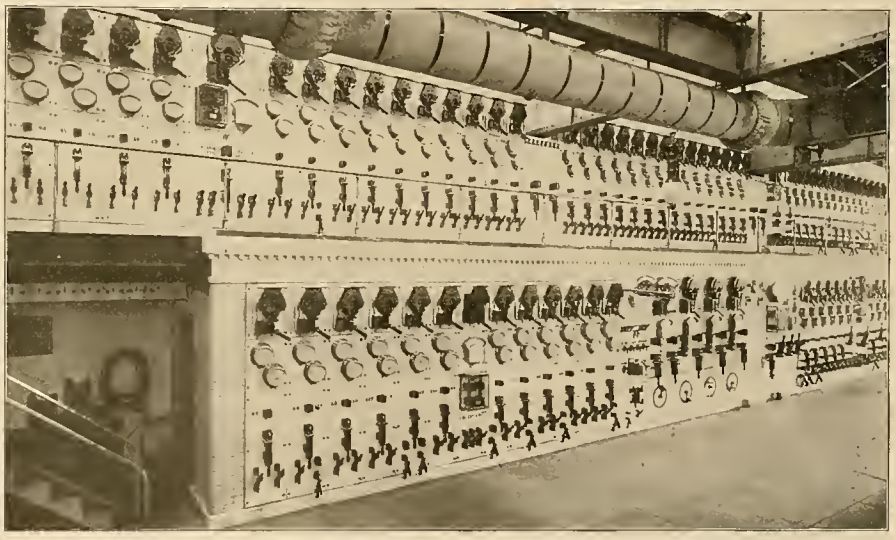


FIG. 22. MODERN SWITCHBOARD PRACTICE.—ANDERSON RAILWAY SWITCHBOARD.

and laid out by engineers of the Philadelphia Union Traction company. The Albert and J. M. Anderson Manufacturing company furnished the switches and practically all the connections. It also made all connections on the board and put up the bus-bars. A view of the board gives one the impression of its having great strength, solidity and ample capacity. It is erected across the south wall of the station, in two tiers, the upper one being 90 feet long and the lower being 60 feet, 15 feet reserved on each side for an entrance, leading to the street and repair shop on the right, and to the stationmen's rooms and lockers on the left.

The feeder panels are seven feet 10 inches high and 18 inches wide. There are four generator panels, 30 inches wide, five tie-line panels, one panel for controlling lights, one panel for recording wattmeter and negative switches, one panel for main ampere and wattmeters, two switch panels for connecting upper and lower bus-bars, and one spare generator panel. The switches, connections and choke coils on the board weigh upward of 14 tons, and the bus-bars about seven tons, which will give a general idea of the amount of metal used. The main bus-bar is designed to carry 16,000 amperes.

[*The end.*]

Space Telegraphy at the Hawaiian Islands.

Communication with neighboring islands and with the outside world means much more to the citizens of the Hawaiian Islands than those who are in daily communication with the world can realize. The recent successful use of space telegraphy to communicate from one island of the group to another was especially welcome. Honolulu and Lanai, 100 miles apart, are now in easy communication, and the other islands will probably be in similar communication soon. Owing to the mountainous nature of the ocean bottom, a cable laid between Oahu and Maui, 70 miles, about 10 years ago, was broken and found impractical to maintain, so that wireless telegraphy seems to be the only hope the islands have of intercommunication other than by steamship.

An English View of Municipal Ownership.

Lord Avebury, in the July Contemporary Review, London, points out that the result of government and municipal "trading," as it is called in England, is not by any means the unqualified success that it is sometimes made to appear to be by enthusiasts 4,000 miles away on this side of the water. Among other things, Lord Avebury, in substance, says:

"The action taken by municipalities not unfrequently tends to defeat the very object they had in view. Take, for instance, the housing of the poor. It is generally agreed that in many, perhaps most of our cities, there are slum districts, with houses unfit for human habitation. Now, there are two ways of dealing with this state of things. The municipalities have power, under the existing law, to compel the owners of such property to put it into a proper condition, and this power might be exercised; or, secondly, they might buy the property, and build workmen's dwellings themselves. The first seems to me the true policy, but the second is that adopted by various municipal authorities. Miss Octavia Hill, however, who speaks with so much authority on the subject, has told us that, in her opinion, it is very undesirable that municipalities should undertake the housing of the poor.

"I firmly believe that municipalities will lose money. We have some object-lessons before us. The telegraphs are often referred to as being a brilliant financial success. But what are the facts? We have lost altogether over £7,000,000, and the yearly deficit is increasing. Three years ago it was £340,000; two years ago, £440,000; last year, no less than £600,000! In Victoria the railways have been for some time worked by the state, and the result has been a loss of no less than £7,750,000. Nor is this the only case. South Australia has also lost £2,000,000. Unless the present tendency is checked, we must be prepared for a great increase in our rates, and in the number of our municipal employes, for an enormous expansion of our local debt, for a serious check to private enterprise, and a discouragement to th eprogress of invention and discovery."

Proposed Power Development of the Youghiogheny River.

A syndicate is considering the matter of developing the waterpower of the Youghiogheny River near Ohiopyle, Pa., and furnishing electric power to a network of electric roads through the coke region. A charter for the Uniontown and New Salem street railway has already been taken out. The key to the waterpower situation is a large strip of land jutting out from a high mountain, around which the Youghiogheny River tumbles and falls for a distance of almost two miles. Across the narrowest part of the neck the distance is only 1,200 feet. The Ohiopyle Falls are at one point of the neck. The entire river plunges over a precipice 16 feet high, and numerous other falls and rapids make a fall of 96 feet in the two miles around the neck. The land on the neck is almost level, and it is said that plenty of room can be had for all necessary buildings. The scheme is to drive a race across the narrow part of the neck and harness the falls after the same manner that Niagara Falls are now harnessed. The same idea had been talked of before, but never materialized. The proposed cut would not be over 25 feet deep at the lowest point. A tunnel will not be dug, as it would cost too much. All the plans have been prepared and are ready for the report of the engineers on the hydraulic power available. J. K. Ewing of Uniontown is at the head of the project.

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CONVENTIONS AND EXPOSITIONS.

Association of Edison Illuminating Companies, Saratoga, N. Y., September 4th to 6th.

Street Railway association of the State of New York, Buffalo, N. Y., September 18th and 19th.

Inter Ocean Automobile Meet, Chicago, Ill., September 18th to 22d.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

Germany is making rapid progress in the application of electricity. On March 1st of this year there were in operation 652 electrical plants, against 489 the previous year. The number of places with electric light exceeds that of places illuminated by gas—900 against 850. The largest electrical plant is at Rheinfelden, with 12,360 kilowatts. Then follow one at Berlin, 9,230 kilowatts; one at Hamburg, 7,290 kilowatts; one at Munich, 6,110 kilowatts; two others at Berlin, of 5,452 and 5,312 kilowatts, respectively; one at Strasburg of 4,955 kilowatts, and so on. All the electrical works supplied last year 2,623,893 incandescent lamps, 50,070 arc lamps, and 106,368 horsepower for motors. The Vaterland is still far behind the United States in the consumption of electric current, but the present rate of extension is remarkably high.

The 1900 census returns of American cities which are now being made public show, as a rule, that the population of the larger towns has increased at a much smaller rate in the last decade than in the corresponding period from 1880 to 1890. This fact has attracted widespread attention and it is attributed to the great extension of the electric railway. Although the figures for the suburban districts are not yet available, it is undoubtedly true that the most rapid growth of the last 10 years has been in the border land about the big cities—just outside the heart of the town, but not far enough to be in the country. The trolley car is responsible for this development It has made possible the thick peopling of land which was formerly too far out to become the homes of persons of moderate means whose daily work was in the city. Anything that reduces the pressure upon land in the great cities is to be welcomed, for fresh air and sunlight are prime necessaries of life; and in this way the electric railway has brought its greatest blessing to city dwellers.

Southend-on-Sea is in disgrace—at least with the "militantly British" portion of the English industrial press. It seems that the borough engineer of the place actually had the temerity to specify American equipment in inviting tenders for electric-railway apparatus, of which the town is in need. This "unpatriotic" conduct is a great shock to the sensitive Feilden's Magazine, from which we obtain our information, especially as "such material is obtainable in our country, at reasonable prices, from industrial concerns that are exclusively British, and which spend the money they receive in our own country, employing British brain and muscle and encouraging British manufactures." In concluding its admonitory remarks to the unhappy municipality, our contemporary rises to the occasion in these words: "We most earnestly hope that never again shall we have occasion to bring to public notice a breach of loyalty to British interests so flagrant as that committed by the corporation of Southend-on-Sea." In short, the Southend officials have been guilty of an offense little short of treason to the British crown because they endeavored, in a perfectly open and legitimate way, to secure a well-tried class of apparatus which they preferred. Is it not a confession of weakness—a significant indication of the alarm felt among English manufacturers—that such a pother is made over the action of a town of 13,000 inhabitants?

The Chicago Tribune criticizes the recent report of the commissioner of labor on the private and municipal ownership of waterworks, gas works and electric-light plants, on the ground that the government does not state "general results," meaning by that, apparently, "the business of interpretation on broad and illuminating lines." But what would the Tribune have? Is it the business of the United States government to take sides in the municipal-private-ownership controversy to "illuminate" the facts? Of course, it is not. The government gathers the data bearing on the case, tabulates the figures and explains and summarizes the tables. These are the results submitted by the department. Persons who have sufficient capacity and interest may draw their own conclusions from this laboriously gathered and classified material; it is not the province of government to do so. The report gives the opportunity for comparison, puts the figures of the two classes of service in juxtaposition, as far as may be, but does not undertake to say in set terms that municipal ownership is to be preferred to private ownership, or vice versa. And, as was pointed out in the Western Electrician a month ago, when this report was considered in these columns, it is impossible to arrive at any "general result," because all the elements of cost of production, as known to central-station men by experience, are not accepted by their adversaries. Without taking sides, there can be no "general result," because the premises that lead to it are in dispute.

It looks as though much of the time of the next session of the Illinois Legislature will be taken up with street-railway franchise questions. It is said that a state rapid-transit commission will be asked by the combined Chicago street-railway companies independently of a similar application by the city authorities. The city will ask for a commission which will give larger powers to the municipality in making a permanent settlement of the transit problem. The companies will ask for a commission, as they did in the defeated Humphrey bill, which will take the power of settlement away from the city almost entirely, so far as the initiative is concerned, giving the people of Chicago only the right of veto, the control of the companies being vested permanently in the state commission. The contention of the companies will be, it is assumed, that the validity of the 99-year act of 1865, under which the predecessors of the Chicago street-railway companies received direct grants from the Legislature, will not be impaired by the expiration of the 20-year extension ordinance in 1903, and that the trunk-line grants to the companies are valid until 1958. On the other hand, the city will assert that the so-called contract rights for 99 years apply to "animal power only," as specified in the original grants, and that the companies have no authority from the state to operate either cable or electric lines. It is possible that the whole question will be referred to a commission, and if so, there will be a vigorous contest before the Legislature to determine the powers and scope of the commission.

Romantic and historic Edinburgh would not sacrifice its good looks to obtain the benefits of the overhead-trolley system. When it was concluded that the old horse railways were out-of-date and insufficient, the city authorities decided to go to the great expense of installing a system of cable railways in order to mar the appearance of the streets as little as possible. But now there are many residents of the proud old city who think that the freedom from poles and wires has been purchased at too great a cost, especially as the new electric-railway system of Dundee has proved a conspicuous success, which the cable cars in Edinburgh have not. A correspondent of the Electrical Review of London, canvassing the situation, says that the cable cars in Edinburgh have so far been a comparative failure. After several years' labor, the full system is not in operation yet, and the lines that are working are a serious annoyance to passengers. Continual breakdowns and stoppages are the fate of the traveler; he may start, but he knows not when he will arrive at his destination. Nothing like a regular service can be maintained, and the cars get bunched together. The drivers do not seem to be able to understand the working of the different junctions and auxiliary cables, and are kept on a nervous tension, which may probably account for some of the stupid things they do. The conductors are disheartened, and long for a return to the old horse-car days, although after the enormous expense of cabling the streets that is an impossibility. At the recent annual dinner of the Merchant company it was freely admitted that the adoption of the cable system in preference to the electric had been done too hurriedly. The annual rent to the Edinburgh corporation is £90,000, and for the last two years the tramway company has paid no dividend; last year, indeed, left a loss on the 12 months' work. The success of Dundee, where car-mile cost has been reduced from the 6d. of animal power to 1 1-3d. by the use of electricity, only makes the position of matters more annoying, for there are many men in Edinburgh who advocated the electric traction, or, at any rate, a period of delay, and who are now pointing to the disorganized cable system, and asking if anything could be worse than that. All in all, Auld Reekie is paying a rather dear price for passing by modern convenience in favor of historic tradition.

Incandescent Lamp Socket Decision.

Judge Nathaniel Shipman of the United States Circuit Court, Southern District of New York, has decided in favor of the plaintiff in the incandescent-lamp socket case brought by the General Electric company against the Anchor Electric company and Henry G. Issertel as its agent and manager, for infringement of patent No. 559,232, issued April 28, 1896, to J. C. Tournier, on a socket for incandescent lamps. Claim 1 of the Tournier patent, which is owned by the General Electric company, reads:

In an incandescent-lamp socket, an insulating block, circuit terminals and a circuit-controlling key with a metallic tip and operating spring mounted thereon, in combination with a metallic socket mounted on the insulating block, the metallic tip of the controlling key being adapted to make contact with the shell and close the circuit.

In his opinion Judge Shipman says, in part:

"The original socket which was made for the Edison filament lamp was a hollowed, cup-shaped, insulated wooden block, in which the circuit-breaker was a thumb-screw. The socket, as a whole, or in its parts, was ill adapted to the needs of a filament lamp. It speedily disappeared, and a porcelain socket took its place, which, instead of a block, had a single insulating disk of porcelain upon which the various metallic parts were secured. The disk was weak and fragile. The metallic parts, not being separated from each other by insulation, produced abundant short-circuiting and the screw shell was permanently included in the circuit and electrified. A change was made to a socket of two thin, separated disks, but the trouble arising from non-insulation of the metallic parts, short-circuiting and frequent breakage did not abate. Each of these sockets was in turn the standard article in common use until the Tournier device was invented for the purpose of having a socket which should overcome their annoying and expensive defects.

"Tournier discarded disks and made a substantial cylindrical supporting block of porcelain or other insulating material the base of the socket. He cut away its edges for the passage of the circuit wires, made cavities or recesses in the sides of the block, in one of which was mounted a binding-screw secured to the key-shaft, and in the other another binding-screw, connected with a metallic contact arm projecting over the top of the block, was mounted. A transverse passageway was cut through the block in which the circuit-controlling key-shaft, its frame and operating spring were mounted.

"Some of the advantages, which are manifest in the Tournier socket and which the mechanical experts for the complainant notice, are the strength of the insulating base, the encasing of the contact-key and circuit terminals within this base, thereby preventing accidental contact with the exterior metallic shell, the separation of the terminals and the metallic working parts by walls of porcelain and the consequent reduction of liability to short-circuiting, the disconnecting the threaded shell from the circuit, except when the lamp is in place or the key is closed, and the simplicity, compactness and strength of the parts, whereby loosening of the metal pieces was avoided.

"The socket was placed on the market in the fall of 1894, its advantages were speedily recognized, it has had an extraordinary success and during the year 1899 more than 2,000,000 Tournier sockets were sold by the complainant.

"Inasmuch as the gist of the Tournier invention consists in his improved solid insulating block which produces safety and permanence by its housing of and its relation to the various metallic parts, it is not strange that no anticipation could be found either in the pre-existing defective disk-shaped structures, or in the Edison wooden cup-shaped article, which speedily disappeared from use.

"The defendant seeks relief from its inability to find that the patent in suit had been anticipated by the assertion that every separate element was old and that no invention was either required or exercised in assembling the various elements in the combination in which they appear in the Tournier structure. The insulating block of the patent, as constructed and arranged to become the receptacle of the various metallic parts, was a novelty, and, in its peculiar characteristics, it had no predecessor. It is a waste of time, in view of the mass of pre-existing patents, the large majority of which were failures, the development of the Tournier device, which was carefully wrought out by a change in the character of the insulating base so as to avoid the defects of the disk sockets, and the complete success of the structure, to deny its patentable character."

Third-rail Line Opened at Albany.

On August 20th the first trip was made over the third-rail line of the Albany and Hudson Railway and Power company of Hudson, N. Y. This company purchased the Kinderhook and Hudson railway, which had been operated by steam power. The new owners have remodeled the system, and have extended the line from Niverville to Rensselaer, an additional distance of 18 miles. The total length of the road is nearly 38 miles. New steel rails have been laid and the roadbed has been newly ballasted according to the best modern practice for high-speed service. The current is supplied by a third rail, and the power operating the railroad is supplied from one power station at Stuyvesant Falls, and generated by waterpower. From that point it is transmitted at a pressure of 12,000 volts to substations along the line of the railway. The construction of the road has cost 2½ million dollars. This is said to be the largest third-rail electrical system in operation. The recent test is said to have been satisfactory in every respect. At points along the line the train ran at the rate of 60 miles an hour. The following-named gentlemen are officers of the company: President, A. M. Young, New York; general manager, Maurice Hoopes; chief electrical engineer, Ernest Gonzenbach.

Unusual Electrical Mishaps.

The midsummer fire report of the Electrical Bureau of the National Board of Fire Underwriters has its usual collection of "terrible examples" of electrical troubles that might have been avoided by greater care or better workmanship. Some of the more unusual mishaps are thus referred to:

A passenger elevator installed on 500-volt circuit with magnetic controlling devices and double-pole circuit-breaker. When attendant attempted to stop car at second floor the devices failed to act. No automatic switch being installed at top of shaft, the car collided with the beams of the roof and stopped. The double-pole circuit-breaker failed to open the circuit because, owing to parts of opposite polarity being too close, the current arced from one pole to the other.

The bursting of an incandescent glass bulb in a knitting mill set fire to lint, which quickly communicated to surrounding inflammable material.

An electric soldering iron was left connected by an employe in a manufactory of electrical supplies. It became overheated and set fire to surroundings.

A switch controlling a small electric motor, used for grinding coffee in a grocery store, was operated by a string. An imperfect contact caused an arc, which set fire to insulation of wires. Fire communicated to surrounding woodwork.

Flexible cord was run by engineer from wires back of canopy of a wall bracket around side wall of room to a receptacle for the purpose of furnishing additional light to occupant of a room in a hotel. On wall, attached to same by tacks and pins, were many inflammable articles, such as calendars, paper fans, posters, etc. One of these fastenings was driven through the cord in such a manner that subsequent movement of the cord completed a short-circuit. The insulation on cord was ignited, the inflammable material caught fire, and before the fire could be extinguished a damage resulted to carpets and furniture of $60.

A large feed mill was operated by an electric motor. The generator at the central station which supplied current to the motor at the feed mill shut down for repairs, and the engineer at the feed mill neglected to open the switch controlling his motor. In a short time the generator at the plant again started up, starting in turn the motor at the feed mill, with entire resistance of rheostat in circuit. The coils in rheostat became red hot and fell against partition to which rheostat was bolted. Partition caught fire, and before flames could be checked the entire mill and its contents were destroyed.

A cloth-cutting machine was placed on a table on one of the upper floors of a large ship-chandlery establishment. The motor operating same was rated as one-sixth horsepower, but evidently developed considerably more. A cord was attached to the motor from a key socket and fusible attachment plug. A girl operating the machine turned on the key socket and shortly afterward, for some reason, gave it another turn. From this it is concluded that the amount of cloth being cut was too great for the motor and stopped it, and when the key was turned the second time an arc was established in the socket. The girl operating the machine noted a flame from the socket and stepped away to get a fire extinguisher. The flame from the socket, which was placed about six inches from the bottom of a shelf, communicated to the latter and fire soon gained rapid headway. There was a fuse of about five-ampere capacity protecting the motor in the attachment plug, and a strip fuse in the service switch of about 20-ampere capacity. The shell of the attachment plug and the metallic parts of the socket were welded together.

A man engaged in pressing trousers with an electric iron, using alternating current, made a ground contact somehow and was instantly killed. Transformer defective.

A verdict of $150,000 damages against an electric-light company for an electrical fire is recorded. It was alleged in the suit that the building had been wired after an obsolete manner, and that the fire, in which goods worth $200,000 were destroyed, was directly traceable to the defective insulation of the system.

Zinc Combination Reported.

Negotiations are said to be under way for the consolidation of practically all of the zinc business of the country, and it is believed that the deal will be closed immediately after the fall election. The matter is in the hands of the principal interests in the New Jersey Zinc company, an organization with a capitalization of $30,000,000 and controlling about half of the zinc business of the country. It is the intention to take in the zinc properties at Joplin, Mo., the Hegler and Matthiessen properties at La Salle, Ill., and a few smaller independent interests. The capitalization of the new company is fixed at $60,000,000.

Institute Members in London.

The reception and entertainment furnished to members of the American Institute of Electrical Engineers on the occasion of their recent visit in London were very cordial and enjoyable. The hosts were the president and members of the Institution of Electrical Engineers, who had invited the American society to visit London and enjoy a varied programme of entertainment during the week of August 12th. Some 30 Americans accepted the British Institution's invitation.

On Saturday, August 12th, a party of 55, including the guests and several ladies, left Paddington for Henley, where electric launches were in waiting. The party was taken nearly to Shiplake, on the Thames, and then returned to Henley for lunch. Professor Perry, president of the British society, presided at the lunch and proposed the toasts of "The Queen" and "The President of the United States." The toast of "Our Guests" was jointly proposed by Mr. Siemens and Mark Robinson, and was responded to by Carl Hering and W. J. Hammer. After lunch the party proceeded on the launches to Maidenhead, took tea at the Thames Hotel and returned by special saloon cars to Paddington. Fine weather favored the excursion, and a very enjoyable time was had by all.

On Monday morning the Electrical Standards Laboratory of the Board of Trade and the General Postoffice Telegraph Department were visited. In the afternoon a visit was paid to the generating station of the Central London railway and the substation at the Marble Arch. The Davies street station of the Westminster Electric Supply corporation was afterward inspected.

On Monday evening a dinner was given in honor of the American visitors at Prince's restaurant, Piccadilly. Professor Perry presided and there were 76 present in all, about 30 of whom were guests, including several ladies. President Perry proposed the toasts of "The Queen" and "The President of the United States." H. H. Cunynghame, C. B., proposed and J. S. Raworth seconded "Our Guests," the toast being responded to by Carl Hering, president of the American Institute, Professor F. B. Crocker and C. O. Mailloux. The toast of "Electrical Engineering" was jointly proposed by R. W. Pope, secretary of the American Institute, and Mr. Mordey, replies being made by Professor Sylvanus Thompson, Dr. A. E. Kennelly and H. Ward Leonard. The speeches were all humorous and lively and the occasion was thoroughly enjoyed by all present.

An excursion was made on Tuesday to Chatham Dockyard, where the party was received by the superintendent, Admiral Holland, and shown through the workshops and the first-class battleships Albemarle and Irresistible. The visitors were next shown the electrical section of the School of Military Engineering by Major Carr, R. E., and were afterward entertained at lunch by General Sir Thomas Fraser at the Royal Engineers' mess. Later they attended a garden party at Lady Fraser's. On Wednesday, August 15th, the British and American members proceeded to Paris, to attend the electrical congress.

Among the American guests present at the various functions were: Carl Hering, Dr. A. E. Kennelly, Professor F. B. Crocker, C. O. Mailloux, W. J. Hammer, R. W. Pope, H. Ward Leonard, H. D. McVay, J. G. White, W. C. Burton, D. Adamson, E. H. Mullin, L. A. Phillips, W. D. Brown, J. R. Edwards, B. J. Arnold, I. W. Henry, E. G. Bernard, R. O. Heinrich, W. J. Clarke and R. W. Lohmann.

A Wonderful Battery.

The following dispatch to the St. Louis Republic bears date of August 16th, and is from Eaton, Ohio: "A young student of electricity who lives near here has succeeded in perfecting a battery that may revolutionize industry. The battery, which he has just completed, will give a steady current of 12 volts per square cell at about 50 amperes. Unlike any other primary cell, it keeps up a constant current until exhausted. Eight quart cells will run a two-horsepower motor 10 hours at an expense of 10 cents. Ten cells will burn 12 32-candlepower lamps 10 hours. The cell differs from any other form in that the exciting fluid is dropped into the cell at the rate of one drop a minute while the battery remains in use. Its cheapness of maintenance and great power will cause its universal adoption on power lines. Almost every house and business place will have its own lighting plant and power for running sewing machines, fans, etc. The highest voltage now obtained from the best form of primary battery is nearly two volts to a gallon cell, and then only for a few minutes, as the current rapidly runs down."

East Toronto, Ont., has decided in favor of issuing $7,500 bonds for the erection of a municipal plant.

DEVELOPMENT OF THE TELEPHONE FIELD.

New Telephone System in London.

[From the London correspondent of the Western Electrician.]

The telephone service in London has hitherto been very unsatisfactory, but a great public system, laid down on the newest lines, has at last been commenced, and though it is as yet too early to say precisely when the first section of the work will be brought into operation, it is possible that it will be quite early in the new year. Nothing less than an entirely new telephone system for the whole London district is what has been begun. It is a gigantic undertaking, and it will take a long time to complete it, but the first portion of it will, in all probability, be in working order some time between Christmas and June next. The district is a very large one, comprising not only London, but the whole area now covered by the National Telephone company, in all something like an area of 660 square miles.

The existing telephone system is almost entirely overhead, the new one will be all of it underground, and as the first portion will comprise the city, the streets of which are literally choked with drains and water pipes, gas pipes and pneumatic tubes, electric-lighting cables and hydraulic mains, and goodness knows what besides, the difficulty and complication of the work may in some degree be imagined. The central exchange will be in the great building in Queen Victoria street, now occupied by the Postoffice Savings Bank Department. This central exchange will serve the city.

The Western Electric company has now on hand for this station a switchboard for 15,400 subscribers, involving the joining up of 70,200 jacks. The calling and the clearing will be automatic. There will be no necessity for the subscriber to call the exchange. The mere unlocking of his receiver will light a tiny glow-lamp under his jack at the central, and the operator there will see by the shining of the light that he wants to deliver his soul of some message. She inserts a plug which extinguishes the light, and merely asks for the number. This being given, the necessary connection is made, messages are exchanged, and the replacing of the receivers on the hooks by the two subscribers lights two little lamps, indicating to the exchange operator that they have finished their conversation and the line is clear.

The cables in preparation are to be dry-core cables. They are to be laid under the streets, not in cast-iron pipes, as has been usual hitherto, but for the most part in glazed earthenware ducts, laid in cement. These ducts will contain the main cables, and from them the distributing cables will branch off into cast-iron pipes running from jointing chambers about 150 yards apart on an average, either in roadways or footways. From the jointing chamber the distributing cables will run along the footways in iron pipes, with small boxes at intervals, for the carrying of separate pairs of wires into buildings.

This commencement of a complete and thoroughly efficient underground telephone system may be regarded as the doom of the overhead lines, which have been set up by various private companies, all of which have been absorbed into the National Telephone company, whose license from the Postoffice expires in 1911. Then, if not before, government will no doubt resume the monopoly of this telegraphic system of communication, which the law declared to belong to it, and with which, if it had been wise, as is now pretty generally agreed, it never would have parted.

Plant of Maryland Telephone Manufacturing Company Burned.

Fire destroyed the six-story building of the Maryland Telephone Manufacturing company in Baltimore on the morning of August 22d. Besides machinery and tools used in the manufacture of telephones, the building contained 1,000 telephones, boxed and ready for delivery to the Maryland Telephone and Telegraph company and other concerns in Baltimore, and there were also about 1,500 telephones in course of construction. The capacity of the plant was about 75 instruments a day. David E. Evans, president of the company, says that the loss will amount to about $75,000, partially covered by insurance. The company intends to rebuild at once, and, pending the construction of a new building, it will establish temporary quarters and resume operations in a few days.

Telegraph Connections in Iowa.

The E. H. Martin Telephone company of Webster City, Iowa, has completed its telegraph wires into Hampton, where connection will be made with the Postal Telegraph company, giving it a northern outlet for its telegraph business, thus doubling its capacity. The company has a large force of men now building an extension to Mason City for the Postal wires, and which it expects to have completed soon. The Martin company will have constructed 150 miles of lines this season when the present work is completed. It has cut out its rate giving free service from and to all points reached by the Chamberlain Telephone company, both being Independent concerns.

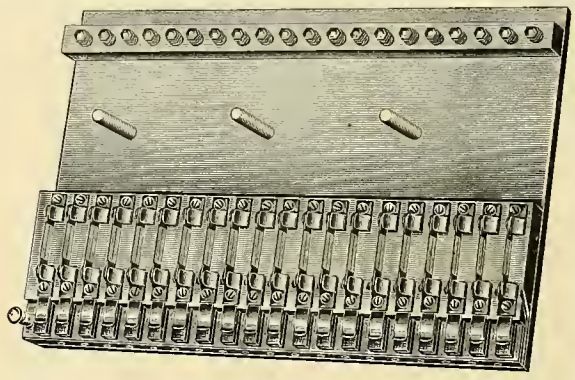
Craig Law in North Carolina.

An answer has been filed at Durham, N. C., in the case of W. K. Bednam against the Southern Bell Telephone company. This case was the first to test the constitutionality of the celebrated Craig law of North Carolina, providing for the domestication of foreign corporations. Bednam had instituted damages for $20,000 against the company on account of being hurt by a workman of the company's force dropping a tool from the top of a pole down on Bednam's head.

The defendant, when the case came up for trial, requested that the case be removed to the federal court, on the ground that the Bell company was a foreign corporation. The court held that the Craig law domesticated the corporation. The case was then appealed to the Supreme Court, and then was carried to the federal court, where the Craig law was declared constitutional. The case has now been returned and will be taken through the courts of the state.

American Lightning-arrester Board.

The accompanying illustration represents the latest improvement on lightning-arrester boards manufactured by the American Electric Fuse company of Chicago. The board is constructed so as to be used as a distributing, transfer and lightning-protector board. The protector strip is made of highly finished birch, the mountings are of heavy brass, with all possible care taken in mounting them. The baseboard is made of finished birch also and the transfer-strip connections are made with brass locknut binding posts having four nuts and four washers on them for holding wires. Pins are also placed every six lines, in order to give the transfer work a good appearance and to aid in tracing jumpers. The whole combined into one is said to make a perfect and practical distributing board for telephone exchanges. This board, shown for 50 lines, occupies a space 10 inches wide and 40 inches long. The American company will be pleased to quote prices on application.



AMERICAN LIGHTNING-ARRESTER BOARD.

Mississippi Independents to Organize.

Notice has been issued that a meeting of the Independent telephone people of Mississippi is to be held at Aberdeen, Miss., Wednesday, September 19th, for the purpose of organizing a state telephone association. It is earnestly hoped that there will be a large attendance. C. W. Bolton, general manager of the Alabama, Mississippi and Tennessee Telephone company of Pontotoc, Miss., is interested in the organization of the new association.

GENERAL TELEPHONE NEWS.

Howard Swartz, superintendent of the Fostoria (Ohio) Light and Power company, has resigned, to take the management of the Tri-county Telephone company at Ashland.

The directors of the West Virginia Western Telephone company held a meeting recently at Parkersburg, W. Va., and declared a semi-annual dividend of three per cent. on the preferred stock and two per cent. on the common stock.

The Citizens' Telephone company of Racine, Wis., has been incorporated, with a capital stock of $125,000, by Frank L. Bliss, Charles R Carpenter, John W. Knight, B. Hinrichs and John B. Simmons. The system will be operated under a franchise granted to Allen Shewmon in October, 1899.

Articles of incorporation have been filed by the Commercial Telephone company of Warsaw, Ind., which has been capitalized at $30,000, to operate telephone lines in Kosciusko, Marshall, Whitley, Laporte, Elkhart, St. Joseph, Cass, Lagrange, Steuben, Dekalb, Starke, Pulaski, Miami, Fulton, Wabash, Howard, Grant, Wells, Huntington, Adams and Allen counties, in Indiana. The company has purchased from the Warsaw Telephone company its local system and all its toll lines, which connect 48 cities and towns in Northern Indiana. The new company will assume control September 1st.

Telephone News from the Northwest.

The Baldwin Telephone company has been organized at Baldwin, Wis., and will establish a local exchange at once.

Work will be begun on the local exchange for St. Thomas, N. D., as soon as the materials arrive.

W. A. Schreiter has been granted a franchise for a local telephone exchange for Red Lake Falls, Minn.

The local telephone system at Long Prairie, Minn., has been completed and put in operation.

The Blue Earth Valley Telephone company will rebuild its exchange in Blue Earth, Minn., at a cost of about $3,000. It will be made a metallic circuit throughout.

The Dwelle Telephone company is rebuilding its exchange at Lake City, Minn. A 50-wire cable is being put in on Main street.

The Wisconsin Telephone company is making improvements to its system at Hurley, Wis.

Herman Hoerl has resigned as manager of the Marshfield (Wis.) Telephone company, to take a position with the Wisconsin Telephone company.

Representatives of telephone companies of the state recently appeared before the State Tax Commission of Wisconsin, and protested against any change being made in the method of taxation of telephone systems.

The Wolf River Telephone company has connected with Waupaca, Wis., with the Union Telephone company's system, giving a number of new connections.

The Mesaba Telephone company is an applicant for a local telephone franchise for Hibbing, Minn., Local parties contemplate engaging in the same line also.

The Independent toll line between Boone and Fort Dodge, Iowa, will probably be completed and put in operation by the middle of September. The line is to be continued to Des Moines.

The exchange at Greene, Iowa, has undergone a number of changes and improvements.

The Iowa Telephone company at Clarinda, Iowa, has installed a telephone receiver in the tabernacle of the city, and patrons can connect and hear the music and addresses given there.

A long-distance line is projected from Laurel, Mont., to Silesia and Rockvale, Joliet and Carbonado, Gebo and Bridger.

The Sunset Telephone company has completed connections between Port Townsend, Wash., and Port Ludlow, Port Gamble and Chimacum. The line will be continued to the straits.

The Rocky Mountain Bell Telephone company has completed its exchange at Phillipsburg, Mont.

Musson Bros. are installing an exchange for Atlantic, Iowa. They have contracts for about 150 connections.

Hickory Grove Township, near Newton, Iowa, has a large number of farmers' telephone lines. There are about 75 connections.

The Mississippi Valley Telephone company, which has been extending lines toward Chaska and East Union, Minn., has stopped work at the former place. It is understood the company insisted on having 40 subscribers there, and, failing to get them, delayed putting in a central station.

The Rocky Mountain Bell Telephone company expects to have its line between Salt Lake, Utah, and Denver, Colo., completed and in operation about September 1st. A line has been completed from Butte, Mont., to Salt Lake. The company has built 2,500 miles of line in the last three years.

The central office of the exchange for Red Oak, Iowa, was recently moved to new and larger quarters. Two cables, holding 100 wires each, have been replaced by three new ones, holding 244 wires each. A larger switchboard has been installed also.

The stockholders of the old Ottumwa (Iowa) Long-distance Telephone company want to find one J. C. Goddard, formerly secretary of the company. It is alleged that Goddard and R. L. Harbin illegally issued stock to themselves, whereby they became a controlling voice in the company, and as such they authorized the sale of the company to the Bell interests. Goddard has been indicted by the grand jury for the act.

The Western Crawford County Farmers' Telephone company of Eastman, Wis., has been granted an entrance to Prairie du Chien, Wis. R.

MANUFACTURERS AND DEALERS.

The Stoddard Telephone Construction company, Monroe, Mich., has issued a circular illustrating its long-distance instruments. The company guarantees its apparatus to be 25 per cent. better than that of any other manufacturer.

Articles of incorporation were recently filed at Milwaukee, by the Farmers' Telephone Construction company, capitalized at $500,000. Charles Sawtell, A. E. Redfield and Martin Maylan are the incorporators. The purpose of the company is to manage, operate, buy and sell and consolidate telegraph and telephone lines and exchanges anywhere within or without the state of Wisconsin.

Western Electric Company Acquires More Land.

For years past the factory facilities of the Western Electric company have been constantly on the increase. No sooner has one addition been finished fairly than something more is planned. The latest acquisition of property is at a distance of about four blocks from the present Chicago plant and is at Polk street, on the west bank of the Chicago River. The east side is a water front and the west side is on railroad siding. The property was purchased from the Young & Farrell Diamond Stone Sawing company, and adjoins on the south the land of the Chicago Dock company. It has a frontage on Polk street on the north of 528 feet. On the south the frontage is 596 feet. The railroad and river frontages are about 400 feet. The only things on the land at present are some one-story buildings used by the stone company. These will be remodeled at once and the underground cable work of the company will be carried on there. S. A. Treat & Co., architects, are making the plans for remodeling the buildings. This arrangement will be only temporary, as the land is too valuable to remain long with small buildings upon it. The price paid for the land and improvements was $617,500.

In the last two years the expenditure of the Western Electric company for buildings alone has represented $750,000. Buildings now in contemplation, not including improvement of the dock property, represent an outlay of $150,000 to $200,000. The manufacturing buildings of the West Side plant represent over $2,000,000.

Professor Michelson's Light-measuring Instrument.

The "grand prix," or first prize, in the natural-philosophy exhibit at the Paris Exposition has been awarded to Dr. Albert A. Michelson, professor and head of the department of physics at the University of Chicago. The instrument for which the prize was given is Professor Michelson's echelon spectroscope, which is probably the most important of a number of instruments invented by him and exhibited with the university exhibit. The echelon spectroscope is used in physics for the separation of the rays of light, and by means of it it is possible to use the wave length of light as a standard of length and thus obtain accurate measurements of infinitesimally small distances and differences of optical density. It is a very sensitive instrument and it is said that if two rays of light vary one three-hundred thousandth of their own wave length, it will detect the difference and record the lengths of the two waves.

Shelby's Largest Mail.

A few weeks ago the Shelby Electric company of Shelby, Ohio, sent to the electrical fraternity all over the country sheets containing instructions and practical suggestions for resuscitation from apparent death due to accidental electric shock. There were 20,000 of these instruction sheets sent out at one time, and it formed the largest mail ever sent out of the postoffice at Shelby. The accompanying illustration shows the 20,000 pieces of mail matter, all in one wagon, ready to leave the factory.

SHELBY'S LARGEST MAIL.

The circular is called "Don't Stay Dead," and is of a size for tacking on the door of a dynamo room or other suitable place. It tells what to do in case of accidental shock from any electrical cause. Illustrations are given which show the different positions to be given to the body of a person being treated.

The Shelby Electric company is the manufacturer of the improved Shelby incandescent lamps. The western office of the company is located at 823 Home Insurance building, Chicago.

Scheeffer Alternating-current Recording Wattmeter.

The accompanying illustrations show the construction of the new improved type of the Scheeffer alternating-current recording wattmeter, manufactured by the Diamond Meter company of Peoria, Ill. This improved meter is designated as type E.

In the early meter days Mr. Scheeffer, recognizing the defects of existing meters, due to contact points in one or more of the measured currents, brought out the induction wattmeter, said to be the first manufactured in the United States, as previous induction meters for alternating current manufactured in this country were amperemeters. These amperemeters have, since the advent of the induction wattmeter, become obsolete. Mr. Scheeffer has since devoted his time developing and improving the present type of induction meter, which is the result of much experience and care, and aims to supply a meter to meet the more exacting demands of central stations.

To meet the conditions of modern meter service the meter has been reduced in size and weight. The type which the company had been manufacturing

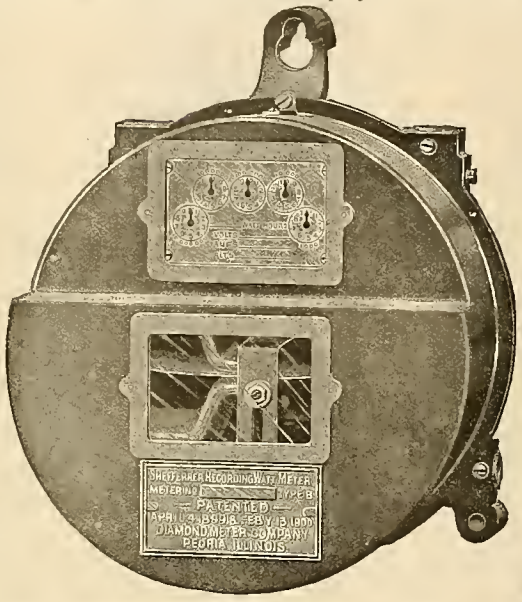


FIG. 1. SCHEEFFER ALTERNATING-CURRENT RECORDING WATTMETER.

weighed about 18 pounds, but this has been reduced with a sheet-metal case to 11 pounds. The meters are furnished with sheet-metal cases to keep down the weight, but cast-iron cases, which add one or two pounds to the weight, are furnished when desired. The meter is sealed at the factory, and is ready for installing without any further adjustment, as all connections are on the outside, and it is not necessary to open the meter. The instruments are said to be made perfectly dust and bug-proof.

One great trouble in previous motor meters has been the deterioration of the jewel and bearing, this being due to the heavy moving element, which, under the pulsating alternating current of considerable strength, would wear away the polish of the jewel and bearing, causing increased friction. While this, as a rule, does not affect the full load of the meter, it will cause the meter to lose its sensitiveness because of increased friction of its bearing, and therefore will run slow on light loads, or even will not register. Of late a number of devices have been adopted to overcome these defects, some very expensive and complicated. Mr. Scheeffer has overcome the difficulty in a simple and efficient manner. The method adopted is in first making the moving element very light. This consists of a very light and thin aluminum disk, with a shaft of light brass tube, the whole weighing but 12 grams. This moving element is rested on a highly polished and hardened steel ball, contained in a sapphire cup. The advantage of this form of bearing is that the steel ball can be made very accurate and is always self-centering, and can at any time be quickly replaced by a new one in connection with the jewel, giving the meter a new bearing without any change or even disturbing the full-load calibration. The disk is subjected to so light a force from the shunt that there are no vibrations of the disk.

The laminated-iron magnets, with the shunt coils, are so constructed that the magnetic flux from them is mostly shunted through an iron mass and very little of the magnetic flux passes through the disk. As the total current consumed by the shunt magnets is about one watt, and only one-twentieth of this is allowed to pass through the disk, a force of one-twentieth watt acts on the disk. This is so slight that no vibrations of the disk take place, and in connection with its light weight makes a bearing which remains almost frictionless indefinitely. Fig. 2 shows the manner of taking out the ball and jewel for inspection or replacing, which is said to be a very simple operation. Fig. 1 represents the exterior of the wattmeter.

The series coil which carries the lighting load consists of only a few turns of thick wire, and is coreless. The loss and drop through it is too small to be ordinarily measured, as the total loss in the meter at full load is two or three watts; this admits of the meter being overloaded 50 per cent. without any alteration of accuracy. The meter responds quickly to sudden loads, because of its light moving element, and this lightness of moving parts makes it extremely sensitive; a meter of ordinary size will register correctly a two-candlepower lamp. The meter is direct reading, no constant being employed, and it is correct on any inductive or non-inductive load.

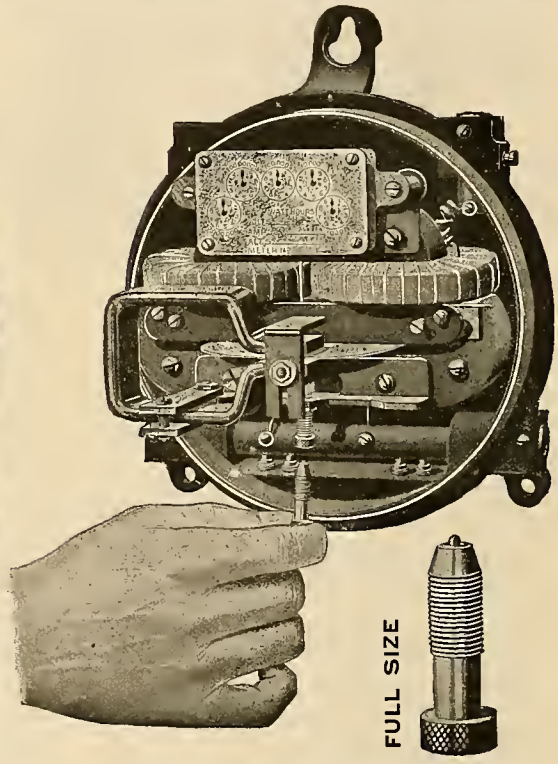


FIG. 2. SCHEEFFER ALTERNATING-CURRENT RECORDING WATTMETER.—REMOVING BOLT AND JEWEL FOR INSPECTION.

Porto Rico's Telegraph System.

The report of General A. W. Greely, chief signal officer of the United States army, recently made to Senator Foraker, chairman of the committee on Pacific Islands and Porto Rico, contains some very interesting reading. Since the occupation of Porto Rico by United States troops the whole telegraph system of the island has been in the hands of the United States army signal corps. The entire telegraph system of the island has been practically rebuilt twice since the summer of 1898.

When American troops landed on the island the telegraph system then in existence would have stocked an old curiosity shop to overflowing. The system was run by the Spanish government, and was practically the same as that put in on the island in 1874, viz., the open-circuit system, with clockwork-tape machines. The lines were overgrown with vegetation and everything in a tumble-down, rusty condition. To get things in working order the whole thing had to be practically rebuilt by the signal corps. The lines were cleared of vegetation and the American closed-circuit system, with sounders, put in place of the old clockwork receivers. The Spanish operators and employes (of which there were a great number more than necessary) would not learn the new system, and, with one exception, had to be turned out. The Spanish force was 184 men, and the United States Signal Corps only required 84 for the same work at the start, and later reduced it more. Major W. A. Glassford has been in charge of the Porto Rico telegraph lines since August, 1898. August 8, 1899, a hurricane swept over the island, which destroyed all the lines, so that they had to be rebuilt.

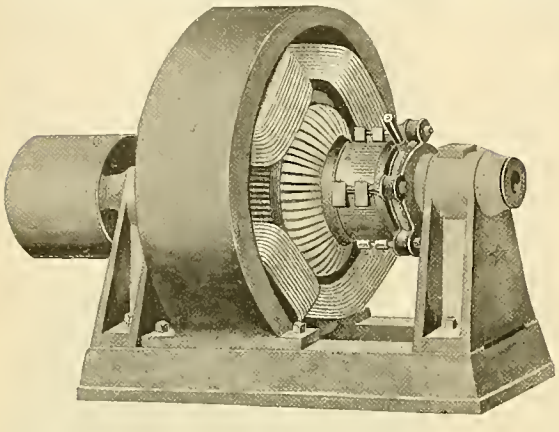
General Greely also in his report discusses the ultimate disposition of the telegraph lines on the island, whether they are to be taken by the United States Postoffice, transferred to the insular government or for the present retained by the signal corps. The latter plan is advocated as being the most expedient and natural, as well as the most economical for Porto Rico and the United States, because a certain number of signal-corps soldiers form a necessary part of the military force of the island. Their pay and allowances are a part of the ordinary expenses, whether they operate military telegraph lines or confine their duties to signal-corps work directly connected with the posts at which they are stationed.

It is pointed out in the report that the maintenance of military telegraph lines will in no manner conflict or interfere with concessions for civil telegraph lines, as private corporations may deem it advisable to construct and operate. Should such concessions be made, it is recommended that the

privilege be sold at public auction, the government to enjoy certain rights as to priority of messages and reduced tariff, and that in time of war the military authorities shall have such facilities and control as may be necessary to the public interest.

Star Dynamos.

The Star Dynamo Works of Jefferson City, Mo., have, since 1894, been making a specialty of small direct-current dynamos and motors, of from three-fourths to six kilowatts. These machines have been well received and are in use through the West and South. They have laminated field cores, ironclad slotted armatures, ring-oiling bearings, and are said to be equal in every respect to any apparatus on the market. The manufacturers have recently commenced the manufacture of larger dynamos than formerly, of the multipolar type. These machines are furnished in sizes up to 20 kilowatts and are high-grade machines. Catalogues and other information may be had by addressing the manufacturers. The multipolar dynamo illustrated is of the usual modern construction, with soft-steel pole-pieces, slotted armature, generous commutator surface, carbon brushes of large area (15 amperes to the square inch), rigid ring-oiling journals and gun-metal bushings. It is designed for medium speed.



STAR DYNAMO.

Electrical Progress in New South Wales.

The annual meeting of the New South Wales Electrical association was held recently at Sydney. O. W. Brain, acting electrical engineer to the New South Wales Railway Department, was president, and in his address gave some useful information as to the progress of electricity in Australia. Thus, says the Electrical Engineer of London, he stated that the most important event last year was the opening of the tramways in George street, which was the first step toward an entirely electric system of tramways in Sydney. This was being brought about as quickly as the railway commissioners could do so. There were then 180 cars working on the electric lines, and the number increased weekly. In Perth (W. A.) also during the past year a system of electric trams had been installed, the plant comprising two generators coupled to Canadian engines, and each having an output of 225 kilowatts. The cars, of which there were 20 running, were furnished with 25-horsepower motors and the usual American double-motor equipments. In Brisbane, Queensland, there were about 60 cars, and the length of track was 20 miles. The Westinghouse company had secured the option of purchase of the Adelaide (S. A.) tramways, and there seemed a probability that the entire system would shortly be converted and extended. The same company also proposes to electrically equip portions of track at Dunedin (N. Z.), and an English syndicate has a complete electric-tramway plant under order for Auckland.

The most interesting lighting event of the year in Australian lighting was stated to be the installation of the Parsons steam-turbine plant in the Victoria commissioners' lighting station at Spencer street railway station, Melbourne. There are three "turbine-alternators" installed, each consisting of a turbine coupled direct to a bipolar generator, the output of which is 150 kilowatts at 3,000 revolutions per minute. The supply is 2,000-volt single-phase alternating current, with a periodicity of 50 cycles per second. The exciter armature is on an extension of the engine shaft. Ferranti rectifiers are provided in the Spencer street station to meet the arc-lighting requirements. The president spoke of the signaling arrangements as used by the New South Wales railway commissioners, and stated that the track electrically protected by block, staff or tablet had increased from 123 miles to 1,170 miles, the length of electric-line wires, other than for power and lighting, from 2,000 miles to over 6,000 miles, and the number of telephones from 75 to 1,150, other electrical appliances having increased in similar proportion. The president thought that with electrical tramways and lighting, and the electrical disposal of sewage, electricity seemed destined to play an important part in the improvement of the town.

Paragon Small Bipolar Motors.

In designing the Paragon motors it was believed that, in considering small apparatus, both manufacturers and the trade had not given sufficient weight to the niceties of design which receive due consideration in larger sizes. With this in mind, the same attention was given to details, and the same designing skill expended by the manufacturer as is given to the highest class of large dynamo-electric machinery; that this was quite justified is said to be demonstrated by the results obtained in the apparatus developed. Eighteen standard sizes of Paragon motors are built, giving a range from one-twentieth horsepower, at 1,650 revolutions per minute, to 1½-horsepower, at 1,800 revolutions per minute, and divided into three series, according to the service for which they are to be used.

The common practice in rating electric motors is to base the rating entirely upon the heat limit, and this is made as high as is permissible, but without regard to efficiency. In the Paragon apparatus, however, the rating is taken at a point practically at the crest of the efficiency curve, and the shape of this curve is such that it is approximately straight at this point, so that 15 per cent. underload or overload can be carried at practically the same efficiency as full load.

The commutators of the Paragon motors are so constructed that the motors will commutate 75 per cent. overload without destructive sparking, and 25 per cent. overload without perceptible indication at the brushes, this being with fixed brushes and with the armature rotating in either direction, as from the construction of the apparatus it is absolutely impossible to alter the line of commutation, so that there is no danger of the brushes becoming displaced by accident, or manipulation by unskilled attendants.

The Paragon commutators are built up of tempered copper bars and insulated with India mica, the whole being assembled under enormous pressure by special machinery; and so rigid is the finished product that low or loose bars are said to be unknown.

On the smaller sizes square pencil brushes are used, their extreme simplicity and satisfactory operation having proved them to be especially adapted to these sizes; and after being properly seated they maintain an even contact of the full area of the brush and a practical uniform pressure throughout the life of the carbon.

On the larger sizes the new Paragon "inclined-plane" brush-holder is used, in which a trangular brush is held between an inclined surface and a pressure finger, their combined action serving to force the brush firmly against the commutator, so that while it is perfectly free and cannot possibly stick, still it is so held as to overcome any tendency to chatter in the holder. A sectional view of this holder is shown in Fig. 2, which illustrates the brush (A), held between the incline (B) and the finger (C), which is under the influence of the tension spring (D).

In the Paragon frame all magnetic joints are avoided and by simply removing two nuts the whole front of the motor may be removed, thus rendering the interior of the apparatus accessible, and this without necessitating the handling of any heavy part.

In view of the many arguments that have been advanced upon the comparative merits of cast-iron and steel for magnetic circuits, this matter was gone into extensively in the design of the Paragon apparatus, with the result that a special cast-iron of high permeability was adopted.

Ample self-aligning and self-lubrication bearings are provided; and, owing to the enclosure of the commutator end and to the protection offered by the pulley, these are rendered practically dustproof.

Field coils are form wound, and after taping with two layers of linen are dipped in insulating varnish of such penetration that the covering of each individual turn becomes saturated, after which they are thoroughly baked, and being wound by automatic machinery, the coils are equal to the fraction of a turn, thus obviating all distortion or unbalancing of the magnetic field.

Armatures are hand-wound by expert winders, the turns being laid in overhanging slots and thoroughly insulated with mica and heavy paper, and, after dipping, are baked similarly to the field coils, the shape of the teeth rendering binding wires unnecessary.

By the use of universal bearings, which may be readily turned to operate in any position, and by means of suitable slide rails, the Paragon motors may be suspended from either side walls or ceiling, as shown in Fig. 1. These methods have become quite popular, owing to the economy of space, the greater accessibility and the absence of supporting platforms or brackets. When desired, enclosing covers can be furnished, which effectually enclose the motor, to the exclusion of all dust and dirt.

Owing to the great variety of duties for which small rotary converters or transformers are required, as electro-cautery, bell-ringing, electro-chemistry, telegraph, medicine, etc., these outfits are not carried in stock, but can be furnished at short notice on stock frames, and upon this line of apparatus a quotation will be gladly furnished upon request by the manufacturer of the Paragon apparatus, the Paragon Fan and Motor company, 572 First avenue, New York city.

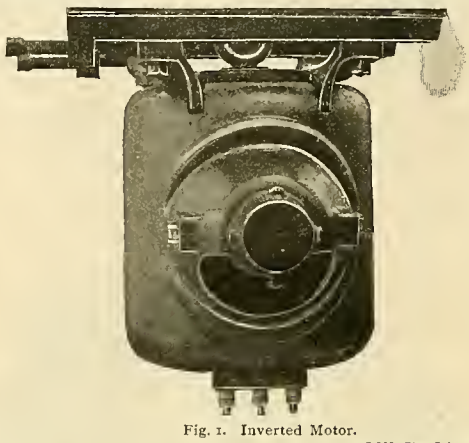


Fig. 1. Inverted Motor.

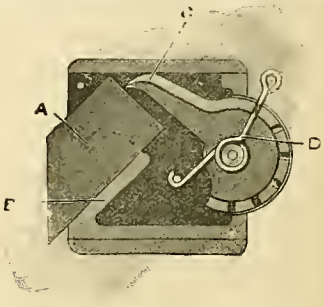


Fig. 2. Brush-holder.

PARAGON SMALL BIPOLAR MOTORS.

Electricity in Textile Mills.

The presence of frictional electricity, generated by the motion of belts, pulleys, running stock and machinery, is a source not only of annoyance, but of positive loss to textile-mill owners. In carding and spinning, particularly, electricity has the effect of causing a change of several numbers in the yarn and causing it to snap and break, while the quality and width of woven goods is noticeably affected. Futile attempts have been made to conduct away this troublesome electricity, but all parts of the machine cannot be properly connected for the purpose, and a resulting residue of electricity is sure to make itself known. It is well understood that on moist days, by atmospheric condition, the electricity escapes as fast as produced, while on dry days it is insulated in belt, machine and stock, and cannot escape into the air, for dry air is a poor, while moist air is a good, conductor of electricity. Moisture evidently plays a very important part in electrical troubles, and various attempts have been made to imitate the action of the moist atmosphere by admitting water to the mill rooms on dry days. The effect which moisture in the air has upon electrification in the rooms appears to be dependent upon the relative humidity in the mill rooms. The amount of moisture which the air will absorb depends upon and increases with its temperature. With the relative humidity above a certain per cent., no trouble is experienced; as this per cent. decreases, the electricity makes its appearance, and grows to be more and more annoying.

A careful consideration of these statements will satisfactorily prove that the whole question of escaping from electrical trouble will be found in the matter of relative humidity. If there is sufficient moisture in the air, electricity always appears.

As moisture depends upon the currents of air to distribute it, no better means can be found than the blower system for obtaining the required results. While doing efficiently its duty as a heating and ventilating medium, the air may be moistened to any desired degree by sprays or evaporating pans in the passages from the heater to the rooms. The exact humidity of the air may be noted by a hygrometer, and regulated to the closest degree. With an average temperature of 70 to 80 degrees in the room, the per cent. of humidity need not exceed 70. This will insure a comfortable atmosphere, and will absolutely prevent the presence of any electricity. The mere benefit from this particular source will repay any enterprising owner for introduction, in these days, when a saving of a fraction of a cent per yard is of vital importance. But with the additional advantage of an efficient heating and ventilating apparatus, controllable under all conditions, there can be no hesitation as to the desirablity of the system.

The above is an extract from the "Treatise on Ventilation and Heating" published by the B. F. Sturtevant company, Boston, Mass.

..The Town Council of Rockville, Md., has ratified the ordinance granting the Washington and Rockville Electric Railway company the right-of-way over Montgomery avenue. Work was begun on August 24th, by the railway company, and it is expected the tracks will be completed by September 4th.

The Operation of a Combined Lighting and Power Plant.[1]

By. J. H. Perkins.

In the early days the attention of managers was soon called to the fact that the supplying of a comparatively large amount of current for so short a time, as is the case in an ordinary commercial-lighting plant, was an expensive and rather unsatisfactory operation, necessitating either high rates and a limited use of the service, or the unprofitable running of the plant.

Following up this idea came the introduction of motor and street-railway service, which materially helped matters by giving some day load. But still, in most of the plants, this power service was rendered, from as many different kinds of machines, they very often being driven by separate engines. The result was, and we find to-day, many plants composed of several classes of machines, each rendering its separate service, with no possibility of helping out one another in time of trouble, or of being combined as needed for the variation of load during the day. Each machine must do its service, whether there is light load or full load. This was and is an inefficient, unreliable and unsatisfactory way to run a plant of variable load and service. The best dividend-earning plant is one which, first, has the long-hour service, and, second, the one which is operated with economy and reliability. The first means the furnishing of as many kinds of service as possible to get the load distributed throughout the 24 hours; the second means the concentration of all classes of service in the same type of machines of various sizes to be combined as the load requires, and to be interchangeable for reliability of service.

This brings us to the advent of multiphase alternating-current apparatus, which has made these refinements possible, and some plants of this type have already been installed. The plant which I represent at Youngstown has been through exactly this cycle of changes, and it is from the experience with its operation that I give this paper.

We have attempted a difficult problem, that of giving satisfactory lighting, motor and street-railway service from the same system, all machines running in parallel and interchangeable. It is true that the correct plan for one plant may not be correct for another, and each plant must work out its own individual system, but by adhering to general outlines we may gain ideas which will apply to all.

At Youngstown we are furnishing almost all classes of service from exactly the same machines and engines, and at times from the same bus-bars. The service includes incandescent lights, arc lights, fans, single and two-phase motors and a street railway. The system in general is two-phase, 60 cycles, 2,000 volts, the lines being at a pressure of 2.000 volts direct from the bus-bars, without station transformers. We still have many small machines of different classes scattered about the station. Some of these are run by two-phase motors, but there is no class of service which we do not furnish, in part, from the alternating-current system, and, eventually, all of the small machines will be discarded, and the service transferred. At the time of the installation of the multiphase apparatus the plant had very little power work to turn over to this service, and only a few arc lights which had been installed on 16,000 alternations.

Incandescent Lighting.

The incandescent lighting was planned for supply from a number of single-phase circuits, each circuit controlled by a double-throw switch to throw the circuit to either phase in case of unbalance. The switchboard panel contains the ammeters, switches and fuse blocks. No provision was made for regulation, all circuits coming direct from the bus-bars, and at the same voltage. At this time the primary voltage was changed from 1,000 to 2,000, and secondary from 50 to 100. It was only by reason of this better efficiency in the lines and of close regulating transformers that good regulation was possible. At present we do not get very good results, but I believe that in time we will have to put a regulator on each circuit with a voltmeter, regulating each circuit according to its needs, and I think a well-designed plant should have this latter arrangement.

Arc Lighting.

The old series open-arc commercial arc lighting is gradually being transferred to constant-potential alternating-current lamps run from the same system of wiring and transformers as the incandescents. We believe that this has done a great deal to make us more money: First, the station apparatus is more simple, more efficient, and more reliable than the old series apparatus; in fact, it brings the service to a common basis with incandescents. Second, on a meter system you get your pay for service rendered, and customers do not use the light except when needed. Third, if one consumer happens to have a dark store you do not have to turn on the whole system in order to supply this one. He can have the light when he wants it, but he pays for what he uses. In this system you are master of your business, and I think you will agree with me when I say that with the series arc system for commercial service on contract rates, you are not a master of your business to its fullest extent. We need no extra man for people on this new system, and the consumers are satisfied that the light is more steady, better appearing, cleaner and more reliable than the old system. Some question the volume of light, but we have never had a consumer change back from the alternating-current enclosed to the direct-current series open when once the former had been installed, except where the consumer was not willing to go on the meter system.

The question may be asked, "Do you find the operation of alternating-current enclosed lamps successful?" In answer, I will state that at the start we did have trouble, but we have finally come to the point where we have little or none, in fact, as little as with the old series direct-current lamps. By the introduction of these new arcs we have secured considerable business around mills and factories running on night turn, which we have been unable to take with the other system.

Motor Service.

Our consumers own their motors, and can, of course, get very little for a second-hand direct-current machine; therefore, the transfer to alternating current is slow. When possible, all new work has been put in on the alternating system, and the old direct-current machines are gradually coming out.

The first motors were installed by combining two single-phase lighting circuits on opposite phases for two-phase motors, or on any of the single-phase circuits for single-phase motors. With the increase of motors, the tax on the lighting feeders was too great, and it was sometimes inconvenient to keep these two circuits on opposite phases. We, therefore, made up a separate two-phase power circuit coming from the same bus-bars, retaining, however, the single-phase motors on the lighting circuits.

The two-phase motor circuit is arranged with a double-throw switch to operate from either the lighting or power bus-bars. The power bus-bars are referred to later on. By this arrangement it is possible to separate the motors from the lighting altogether.

The question most discussed in this connection is, "What will be the effect on the lighting?" This is hard to answer on paper, and the best answer is an inspection of the service in operation.

The large inductive current on the starting of an alternating-current motor is inherent, and the designers say we must always have at least some. The effect of this inductive current on the transformers and generators is the cause of poor regulation. The question is, how much will it affect the lights? There is considerable difference in transformers on inductive drop. A certain transformer may have very good regulation on non-inductive or lamp load, but on a motor load it may be very poor. The choosing of transformers for this work must be done carefully. However, if the motors and lamps are not fed from the same transformers, this will not apply, and it is more apt to be the case, for with motors of large size there will probably be a separate service.

I would call attention more forcibly, however, to the effect on the generator from the starting of alternating-current motors. Central-station men make a great mistake in expecting good regulation in the operation of motors on small generators. The regulation of alternating-current generators on inductive load is inherently poor. To be sure, there is a difference in generators, but any of them are poor enough. The capacity of the generator must be relatively very large to that of a motor, that the starting may not show on the lights.

As to the results in Youngstown: Our smallest generator has a capacity of 75 kilowatts, and it generally carries the day lighting and motor load. At noontime one can tell when the separate motors go on, by momentary drops in the voltage of from one to five per cent., according to the motors, which average from one-half to 10 horsepower. But you must remember that this is only during the day at a time when this is not objectionable, and there would be no appreciable effect with the larger generator during the evening; and I think that I can safely say that we, at no time, have any effect on the lights from motors which any consumer or station manager could complain about; at least, we have no trouble from this source. There might be trouble with some of the smaller stations in trying to run motors on small generators at all times of the day, and I would recommend careful consideration against small, poor regulating generators on inductive loads, for this service.

As to the difference in the effect of single and multiphase motors on the lights, we find none, and it becomes a question of ease and expense of installation between the two.

As yet we have no series street arc lighting on the alternating-current system, having gone no further than a few experiments, but in discussing this point of inductive drop in generators it may be well to add that the regulating apparatus of the arc system will have more or less the same effect as the starting of motors, and with some form of apparatus now being advocated, there must surely be an effect on incandescent lighting.

Street-railway Work.

In taking up the work necessary to fulfill a contract for furnishing power to operate a street railway, we had very little time in which to perfect our arrangements and have things in running order. The first thing which came to mind in operating the rotary transformers from the 60-cycle, two-phase current, was, what will be the effect of the rapidly changing street-railway load upon our lighting system? We could get no definite answer from the manufacturers of the electrical apparatus in the way of guarantee or specifications as to what would be the effect on the generators and our station voltage, and we knew very little concerning the outcome.

After careful consideration we decided to add a second set of bus-bars to our switchboard, which we now call the power bus-bars, and to add a switch for each generator connecting with this set of bus-bars. Our idea was to be able to operate any generator or any combination of generators on either set of bus-bars, or on both sets at the same time, if desirable. In this way we can make any possible combination, and operate the railway, or power bus-bars, independent of the lighting, or in parallel with the lighting, as desired. The street-railway service which we are required to furnish is a peculiar one. The railway operates an amusement park at its terminal, causing an immense summer traffic, while the winter traffic is comparatively very much lighter. We figured that this would give us not only a day load, but a very good summer load, our ordinary summer lighting load being very light. In other words, we not only thought of increasing our all-day load, but of the season business as well. This has been found correct, except that the two heavy loads overlap to some extent during the early fall for about two weeks.

At the car barns and rotary sub-stations, located between the termini of the road, are two 200-kilowatt rotary transformers, working in parallel, both on the alternating and direct-current sides. During the day in winter time and through most of the summer the load varies from nominal no load to 225 kilowatts. On special days during the summer, and during the evening all summer, the load varies between 0 and 500 kilowatts. The zero loads under these conditions are necessarily less frequent.

Our station apparatus consists of two belted machines and one direct-connected, and we are at present installing a second direct-connected unit. The belted engines are ordinary tandem-compound, high-speed engines, with fairly good governors. The direct-connected engine is a vertical cross-compound. None of these engines had been designed with special reference to running rotary transformers, but had been adjusted to run their generators in parallel.

On the starting of the rotaries it was found that they would operate perfectly satisfactorily on the belted engines with no sign of pumping, or any cause for complaint. In trying to operate the rotaries with the direct-connected engine we found considerable difficulty. Experiments were carried on to determine the location of the trouble. It was undoubtedly in the engine. The operation of this engine in furnishing incandescent lights has been highly satisfactory, and the operation under varying conditions of lighting load has been the source of much pleasure to visitors at our station. A dash-pot was put on the engine to steady the action of the governor, and this helped matters to some extent, but by no means relieved the pumping of the rotaries, which was very severe. The governor was experimented with, and by blocking it out of action, found that the trouble did not lie there. The final conclusion was, that there was some unbalanced action of the engine which produced a pendulum motion or an irregular angular velocity in the rotation of the engine.

It must not be forgotten that, under ordinary circumstances, this engine regulated very closely, being well within two per cent. The cause of the rotaries pumping was an uneven motion during any one revolution of the engine, causing an unsteadiness in the action of the rotaries. The permanent cure for this action seems to lie in a larger flywheel. The temporary relief for the trouble was found in running a large two-phase induction motor without load, which resulted in a considerable flywheel effect, both electrically and mechanically. Two wattmeters were connected reversely in the circuit of this motor, their readings showing very plainly that the result was the giving and taking of energy to the system as it was needed to balance the irregularities produced by the engine. With the installation of this motor we have had no further trouble from the pumping of the rotaries. It was impossible at the time to change the flywheel of the engine. This will probably be done later on.

The interesting point in connection with this railway service is the effect upon the lighting system when the two are in parallel. We were very agreeably surprised in the outcome, and it was found that, except for very heavy overloads, the fields of the rotaries could be adjusted for a power factor of one at medium load, thereby giving our generators a lagging current at light load and a leading current at higher loads and overloads, which resulted in keeping down the voltage, which would ordinarily be high on suddenly taking off so large a load from the machines, and raising the voltage, by reason of the leading current at overloads, thus causing the voltage to rise, which would ordinarily be low at overloads.

The increase of voltage at overloads can be adjusted by the fields of the rotaries, so that we can overcome, not only the drop in the machines, but the drop in the speed of the engines, and with a load of 50 per cent. lighting, and 50 per cent. street-railway service, the railway service varying this full amount instantaneously, we can operate with a voltage change on the lighting not exceeding 1½ per cent., which, I think, will not be noticed by any

1. Read before the Ohio Electric Light association, at Toledo, O., August 15, 1900. Mr. Perkins is assistant manager of the Youngstown Gas and Electric company at Youngstown, O.

ordinary observer. On extreme overloads, however, it is more difficult to get these results.

After our experience in this matter, I would not say that, as a general rule, it would be policy to operate street-railway service and lighting from the same machines of this type under all conditions. Under ordinary circumstances, however, it is perfectly satisfactory, and, as you will note, we have made it possible, by our switchboard arrangements, to work in either way at will, and in any arrangement for operating this sort of service, I would recommend the same provision.

Since the matter is closely allied with the operation of machinery in parallel, it might be well to discuss at this point the question of engines in regard to this feature.

The lower the frequency with alternating apparatus, the better will be the operating on parallel. In the case of a combined lighting and power plant, which we have assumed, a frequency much less than 60 cycles is out of the question. We have found that the parallel operation of high-speed, belted engines of different sizes is the easiest possible combination. In fact, we were for a time paralleling two generators on these engines which were connected dead opposite on the synchronizing lamps, and they went into step without trouble. The belts act as a flexible connection between the two, and once the machines are together, it is almost impossible to get them out of step. With direct-connected engines, however, the case is different, for we do not have this flexible connection, and any influence toward an unsteady or oscillating motion tends to cause pumping and serious trouble, if not counterbalanced by some exterior influence.

Do not understand me that it is a poor regulating engine which causes this trouble; in fact, engines with a considerable drop in speed between no load and full load have been found to operate machines in parallel better than close regulating engines. It is the unsteadiness of motion, or, more exactly, the irregularity in angular velocity which seems to cause trouble. This may be caused by a racing governor, a too-sensitive governor, or by an unbalanced condition in the working parts of the engine itself. In some cases this trouble has been relieved by a dash-pot on the governor, in some cases by pole shoes or dampening magnets on the generator, and in some cases by a larger flywheel.

I am satisfied that in the case of our vertical, direct-connected engines, it is the unbalanced effect between the upward and downward stroke which causes the trouble, and it would seem that this could only be relieved by a larger flywheel. The engine which we are now installing is horizontal, cross-compound. With synchronous apparatus, it is inherent that any unsteadiness in the system should cause trouble. The rotary transformer is of this type, but if the system consisting of rotaries, generators and engines can be carefully designed, I think there should be no trouble, and the rotary transformer is certainly a very serviceable piece of apparatus, if we relieve it from any unbalanced condition in the system.

Another feature which we have learned in the operation of this system, and especially in the operation of railway service, is that the modern alternating-current generator will stand more punishment in overloads than any other machine which we have yet had to deal with. To obtain the best results, however, the capacity of the engine must be relatively large.

To sum up, we have found that, by the addition of a reliable motor service, by the introduction of constant-potential arc lamps, thereby securing the lighting of factories and shops working on night turn, and by the addition of this railway service, we have obtained a night load which is almost double our former all-night load, we have secured an all-day load which is three times as large as our former day load, and increased our summer-night loads to double their former value, and increased in no case our objectionable night peaks during the winter in anywhere near the same proportion. By this uniform system we have increased the reliability of the service, and our records show that by this uniform system and an increased output due to the more even load, we have considerably decreased the cost of manufacture per kilowatt, thereby being able to give somewhat better rates and a general increase in our business all along the line.

I do not wish to infer that this system is perfect; we still have our troubles; but I do think it is a step looking toward modern methods, and I trust this experience may correct some misapprehension and prevent some mistakes in the plans for the installation of such a system.

Struck by Lightning on a Mower.

A peculiar fatality is reported from near Burlington, Wis., in which a man driving a mowing machine was struck by lightning and left sitting on his machine as though petrified. The victim of the accident was a farmhand, and he was in the meadow at work when a sudden thunderstorm came up. He saw the storm clouds coming up, it appeared from the manner in which his body was found, and started back. The storm came up so rapidly, however, that he did not have time to reach shelter before the storm was upon him. He had raised the knives from the ground and still had his hand on the lever controlling the blade when a bolt of lightning struck. Both horses were killed and the man also was struck dead. While the horses fell together when killed by the stroke, he remained in his seat on the machine, dead though he was. When he did not return to the house for supper a search was made. He was found with one hand still resting on the machine lever, while the other firmly grasped the reins with which the dead man had been guiding his horses when death came. His body was rigid when found, and it was with considerable difficulty that the limbs were straightened after an undertaker had been summoned.

Highway Crossing Alarms.[1]

By J. S. Evans.

A few years ago automatic crossing alarms were practically an unknown quantity because the few that were then in use gave such poor service that their general use could not be recommended. But as railroading has advanced, so have crossing alarms, with the result that there are now quite a number on the market, giving excellent satisfaction. The matter of protecting highway crossings by means of automatic alarms commands attention for the following reasons:

1. The number of accidents that are constantly occurring, and the accompanying loss of life, and the expense incident thereto.
2. To forestall unjust legislation against railroads by local city and town authorities.
3. The increased speed and number of trains, which demand a clear right of way.

It is evident that more and better protection is necessary at all highway crossings in thickly-settled districts, and many dangerous crossings in sparsely-settled districts, which cannot be furnished, except at prohibitory expense, unless it can be done by some automatic device.

The protection of highway crossings with a gate and gateman means, approximately:

An initial investment of	$300
Maintenance expense (labor, interest, repair, fuel, etc.) per annum	400
	$700
Cost of protection, first year	$700
Cost of protection per annum thereafter	400

To guard a crossing with an automatic alarm means approximately:

An initial investment of	$200
Maintenance expense per year	50
	$250
Cost of protection, first year	$250
Cost of protection per annum thereafter	50

These figures show a net saving of at least $350 a year in favor of the automatic alarm, not taking into consideration that the alarm is on duty at all times.

The questions arise: Are automatic alarms an adequate protection? What is the proper principle upon which they should be constructed? What may be expected of them? The signal engineers of all the larger roads have long ago condemned any electric signals that the elements or train movements may injure or put out of order without notice thereof being given immediately. Hence, the closed track-circuit has been universally adopted because of its simplicity, reliability, and self-operating tell-tale qualities if properly constructed.

Nearly all track-circuit crossing bells operate on practically the same principle, and if properly installed and maintained will announce the approach of every train. Such a signal should be designed to meet the following requirements: The alarm at the crossing should be given when the first pair of trucks reach a point sufficiently distant from the crossing to give at least twenty seconds' warning for the fastest approaching train. It should not cease until the last pair of approaching trucks have crossed the highway. If the alarm is silenced when the first pair of trucks have passed the highway, a second approaching train would give no warning, and such a condition, where double tracks are used, would increase the danger instead of eliminating it. My road has a crossing protected where there are four tracks, all of them used for single track movements, and it happens very frequently that a second and even a third train approaches the crossing at high speed before the first has entirely passed the highway. If the bell would stop ringing when the first pair of trucks reached the highway, anyone waiting to pass over would proceed when the first train had passed, perhaps just in time to be met and injured by the second train on one of the other tracks. The alarm not being silenced, however, until the last wheel approaching from any direction has reached and passed the highway, the warning continues and danger of accident is averted. It often happens that a train of considerable length is followed by a light engine only a few hundred feet distant from the rear end of the train. This is especially the case where trains are coming into the yard limits. In such a case, it is very evident that if the first pair of trucks silenced the bell, there would be no warning of the approach of the second train. Again, it is not a rare occurrence that a train breaks in two while running, and the forward section of the train gets a considerable distance ahead of the remaining portion. In this case, if the bell were silenced by the first pair of trucks, the rear end of the train approaching the crossing would be as much a menace to human life as the light engine or second train. Incidents of this kind are not lacking to demonstrate the value of the above feature.

An alarm should be constructed on the closed circuit principle, so that if the batteries have become exhausted, either from actual work or by accident, an indication thereof will be given. The breaking of relays, wires or other mechanism forming a part of a highway alarm should also be automatically indicated.

The bell should be sufficiently loud and of a decided, plain stroke, so that its meaning cannot be misunderstood.

The batteries should be placed in receptacles in which they will not freeze, and in which they cannot be tampered with (preferably iron boxes), or non-freezible batteries should be used, and the mechanism of the alarm should be as simple as possible, with only as many moving parts and contacts as are absolutely necessary, so that the ordinary lineman or telegraph operator who is familiar with simple electrical devices will have no trouble in understanding it and will be able to install and maintain it.

Lastly, under no circumstances should the bell ring after the train has gone by the crossing, or ring when actual danger at the crossing does not exist. If there are sidings or passing tracks at the crossing, the alarm should be given for all tracks, but should be so arranged that a train taking the passing siding and stopping before it reaches the crossing, will not operate the bell continuously, but as soon as the train starts forward again (at which time danger will exist at the crossing) the bell should ring just the same as if it were a through train on any of the other tracks. While the bell is inoperative for a train so standing on a passing siding, the bell must give warning for all approaching trains on the other tracks; and should this train back away from the crossing instead of proceeding, no alarm must be given for this movement. In other words, any crossing alarm should be so arranged and designed that there can be no mistaking what it means when the gong is sounding, that is, for every wheel that approaches the crossing, which is a menace to human life, it must cause that alarm to be given; under no circumstances must it give a false alarm. In all track-circuits, whenever they are short-circuited, no matter whether the wheel is going away from, or approaching the crossing, the alarm will be sounded. Ample provision should be made to guard against the sounding of the alarm as the wheel goes away from the crossing, and any alarm which cannot be so arranged as to cover this point is, in my estimation, not a proper one to ask the public to depend upon, and would not furnish adequate defense to a railroad company so using it in case of accident.

1. Paper read before the Association of Railway Telegraph Superintendents at Detroit, June 21st. Mr. Evans is superintendent of telegraph for the New York, Chicago and St. Louis Railway company.

CORRESPONDENCE.

London Letter.

London, August 14.—The erratic conduct of electricity is proverbial, and an alarming illustration of what may unexpectedly occur happened opposite the Gaiety Theater, in the Strand, early on Sunday morning. By some means the underground electric-light circuits got afire and the lid over a manhole in the footway was blown into the air. From the cavity there ascended a stream of fire 10 or 12 feet high, to the effect of which was added rapidly succeeding explosions. Alarm was immediately given to the fire brigade, and very speedily several engines were on the scene. Their services, however, were of no avail whatever, it being apparent that nothing would serve to abate the danger but cutting the wires. The firemen were thus placed in the singular position of being passive spectators of an outbreak which was beyond their power of dealing with. Electricians were the essential want of the moment, and they being summoned without delay, the danger of the situation was soon abated. Similar incidents have frequently occurred in London, but this is said to have been the worst of the kind so far experienced.

The opening of the "two-penny tube," as the new Central London railway is being called, seems to have roused Londoners to an appreciation of the advantages of electric traction. They have been rather a long time coming to this appreciation, for though the underground electric railway from the city to Stockwell, on the south side of the Thames, has been open for some years, London has allowed many of the provincial towns to get far ahead of her in the matter of electric traction. The Central London, however, is proving a boon and a blessing to over 100,000 passengers a day, and already the demand made upon its accommodation is greater than it can conveniently cope with. The success that has attended the new venture is leading to a general demand for additional accommodations of this kind above ground, as well as below. At the present time there is no above-ground tramway of any description allowed within the sacred precincts of the city proper, and, indeed, sandwichmen and hill distributors are not even countenanced within the one square mile. The city, however, will soon have to relax the iron-bound rules it has laid down

in the past, unless we are to have a further development of the underground electric railways.

The inconvenience caused last week by the breakdown of the Postoffice telegraphs, consequent on the storm, has revived attention to proposals for substituting a safer system than the overhead wires. After every storm wires are down in different parts of the country, and the elaborate and intricate system of news dispatch, to say nothing of private messages between London and the provinces, is thrown into disorder. The result of the late storm, for instance, was to cut off for some hours communication between London and the country. I observe that the Great Western railway, in its northern section, has taken down its overhead wires and enclosed them in a box, resting on stunted posts, by the side of the railway. The expense of boxing the Postoffice wires would be great, but the interest on the capital expenditure would probably be met by the saving of the amounts that now have to be spent in repairing damaged lines, to say nothing of the loss of revenue while the wires are down.

Whatever may have been the result of the experiments with wireless telegraphy during the naval manenvers, the Admiralty seems satisfied of its usefulness, for the training ship Minotaur at Portland is to be fitted with a mast 180 feet high, for the purpose of experimenting, while other masts 150 feet high will be erected on various headlands between Dover and the Scilly Isles. The result of the new departure, which is designed to enable a ship in the channel to give warning of an intended attack to the land, will be watched eagerly.

An electric omnibus, the necessary current for which is taken from an overhead conductor on the same lines as that adopted for electric tramways, was put in operation at the Vincennes annex of the Paris Exposition last week. The system is that of Lombard & Gerin. W. H. B.

New York Notes.

New York, August 25.—In relation to the prevention of third-rail accidents on the Brooklyn elevated railroad, Deputy Commissioner James J. Kirwin of the Department of Public Buildings, Lighting and Supplies, is reported as saying that he would at once, unless the railway companies surrounded the third rail with such safeguards as would protect employes and persons crossing the tracks, issue an order preventing the further use of the third rail as a means of transmitting power. He proposes to have the third rail placed between the tracks instead of on one side, as now.

That a space might be cleared for the work of excavating for two sections of the rapid-transit tunnel, about 20 of the shade trees on Broadway were felled on Friday. Considerable objection was made by people interested in the sections between Sixtieth and Eighty-sixth streets, and Contractor McDonald ordered the sub-contractor not to cut down any more unless it was absolutely necessary.

Richard Grey of this city and Charles C. Weedon of Sea Cliff, L. I., were arrested on Monday, and warrants are out for the arrest of Alfred R. Goslin, who figured prominently in the Brooklyn Rapid Transit and Dean cases, George M. Eberman, Eugene L. Packer and Frank Morgan on a charge of conspiracy to defraud by certain transactions in the stock of the New York Electric Brake and Coupler company.

It is reported that another big trolley deal is under way, which contemplates a line between New York and Harrisburg, which is to be the connecting link for a proposed trolley line between Boston and Washington. J. F. Shaw & Co., a Boston concern, are said to be engineering the deal, and have already started to build a line between Trenton, N. J., and Philadelphia. Heirs of the late Isaiah Williamson, the Philadelphia multi-millionaire, have sold the Delaware River toll bridge at Calhoun street, Trenton, to the Boston concern. The Williamsons are interested in a line operated by Owen Moon, between Morrisville, Pa., and Yardley, Pa. They are also interested in a steam road between Trenton and Princeton, to be connected with the Philadelphia and Reading railroad.

There will be 10 new-style motor cars placed on the Fifth avenue elevated line as soon as they are equipped with electric motors. One of them has been given a trial, which appeared to be satisfactory to the officers of the road. The car is built in a fashion similar to that of the cross-seat cars now in operation on the East New York line, except that each seat holds only one passenger. There is a saving of aisle room by placing the seats about half a foot behind each other at a slight angle.

A combination trolley car of the Third Avenue line struck the tilted cover of a manhole on Amsterdam avenue, near One-hundred-and-sixtieth street, on Wednesday night, and was thrown across the track. A second car, running close behind the first one, smashed into the wreck. Both cars were well filled, and although several passengers received small injuries, no one was seriously hurt.

Application has been made to Circuit Judge Hazel to have the Clyde Gas and Electric Company of Clyde, N. Y., declared an involuntary bankrupt. Argument on the application will be heard at Buffalo on September 4th. The corporation went into voluntary dissolution April 7th last. The nominal assets are $71,344.82; the actual, $40,000; liabilities, $50,279.21.

Charles Stewart Smith, a member of the New York Rapid Transit Commission, who has been devoting considerable time to studying both the Paris and London underground electric railways, says that he is prepared to make a complete report to the commission on his return to New York. Mr. Smith says: "The London electric railroad is certainly a great improvement over anything London has ever had. But, after all, it is not rapid transit in the sense we understand it in the United States. The distance from the Bank of England to Shepardsbush is 400 yards short of six miles. This is covered in 25 minutes, including 13 stops. This is done by means of two single-track tubes, which, of course, prevent the running of express trains. The New York line will contain four tracks, and express trains will run from the city hall to the northernmost end of the island in from 18 to 19 minutes. The engineering work in London is admirable and the rolling stock is an improvement even on that of the New York elevated railroad, as the cars are better lighted and better furnished."

The first test of a motor vehicle for collecting mail matter that has been made from the General Postoffice occurred on Monday. The vehicle was started out in the early morning and made several trips, the first being on what is known as the James Slip route. The letter boxes in that district and through Ann street back to the Postoffice were visited and the matter collected by the regular carrier, a motorman running the vehicle. Trips were made later on other routes. The tests are being made at the expense of the company manufacturing the vehicle, which will be sent to some branch station near the center of the city when the tests downtown have been finished. Postmaster Van Cott said that he would forward a report of the tests to Washington some time next week. He could not say now whether the trials had proved more successful than the old way of collecting the mails or not. M. L. G.

Northwestern Notations.

Minneapolis, August 25.—Residents of Grand avenue, in Duluth, Minn., want the street-car tracks extended to the suburb of Ironton.

N. J. Schlachter of Gettysburg, S. D., has bought an engine and contemplates securing a dynamo and other equipment for a local electric-lighting plant.

Charles Steinert, a 12-year-old boy of Oshkosh, Wis., was terribly injured by touching a guy wire which had become detached from the pole it supported. It was crossed with a telephone wire, which in turn was crossed with a feed wire of the street-railway company. The insulation was sufficiently worn to allow the current to escape. The boy's shoulder was burned to the bone, and his hand was also fearfully burned.

It is understood Butte capitalists will establish a street-railway system in Missoula, Mont., bringing power from Bonner.

Plans are being prepared for rebuilding the power house for the street-railway and light company at Appleton, Wis. The new power house will be much larger than the one which was burned, as it will furnish power for the interurban line, as well as the street-lighting and local car systems.

A plan is on foot at Iola, Wis., to build an electric railway through Scandinavia to Waupaca, Wis.

George Dugdale, a lineman of the electric-light system at Mount Pleasant, Iowa, was instantly killed by touching a live wire, while working on a pole.

The Marshalltown (Iowa) Light, Power and Railway company has made application in the United States court for an injunction to restrain the city from enforcing a new ordinance containing maximum charges which the company may make for light and power. The company does not question the right of the city to regulate charges, but says that the charges are not remunerative. It claims that under the new rates the company will run behind $2,000 a year.

Commissioner of Public Works Claussen of St. Paul has inaugurated a crusade against poles in the business district of the city. He claims that there are a good many unnecessary wires and poles in the downtown district, and proposes to have them eliminated, as far as possible.

The Union Electric company of Dubuque, Iowa, has been incorporated, with $1,000,000 capital stock. This company is the new one under which the street-car and electric-light systems have been consolidated. It is expected that about $100,000 will be expended in changes and improvements to the system, to put it on a paying basis.

Saturday, September 8th, the Women's College association of Sioux City, Iowa, will have charge of all the street cars in Sioux City. The proceeds of the day will be devoted to the pipe-organ fund of Morning Side College chapel. It is stated that something unique has been planned among the features for the day.

The Gas and Electric company of Grand Forks, N. D., has completed arrangements to supply a night direct current.

Dehler & Bosworth, owners of the electric-light plant at Le Roy, Minn., have dissolved partnership, Mr. Bosworth succeeding to the business.

The Advancement association of Plymouth, Wis., is considering a plan to secure a municipal light and water system. It is proposed to grant a franchise for a system, to be sold to the city when completed. It is estimated that a system will cost about $60,000.

Thomas Higgins of Menasha, Wis., is an applicant at Two Rivers, Wis., for a franchise for an electric railway between Two Rivers and Manitowoc. J. E. Hamilton made a similar application to the council of Manitowoc.

The council of Muscatine, Iowa, unanimously rejected the proposition of the electric-railway company to expend $90,000 in improvements upon condition that the council extend its franchise 25 years and contract for street lighting for 10 years.

The Osakis Milling company of Osakis, Minn., has completed an electric-lighting system and put it in operation.

Jefferson, Wis., recently voted to purchase the local electric-light plant.

The new charter lately adopted by the city of Duluth, Minn., prevents city officials from accepting passes on the street cars. Policemen and firemen only are excepted.

An 800-horsepower engine is being installed for the electric-light and water system being constructed for Austin, Minn.

H. P. Mortenson, who owns the electric-light plant at Toronto, S. D., contemplates establishing a similar plant for Hendricks, Minn.

The Madison Canyon Power company has been granted a franchise for a heat, light and power system for Virginia City, Mont.

The Richardson Electric company has been granted a franchise at Cloquet, Minn., for a local electric-lighting system. The city contracts for 25 arc lights, at $7 each per month.

The village of Grand Rapids, Minn., is negotiating with John Beckfelt for the purchase of the electric-lighting plant.

The Cass Water, Light and Power company of Cass Lake, Minn., has been incorporated, with $50,000 capital stock, by Roland Hartley, Heber Hartley of Cass Lake and R. Green of Fredonia, N. Y.

It is rumored that an electric railway may be constructed from Rockford through to Blue Mounds, taking in Brodhead, Albany, Belleville and other southern Wisconsin towns.

It is suggested that the city of Blue Earth, Minn., install a hot-water heating plant, in connection with its water and light system.

The Iowa Falls (Iowa) Electric Light and Power company has filed amended articles of incorporation.

The Mason City and Clear Lake (Iowa) Electric Railway company has made a traffic arrangement with the Chicago and Northwestern railway.

The Chippewa Valley Railway company has completed its new power house at Chippewa Falls, Wis., and put it in operation. The station, with equipment, has cost about $35,000.

A tornado struck Sheboygan, Wis., recently and damaged the property of the Electric Light, Power and Street Railway company. The plant was crippled so that no cars or lights could be operated. The loss was placed at $5,000. The street-car barns were also demolished, with a loss of $6,000.

The receiver of the Duluth (Minn.) Street Railway company has been discharged, and the system has been formally turned over to the Duluth-Superior Traction company. A trust deed for $2,500,000, covering the issue of first-mortgage bonds by the Duluth Street Railway company, has been filed, running to the Central Trust company of New York, as trustee. Work is to be started at once improving the systems. R.

From the Buckeye State.

Columbus, Ohio, August 25.—The Pennsylvania railroad has taken the initiative with respect to women telegraphers, who have been placed under the ban. In a circular notice just sent out, orders have been issued by the executive officers that hereafter the employment of the gentler sex to handle the lightning tickers is absolutely prohibited. It is claimed that, while they are perhaps as accurate and reliable as the men, they are not as available for all kinds of positions as their male competitors.

The first electric car has been run on the Toledo, Fremont and Norwalk electric line, as an experiment. It is expected that cars will be in complete operation on schedule time within the next 10 days.

Lightning played havoc in machinery hall at the state fair grounds this week. A number of the dynamos were severely damaged. The loss on the building and electrical appliances amounted to about $500, with no insurance.

The Urbana, Mechanicsburg and Columbus Electric company, through one of its officers, General H. A. Axline, has presented its proposition to this city, in compliance with law, for a franchise on certain streets of the city. The company agrees to carry passengers at the rate of five cents single fare, seven tickets for 25 cents and 28 tickets for $1. They guarantee that the fare to Urbana, which is about 45 miles distant, shall not exceed two cents a mile. The matter will likely come up before the council and the Board of Public Works at their next regular meeting.

Work on the Dayton, Springfield and Urbana electric railway is being rapidly pushed.

S. L. Nelson of Springfield is endeavoring to get a franchise from that city for lighting and heating the city by a new electric system of which he is the inventor.

The Canton-Massillon Electric Railway company has filed a mortgage deed at Canton for $1,000,000. The deed is given to the Cleveland Trust company

to secure a loan of $1,000,000. One thousand bonds, of the value of $1,000 each, are to be issued, bearing interest at the rate of five per cent. per annum, the last one to be payable in the year 1920. The money is to be used in refunding the present indebtedness and in changing the road to a standard gauge, and other necessary improvements. W. A. Lynch is president and A. J. Underhill secretary of the road.

During the electrical storm at Mount Vernon this week, one of the big armatures at the power station was burned out, also an armature in one of the street cars was destroyed. The loss to the electric light and power company will be quite heavy.

The extension of the street-car system at Marietta to Norwood is pretty well completed. The work on the power house is being pushed along, and it is thought that within two or three weeks the engines will be in place and ready for use.

There has not been a time for years when there was such general complaint over the state of damages to all kinds of electrical appliances as during the storms of the last week. The trouble seems to have affected all parts of the state.

The City Council of Sandusky passed an ordinance a few weeks ago, placing a special tax of $1 on each telegraph, telephone or electric-light pole located within the city limits. The measure brought forth considerable animated discussion and various were the opinions advanced as to its legality. After a careful count it was discovered that there were about 3,500 poles that would come under the law. The mayor proceeded to carry out his instructions under the law, and notified all the companies to make their first settlement by August 1st. This brought the contention to a focus at once, and before the attorneys for the interested companies could be heard, City Solicitor Hart began a thorough research of the ordinances and has reported to the mayor that the law is illegal and will not stand.

An electric car on the Cleveland and Chagrin Falls suburban line jumped the track on a curve near Chagrin Falls Wednesday while running at full speed. Twelve or 15 people were badly hurt. Had the car not struck a pole as it left the track, it would have gone down a steep embankment and a number of lives would doubtless have been lost. The accident was caused by a broken brake rod.

The Southern Ohio Express and Freight company has been organized at Dayton, with a capital stock of $100,000. The organizers are the principal owners in the various traction companies that radiate from that city. The object of the organization is to furnish safe and expeditious transportation for the smaller towns surrounding Dayton. James M. Randall is the manager.

Some officers of the Hocking Valley Railway company, which operates an electric railway between Jackson and Wellston, had a bad scare recently. Just as the pay car was leaving Wellston, a man appeared on the track flagging the train, and at the same time flourishing a gun. The paymaster and his assistants were getting ready for a fusilade, when the stranger quietly told them a horse was fast in one of the trestles just ahead of them. The warning of the stranger was a generous act, and his services have just been handsomely rewarded by the company.

The City Council of West Jefferson has granted a right-of-way to the Columbus, London and Springfield electric railway, through the corporate limits of that village. The company met with scarcely any opposition from the residents of that place, who seem glad to avail themselves of the opportunities the road will afford them.

The thousand employes of the Columbus Street Railway company enjoyed their annual outing at Olentangy Park Wednesday of this week. A large number of their friends were present to help make the occasion a pleasant one.

A franchise for an electric line between Coshocton and Newcomerstown has been asked of the county commissioners. The towns are 16 miles apart, and the line will pass through a very rich agricultural district. Harry S. Sands of Wheeling and L. G. Hallock and E. D. McKee of Steubenville are the promoters.

Hon. Cyrus Huling, as attorney for the Columbus and Johnstown Traction company, has submitted to the law department of the city copy of an ordinance granting permission to bring its cars into the heart of the city, over the lines of the Columbus Railway company. The term of the franchise is 25 years. O. M. C.

PERSONAL.

R. H. Mansfield, president of the Ironclad Resistance company, Westfield, N. J., was in Chicago a few days ago in the interests of his company.

General Buller, the British commander who relieved Ladysmith after some difficulty, is said to be something of an electrical engineer. He supervised the wiring of his own house and is reputed to be mechanically and electrically skillful in other directions.

Louis A. Ferguson, general superintendent of the Chicago Edison company, is enjoying a month's vacation in the East. He will spend most of his time at Nantucket, Mass., but will attend the convention of the Association of Edison Illuminating Companies at Saratoga next week.

In a competition established by Municipal Engineering for the best set of accounting forms adapted to the use of electric and gas-lighting companies, the prize for the best set of forms for use in conducting the business of an electric-lighting company suited to cities under 50,000 population was awarded to Thomas F. Bechtel, secretary of the Edison Light company of Grand Rapids, Mich. For the second best set A. H. Purdy of the Edison Electric Illuminating company of Topeka, Kan., was awarded the prize.

Charles D. Haskins, an electrical engineer well known among the older members of the fraternity, has been missing for several months. Mr. Haskins had been in the employment of the Western Electric company of Chicago for a number of years, and was well versed in the patent department of that company's business. He was a great traveler, and lately took a trip through the South. After a time letters failed to reach him, and it was reported that he had gone abroad. Inquiry in Paris and London failed to locate the missing man, however, and his present whereabouts are unknown to his friends in Chicago. Mr. Haskins is a veteran in the electrical business, and his friends trust that no harm has befallen him. His family lives in Brooklyn.

ELECTRIC LIGHTING.

The Statesville (N. C.) Electric Light company will enlarge its plant.

H. B. Trout has been granted a franchise for an electric-light plant in Shelbyville, Ill.

E. T. Kirk, at Walla Walla, Wash., has been voted a franchise for an electric-light plant.

Brockville, Ont., has voted to issue $100,000 in bonds for building a municipal electric-light plant.

O. Ford of St. Louis, Mo., has a contract for the erection of an electric-light plant at Natchitoches, La.

The Dustin Island Woolen Mills at Penacook, N. H., will put in an electric plant of 300 horsepower.

West Plains, Mo., has voted to issue $27,000 in bonds for building an electric-light plant and waterworks.

The New Kensington (Pa.) Electric Light, Heat and Power company has been incorporated, for $75,000.

The Dayton (Ky.) Electric Light and Power company, recently incorporated, is asking for bids for a new plant.

The Citizens' Electric Light and Power company of Sandusky, Ohio, was incorporated, with $100,000 capital stock, recently.

The Zombro Power company of Pasadena, Cal., has been incorporated, with $350,000 capital, by E. Eason, N. Bridge and C. W. Smith.

The Covina (Cal.) Electric company has been incorporated, with a capital stock of $25,000, by T. B. Thomas, O. Anderson, H. M. Houser and I. D. Houser.

The Shamokin and Coal Township Electric Light and Power company, at Shamokin, Pa., has been incorporated, by T. Gillespie, F. P. Lewellyn and E. M. Leader.

The superintendent of the Chiloca (Okla.) Indian school has been authorized by the government to employ a competent electrical engineer to draw up plans for a $3,000 lighting plant for the school.

The Toccoa Falls Light and Power company of Toccoa Falls, Ga., has been incorporated, to develop water and electric power. The capital stock is $50,000, and the incorporators are E. P. Simpson, L. A. Simpson and S. V. Davenport.

The Simpson Manufacturing company of Winthrop Harbor, Ill., was recently incorporated, with a capital of $100,000, for the purpose of furnishing heat, light and power. The incorporators are J. L. Bolen, S. Rosenblatt and H. E. Mills.

The Goldsboro (N. C.) Electric Light and Power company's plant has been purchased by the Goldsboro Illuminating and Traction company, for $7,000. The plant originally cost $28,000. The plant has been materially increased by the new company.

The commissioners of Crisfield, Md., granted a franchise to the Crisfield Ice Manufacturing company to put in a system of electric lights in Crisfield. The company will begin work at once and expects to have the plant in operation in two months.

A new incorporation in Pennsylvania is that of the Bellefonte Electric company of Bellefonte, with J. C. Miller, S. D. Gettig, E. L. Hoy and C. M. Bower named as the incorporators. The company contemplates the erection of a large electric-light plant for the furnishing of light to Bellefonte and the surrounding towns.

A storm-signal lighthouse to be built on order of the Department of Agriculture and to be in charge of the Weather Bureau, is to be erected in South Chicago, Ill. It will be equipped with apparatus to send a light 15 miles out over the lake. It will be constructed of steel, 100 feet high, and will be provided with an electric light sufficiently powerful to warn all vessels entering or leaving the Chicago harbor on the southward of the approach of storms.

ELECTRIC RAILWAYS.

Junction City, Kan., has granted a street-railway franchise to F. V. Crouch of Carrollton, Mo.

The Glenwood and Polytechnic College Street Railway company contemplates building two power stations.

The Grand Rapids, Spring Lake and Grand Haven Transit company has been granted a franchise at Grand Rapids, Mich.

The city trustees of San Bernardino, Cal., have granted a franchise to build an electric-car line to Judge Campbell and J. H. Boyd.

Tramway cars are used for carrying factory freight in three German cities, Gera, Frost and Spermberg. All these places are active manufacturing centers.

The Terre Haute and Wabash Valley Railroad company has been incorporated, with $300,000 capital stock, with J. R. Kendall, G. A. Conzman, B. G. Hudnot and H. G. Miller, as directors.

The Fairmount and Clarksburg Electric Railway company of Parkersburg, W. Va., has been incorporated, with $100,000 capital. J. H. Camden of Parkersburg is attorney of the company.

It is reported that the Grand Rapids and Indiana Railroad company is about to make an experiment with electric motors as the motive power for its resort line between Petoskey and Harbor Springs, Mich.

An electric railway is to be built between Farmington, Mo., and Delassus. An ordinance has been passed by the council of Farmington granting W. E. Stevenson & Co. of Indianapolis a franchise for the proposed road through the city.

The Fairmont and Clarksburg Electric Railway company was recently incorporated, with $100,000 capital stock, at Charleston, W. Va., by ex-Senator Johnson Camden of Parkersburg and others, for the purpose of building an electric railway from Clarksburg to Fairmont.

The General Electric company has secured a temporary injunction against the Star Brass Works, restraining them from infringing the Anderson patent, No. 412,155, for a trolley-contact spring. The injunction order was issued July 31st by the United States Circuit Court for the Western District of Michigan at Grand Rapids.

President John M. Roach of the Chicago Union Traction company has notified Acting Mayor Walker that the company has prepared vestibuled cars for use during next winter. The ordinance requiring vestibules in winter has been in effect for some time, but the companies have not succeeded heretofore in getting all cars fitted with vestibules.

The Winchester Avenue Railroad company of New Haven, Conn., has issued an order which prohibits passengers from riding on the running board of a car or from standing between the seats of a car on its system. As soon as all the seats in the car are filled the conductor must refuse to take on even one more passenger until a seat is made vacant by a passenger getting off.

J. H. Farrar of Chicago has proposed a system of sidewalk subways for the relief of the congested streets in Chicago, to the street-railway commission. For use on the sub-sidewalk railway the inventor proposes an open car, resembling a carette with the top cut away. The sidewalk above furnishes the top for the car, prismatic walks above give light, aided by electric lights within, and gas radiators along the curb will furnish heat. The lightness of the cars which such a construction would permit, it is stated by the inventor, would reduce resistance to a minimum.

AUTOMOBILES.

William K. Vanderbilt recently beat one of the fast electric cars running between Newport and Fall River with his imported automobile.

The Baltimore (Md.) Automobile company has nearly completed its contract for a Washington company for autocarettes, to be run over streets where the herdics are now run.

The members of the Automobile Club of America are making extensive preparations for its first exhibition of automobiles and automobile accessories, which is to be held at Madison Square Garden, New York city, in November. All of the regular space on the floor of the building has been taken, and additional space will be provided by flooring over the boxes on the north side of the Garden.

C. C. Wridgway of Brooklyn, N. Y., expects to commence a 1,000-mile trip in an automobile to Chicago, passing through Schenectady, Utica, Syracuse, Rochester, Buffalo, Erie, Cleveland, Toledo and Detroit. This trial will be made under the auspices of the De Dion-Bouton Motorette company of Brooklyn. Mr. Wridgway is scheduled to arrive in Chicago September 18th, in time for the automobile exposition and tournament September

18th to 20th. The trip will in no sense be a race against time, but simply a practical test under the worst conditions of weather, putting the carriage through a severe trial.

One of the most enthusiastic automobilists in England is R. J. McCredy, who climbed the Mountain of Cairnotoul, with a Daimler machine, and who has now steered a vehicle over the steepest of the Wicklow Mountains. He is most enthusiastic over the trip. Automobiles, he says, have now arrived at such a pitch of perfection that they can be relied on to work with as much certainty as a horse-drawn vehicle when running through the south-west of Ireland district, which is the most trying for vehicular traffic of any sort, owing to the numerous hills and mountains to be met with. Mr. McCredy says his vehicle covered 700 miles, at an average pace of 15 miles an hour, over roads of the most trying description, including several of the worst passes in Kerry.

PUBLICATIONS.

The New England Motor company, Lowell, Mass., has issued three bulletins lately, covering some of its recent productions in the way of generators and motors of from five to 25 horsepower. These motors have some interesting and desirable features.

The Standard Welding company, Cleveland, Ohio, has issued a handsome catalogue devoted to its seamless steel-tube bicycle parts and its electric welding of metals. Illustrations are given of different bicycle parts and of other articles, such as gear blanks for lathe chucks, top-pole rings for telegraph and telephone poles, etc.

"Aerial Cableways and Tubular Dispatch" is the subject of a circular recently published by the Consolidated Telpherage company of New York. Telpherage is the automatic transportation of light or divisible material to a distance by electricity, and a number of illustrations are given of different installations. An electric tubular dispatch system is also given a detailed description.

TELEGRAPH.

The Sultan of Turkey has ordered the establishment of direct telegraphic communication between India and Constantinople. There was a line formerly by way of Fao, at the head of the Gulf of Persia, but this line could not be maintained, and messages now go by way of English and Russian cables.

Congress appropriated $415,000, to be expended in the construction of the Alaska telegraph lines of the government. Eighteen carloads of the cable which is to connect Cape Nome with the outside world has been shipped from a Connecticut factory, and it will probably not be long before cable communication with that much-overpopulated mining camp will be established.

The committee appointed by the Chicago Board of Trade to investigate the question of establishing a new telegraph company for Board of Trade service and take steps to organize such a company if thought best has announced that the company will be organized. The committee is composed of President Warren, John F. Harris, F. P. Frazer, A. O. Slaughter, P. A. Valentine, P. B. Weare, Benjamin Bryant, Frederick Crawford, general manager of the Chicago and Milwaukee Telegraph company, and Attorney H. S. Robbins.

SOCIETIES AND SCHOOLS.

An illustrated lecture upon the Chicago drainage canal, with electric-lantern views, will be given by Isham Randolph, chief engineer Chicago Sanitary District, on Saturday evening, September 1st, at the rooms of the Robert Fulton Association of Stationary Engineers, 309 Masonic Temple, Chicago.

MISCELLANEOUS.

The total world's supply of india-rubber to-day is about 120,000,000 to 130,000,000 pounds, valued at about $75,000,000. More than half the total supply is exported from the Amazon district.

W. E. McCurdy, assistant engineer of the San Diego Gas and Electric Light company of San Diego, Cal., was killed by an electric shock August 19th. It is reported he received a current of 7,000 volts. The shock threw him over another machine standing near. An account of the accident states: "In his flight through the air he apparently disarranged the gearing, for the engine ran away and burned out the dynamo. As a result the city is without street lights."

TRADE NEWS.

The Aluminum Storage Battery company of Chicago was recently incorporated, with a capital stock of $2,500, by M. H. Casler, W. P. Johnson and C. K. Chamberlain.

It is reported that the Colonial Electric company of Ravenna, Ohio, has just closed a contract with the Pan-American Exposition company for 200,000 incandescent lamps.

F. W. Greer, secretary of the Texas Arm and Pin company, Beaumont, Texas, is in Chicago looking after the constantly increasing business of his prosperous company.

Charles Wirt, president of the Wirt Electric company of Philadelphia, is spending a week in Chicago. The western agency of the Wirt company is at 141 South Clinton street, in charge of Thomas G. Grier.

The Safety Armorite company, Rankin Station, Pa., is erecting some additions to its factory. One building will be 100 by 260 feet, and one 150 by 150 feet. Both will be iron buildings throughout, the contracts being let to the American Bridge company.

The Ball Engine company of Erie, Pa., which furnished the 350-horsepower engine for the electric motive power for the special machinery exhibit of the United States at the Paris Exposition, has been awarded a gold medal by the exposition authorities.

The Mica Insulator company, 218 Water street, New York, has been awarded a gold medal at the Paris Exposition for its complete and unique exhibit and on account of the fact that it was the originator of Micanite.

The War Department, through the Corps of Engineers, is inviting sealed proposals, until September 6th, for delivering at New London, Conn., one 50-kilowatt generating set and accessories, and until September 14th, for delivering at the same place two accumulators and accessories. Specifications and full details will be furnished intending bidders upon application to Major S. S. Leach, New London, Conn.

The Chicago General Fixture company has sold to M. B. Austin & Co. its entire stock of electrical supplies, consisting of a large and complete stock of standard electrical goods, its electrical supply catalogue, No. 22, and the good will of the electrical supply department of the company's business. The steady growth of the Chicago company's fixture business made it necessary for it to largely increase its manufacturing facilities and devote its entire time and attention to it. M. B. Austin & Co. are now in a position to take care of their customers' business with better facilities than ever.

A. C. Becken of Chicago, manufacturer of the well-known Paillard non-magnetic watch, so largely used by those who come in contact with electrical machinery, recently returned from an extended business and pleasure trip to Europe. Mr. Becken visited nearly all the prominent cities in Europe and stopped at London, Paris, Geneva, Carlsbad, Berlin, St. Petersburg and Amsterdam. Mr. Becken returned greatly improved in health, and the new arrangements he has made for the sale of the Paillard watch promise to greatly increase the demand for this popular article. Mr. Becken will be pleased to furnish particulars of the watch to interested parties.

An interesting study in methods of publicity and promotion is presented by the progress of the B. F. Sturtevant company of Boston, Mass., during the last few years. This company, devoting itself principally to the manufacture of blowers, has gradually evolved many special types designed for specific uses. It has not been deemed sufficient to merely advertise these types, but exhaustive study has been made of the conditions and best methods of application, special treatises have been prepared upon these subjects, purely educational articles regarding them have appeared in the technical press, and special illustrated lectures have been delivered before technical schools and societies. Some of these lectures, devoid of all reference to the B. F. Sturtevant company, have been published for free distribution, with gratifying results. Among recent publications are lectures by Walter B. Snow, of the engineering staff, entitled "The Influence of Mechanical Draft Upon the Ultimate Efficiency of Steam Boilers," "Mechanical Ventilation and Heating By a Forced Circulation of Warm Air" and "The Application of Mechanical Draft to Stationary Boilers." Any one of these publications will be sent upon request.

BUSINESS.

The Century Glass company, Bellaire, Ohio, announces that, beginning September 1st, it will operate its entire factory on electrical and railroad glassware and kindred lines.

The Dunmore Steel and Iron company, Dunmore, Pa., has recently decided to equip its plant with electricity and has placed an order with the Sprague Electric company in New York for two split-pole generators and 50 motors. The generators are 62½ and 100 kilowatts, and the motors range from three to 20 horsepower.

The Kansas City and Southern Lumber company, Kansas City, Mo., states that it has arranged to keep a large stock of pins and brackets in Kansas City, in order to supply the trade for local shipment, as well as in car lots. It also states that its trade is constantly on the increase. The company manufactures oak pins and brackets. Its factory is located at Springfield, Mo.

K. McLennan & Co., Chicago, manufacturers of the well-known Gale commutator compound, report a most flattering business. Among recent large orders for this well-known product is one for 300 dozen sticks from Yokohama, Japan. This is undoubtedly one of the largest orders for commutator compound ever placed, but McLennan & Co. are constantly receiving others of good size, although not quite as large as the one mentioned above.

The Cream Flux company, 100 Washington street, Chicago, manufacturer of the Cream soldering flux, is elated over the success which its business has attained. Although the flux was only recently placed on the market, the company is receiving orders from all over the country, and the unsolicited testimonial letters which are being received from those who have given the flux a thorough test assure it a wide sale. The company says that this article is absolutely non-corrosive, easily applied and efficient. The product is indorsed by the National Board of Fire Underwriters.

The Pacific Electric company, La Crosse, Wis., is placing a number of new styles of shade lamps on the market for the coming season. The company states that the enamel finish on its shades has been greatly improved and that the enamel on lamps which it now turns out does not crack or turn yellow. The company makes 35 styles of shade lamps, which are adjustable and made especially to protect the eyes. The shades are manufactured to suit the purchaser, and can be used anywhere. The company has issued a new catalogue, which it will be pleased to mail to those contemplating the use of shade lamps.

The Emerson Electric Manufacturing company of St. Louis is now working upon a large export order for alternating-current ceiling fans, to be shipped to the Argentine Republic. This order will be shipped September 1st, and consists of over 400 fans, the shipment making a solid carload of large size. This order is said to have been obtained in competition with American and European manufacturers, and the Emerson company considers it a very handsome tribute to the reputation of the Emerson apparatus in foreign countries. Another large export order received by the Emerson company was for ceiling fans to be shipped to Budapest, Hungary, to be operated on the unusual frequency of 15 cycles a second, or 1,800 alternations a minute. This frequency is much lower than anything used in the United States, the fans being used in railway cars which are operated by a three-phase current.

The American District Steam company of Lockport, N. Y., was the pioneer in central-station heating. It is now more than 20 years since the first underground plant was constructed. At present, instead of stations constructed for a direct steam supply, many of the electric-light and railway companies are piping out their exhaust steam for heating all kinds of buildings, thus utilizing a waste product. The American company reports an unusually busy season. Its system is being introduced in Atlanta, Ga., Seattle, Wash., Champaign, Ill., Grand Forks, N. D., Cumberland, Md., Youngstown, Ohio, and in Washington. Johnstown and Wilkinsburg, Pa. The Atlanta (Ga.) Railway and Power company is constructing more than two miles of heating mains, to utilize its large amount of exhaust steam, the largest being a 16-inch pipe.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 21, 1900.

656,158. Confiner of Wires for Electrical Connections. Charles F. Ash, New York, N. Y. Application filed December 11, 1899.

A wire-confiner for electrical contacts consisting of a piece of resilient metal bent into the desired form, one end of which is permanently attached to the binding post or similar part of the apparatus adjacent to the point of contact, the other end being adapted to automatically open for the release of the wire and to be closed upon the wire by the pressure of the thumb-screw or similar device.

656,165. Electric Generating Apparatus. John H. Bickford, Salem, Mass. Application filed December 8, 1899.

An electric generating apparatus comprising a power-generating and converting apparatus, the energizing agent of which is developed by heat, a dynamo, and a controlling device operated by the circuit of the dynamo for varying the supply of energizing agent to the generating and converting apparatus, whereby the output of the generating and converting apparatus may be varied to compensate for variations in the output of the dynamo.

656,177. Commutator. John T. H. Dempster, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed June 8, 1900.

A commutator for an electric machine, having its segments locked together at their bases between the ends of the bars by an insulated metallic fastening device to prevent buckling.

656,192. Manufacture of Pipes or Conduits for Electrical Conductors. Albert H. Howard, London, England. Application filed May 18, 1900.

The process for the manufacture of pipes or conduits, consisting in placing asphalt, or like bituminous matter,

in a mold, or in a tube closed at the ends, and imparting rapid rotation to the mold or tube, so as to cause the asphalt, or the like, under the action of centrifugal force, to spread out over the interior of the mold, or form a lining to the tube.

656,207. Trolley Wheel. Henry A. Osborne, Plainville, Conn. Application filed December 6, 1899.

As an improved article of manufacture, a trolley wheel having a web, side parts extending beyond the web and forming a groove, projecting ribs extending along the side of the web from a point within its periphery and terminating at a point beyond the periphery of the web.

656,266. System of Electrical Distribution. Harry F. Roach, St. Louis, Mo. Application filed July 10, 1899.

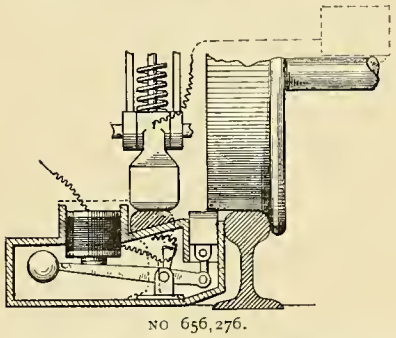
The combination with a dynamo and the armature and working circuits of a separately excited field coil for the dynamo, and connected to the working circuit, of a shunt-coil opposed to the separately excited field coil, a series coil for assisting the shunt coil in its opposition, both of the last-mentioned coils being in the armature circuit, and means consisting in an electroresponsive device shunted across the armature circuit for cutting in and cutting out the working circuit at predetermined voltages.

656,276. Electric-railway System. Louis E. Walkins, Springfield, Mass. Application filed December 15, 1898.

In an electric-railway system, the combination with the usual track rails and a series of successive third-rail sections, and a continuous current-feed wire, of devices for each third-rail section, each consisting of an electromagnet, a depressible member movably mounted adjacent the magnet and having its top normally above the tread of one of the track rails, a lever adapted to be swung in conjunction with the movements of the depressible member and having an armature coacting with the electromagnet, a contact piece, electrically connected with the third-rail section, a switch member constituted by a member of the lever and adapted to make and break connection with the contact piece, a conductor connecting the feed-wire with the coil of the electromagnet and a conductor also connecting the coil of the electromagnet with the switch member. (See cut.)

656,282. Circuit-breaker. George S. W. Brubaker and William S. Twining, Philadelphia, Pa. Application filed November 20, 1899.

In a circuit-breaker means for operating the same and a spring tube or throw-out device, the exposed parts of which present a surface of non-conducting material, so that they can be placed in proximity to the terminals of other live parts of the circuit-breaker and arcing thereto is prevented.



NO 656,276.

656,284. System of Non-interchangeable Contact Parts. Moriz Fröschl, Vienna, Austria-Hungary, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed September 2, 1899.

This patent relates to the detailed arrangement of parts in an incandescent-lamp socket.

656,292. Electrically Operated Submarine Torpedo. Peter C. F. Hoffmann, Kiel, Germany. Application filed April 30, 1898.

The combination with a torpedo, electric metallic contacts studding its surface, a chamber containing the explosive charge of signal circuits closed by the contacts on the surface of the torpedo, an igniter in the chamber containing the charge and its electric circuit, an electric-motor circuit and a driven mechanism, a magnetically operated detent for the mechanism, the signal, firing and detent-operated circuits in parallel and independent of the motor circuit.

656,305. Process of Electrolytically Extracting Zinc from Ores. Wilhelm Strzoda, Falenze, Germany. Application filed January 20, 1899.

The process of electrolytically extracting zinc from its ores which consists in placing the disintegrated or pulverized ore in its natural state in an electrolytic vat containing an aqueous alkali-metal solution capable of dissolving the ore with production of a zincate and in direct contact with the cathode, and closing the circuit through the vat, thereby precipitating zinc and the alkali metal at the cathode, the alkali metal reacting with the water to regenerate the solvent solution.

656,309. Electric Burglar Alarm. Paul V. Vandevelde, New York, N. Y. Application filed February 16, 1900.

The combination of a sash-weight, a window adapted to move up and down, a sash-cord connecting the window to the weight, a rod, a support in which the rod is free to move up and down, a retractile spring tending to hold the rod in its downward position, one electric terminal on the rod, and another on the support in the path of the first, an arm provided with a hole extending from the rod, the cord passing through the hole, and the arm being in the path of the weight.

656,323. Electric Bicycle. Albert Hänsel, Zeitz, Germany. Application filed February 1, 1899.

In a bicycle or like vehicle, the combination with the bicycle frame, of an electric motor and a storage battery suitably secured to the frame, and means for directly actuating the electric motor by the movement of the driving-wheel of the machine.

656,324. Controlling Electrical Currents. Arthur B. Holmes, Liverpool, England. Application filed April 11, 1899.

In an electric circuit, a circuit-opening and closing device, adapted automatically to normally close and keep closed the main circuit; an electromagnetic device connected with the opening and closing device, and operated by the current passed through the main-current wires, and adapted to actuate the device and open the main circuit when an excess of current takes place, and a branch circuit connecting the two ends of the line on either side of the point at which the circuit is closed and broken, and through which the whole current is adapted to pass when the main circuit line is opened, a resistance on the branch circuit, and an electromagnetic device on and operated by the current passed through the branch circuit, and directly connected with the circuit opening and closing device in the main-circuit conductor, and adapted to keep the main circuit open by its action on the circuit-opening and closing device, while an excess of current continues. (See cut.)

656,333. Telephone-switchboard Apparatus. Thomas C. Wales, Jr., Newton, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed November 7, 1899.

A telephone line extending from a substation to a central station, and provided at the latter with a jack or switch device at each of the regular sections or operators' positions of a multiple switchboard; an answering-jack and associated call-signal device at one of the sections; an auxiliary answering-jack and associated call device at a special section of the switchboard; and means for alternatively connecting either call-signal device with the telephone line, whereby the substation calls may be received either at the regular or special answering sections, as desired.

656,336. Switchboard for Telephones. Milton I. Baird, Glenfield, Pa. Application filed March 1, 1900.

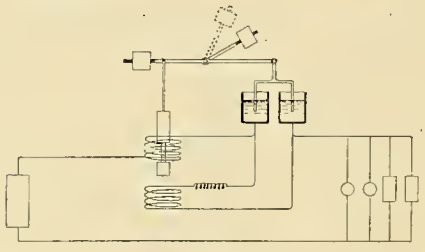
In a telephone switchboard, the combination of a jack or socket, a plug, means for shifting the plug, and means for checking the outward movement of the plug and holding it in two or more positions.

656,372. Guard for Controller Brushes. Andrew L. Riker, New York, N. Y. Application filed January 8, 1900.

The combination with a controller brush and its controller segment, of a guard for the former that keeps it from interfering with the latter. (See cut.)

656,384. Switchboard for Telephones. Milton I. Baird, Glenfield, Pa. Application filed December 1, 1899.

In a telephone switchboard, the combination of a socket, a plug, mechanism for forcing the plug out of the socket, and means for regulating the outward movement of the plug-ejector.



NO 656 324.

656,421. Brush-holder Ring. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 5, 1898.

In a dynamo-electric machine, the combination of a field magnet and a brush-holder ring having a continuous bearing in the body of the field magnet.

656,431. Cord Adjuster for Electric Lights. Frank H. Stewart, Camden, N. J. Application filed May 9, 1900.

A cord adjuster for incandescent lamps is described. (See cut.)

656,434. Combined Visible and Audible Signal. Eugene W. Vogel, Chicago, Ill., assignor to David S. Wegg, Chicago, Ill. Application filed July 7, 1899.

In a combined audible and visible signal, the combination with a source of electrical supply, of a bell located in a circuit and a lamp located in another circuit, and switch mechanism acting automatically to alternately throw a current through the bell and through the lamp.

656,445. Cooling Brakes. Axel Ekström, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed April 27, 1898.

In a braking system for an electrically propelled car or train, the combination of electric brake-shoes and devices for applying them, magnetic coils controlling the shoes, a system of main pipes running through the train, auxiliary pipes connected therewith for cooling each shoe, and means for circulating a cooling fluid through the pipes.

656,451. Automatic Circuit Interrupter. Lionel Fleischmann, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed July 12, 1899.

An automatic cut-out, comprising a gas-tight inclosure containing an explosive gaseous body and a thin conductor within the inclosure, and terminals connected with the conductor extending outside of the inclosure.

656,454. System of Non-interchangeable Electrical Contact Parts. Moriz Fröschl, Vienna, Austria-Hungary, and Rudolf Hundhausen, Wilmersdorf, Germany, assignors to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed March 6, 1899.

A special arrangement of parts in an incandescent-lamp socket is described.

656,455. Summation Meter. Jesse Harris, Lynn, Mass., assignor to the General Electric company of New York. Application filed July 17, 1899.

A summation meter comprising a register, operating devices therefor controlled by a plurality of meters, a locking circuit for the operating devices including parallel branches governed by the respective meters, and locking magnets in the circuit between the several branches.

656,473. Electric Controller. Charles J. Reed, Philadelphia, Pa. Application filed January 13, 1899.

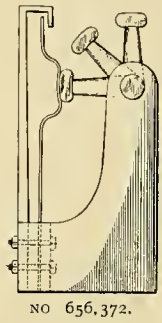
An electric controller or switching device, comprising a plurality of brushes constituting the terminals of translating devices, sources of energy or component parts of operative electric circuits, in combination with two separate systems of contact plates arranged in sets or groups and means for causing the brushes to engage successively several sets of contact plates of one system in a fixed order and subsequently to engage successively several sets of contact plates of the other system in a fixed order, and for causing each system of contact plates to return to its initial or out-of-circuit position during the engagement of the other system with the brushes.

656,511. Electric-railway System. George L. Campbell, New York, N. Y., assignor to the International Electric Traction company, New York, N. Y. Application filed December 15, 1899.

In an electric-railway system, a conduit having a main conductor, a trolley mounted to travel in the conduit in contact with the conductor, and carrying an armature for the magnets on a moving car, to move the trolley in the conduit, a surface conductor separated from and external to the conduit and electrically connected with the main conductor in the interior of the conduit, and a contact piece on the car for contact with the surface conductor.

656,522. Apparatus for Converting Alternating Currents Into Continuous Currents. Max Déri, Vienna, Austria-Hungary. Application filed July 6, 1899.

Apparatus for converting alternating currents into continuous current, comprising a stationary magnet core having two separate winding systems similar to the armature winding of a dynamo, each provided with a commutator and each connected with a separate group of conductors supplying from generators or transformers alternating currents which in the magnet produce fields, the magnetic flux of which common to both windings flows entirely through iron, in combination with short-circuited brushes revolving synchronously with the fields and connecting together those parts of the two commutators which have in the one system the highest positive, and in the other system the highest negative potential, and terminals for the continuous current connected to fixed points of the two separate supplying and exciting circuits.



NO 656,372.

NO. 656,431.

656,545. Electricity Meter. George Hookham, Birmingham, England. Application filed July 9, 1900.

In electricity meters in which two pendulums are compared, one being affected at periodic intervals by the current to be measured and the other beating normal time, a synchronizing device consisting of a balance gear adapted to correct deviations from synchronism between the pendulums during alternate periods in which both pendulums are unaffected by the current or energy to be measured.

656,558. Electrolytic Apparatus. Gérôme Loiselet, Paris, France. Application filed November 7, 1898.

In an electrolytic apparatus, the combination of a series of cells arranged side by side, each having its ends and bottom constructed of insulating or non-conducting material and having its sides each made of an inner strip of porous material, and an outer perforated metallic plate, the strip and the plate being secured to each other and to the ends and bottom, the adjacent plates of each cell lying in contact with each other without an intervening space, the alternate pairs or sets of plates at one end of the apparatus being connected with the positive pole of an electric generator, and the alternate sets or pairs of plates at the opposite end of the apparatus being connected with the negative pole of the electric generator, the sets or pairs of plates connected to the negative pole of the generator being located between the sets or pairs of plates connected to the positive pole of the generator.

656,571. Controller for Electric Motors. Thomas S. Perkins, Idlewood, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed January 13, 1900.

In a controller for electric motors, the combination with a movable member having suitably arranged and connected contact pieces, of co-operating contact fingers, one or more electromagnets, and arc shields provided with magnetic flux conductors, which project between adjacent fingers and into proximity to the pole pieces of the magnet or magnets.

656,578. System of Electrical Distribution. William J. Davis, Jr., Schenectady, N. Y., assignor to the General Electric company of New York. Application filed June 29, 1900.

The method of supplying power to synchronous apparatus, which consists in operating the machines in multiple at light loads and independently at heavy loads.

656,606. Motor-car Truck. Charles E. Moore, Chicago, Ill., assignor to Elmyr A. Laughlin, Chicago, Ill. Application filed January 26, 1899.

In a street-railway electric-motor car, the combination with the car body of a motor-truck frame, slotted longitudinally adjustable retaining castings secured to the car body, and having recesses or sockets to receive the ends of the truck sills, and cupped rubber cushions compressed between the car body and truck frame and securing the car body and truck frame together by suction, vacuum or atmospheric pressure without bolts or direct connections and insulating the car body from sound or vibration transmission from the motor truck, and permitting the ready removal of the car body from the truck.

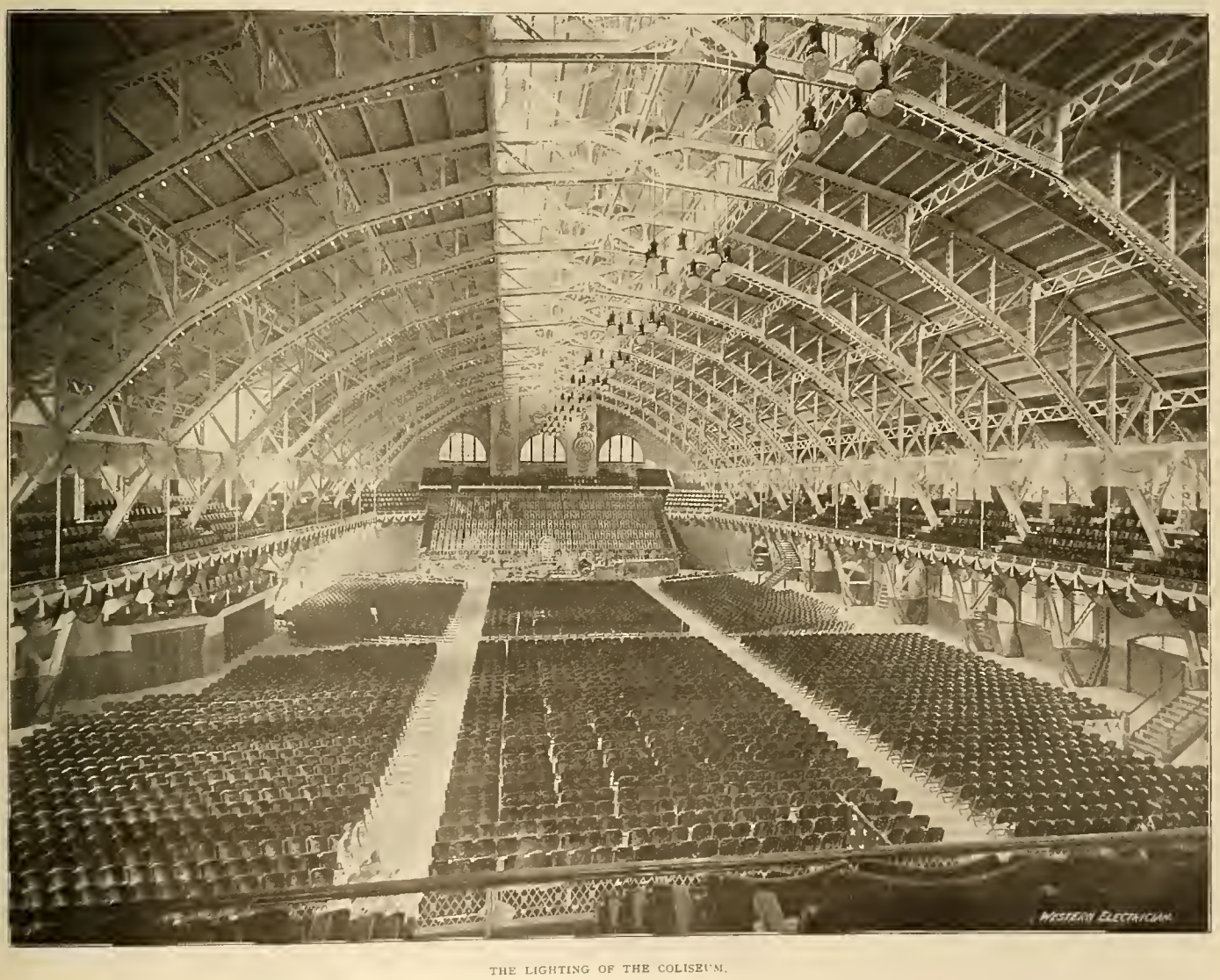
Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, SEPTEMBER 8, 1900. No. 10

The Lighting of the Coliseum.

Since the burning of the old Coliseum on Sixty-third street, Chicago has needed a large modern building in which to hold great public gatherings, expositions, conventions, horse shows, etc., and the new Chicago Coliseum erected on Wabash avenue, near Fifteenth street, has been built to supply this want. The building stands on the site of the famous Libby Prison, the structure which was removed from Richmond to Chicago, rebuilt and used as a war museum. The ornamental wall that was constructed in front of the old prison has been left standing and now forms the front of the Coliseum.



THE LIGHTING OF THE COLISEUM.

An illustration on the next page gives a view of the exterior of the building as it now stands.

The Coliseum has a total length of 307 feet and is 173 feet in width, and is of steel and brick construction. The rounded roof is supported by 12 large steel arches, thus giving the interior a full sweep from wall to wall without pillar or post. An excellent idea of the size and construction of the interior may be obtained from the above picture. A large balcony is arranged around the four walls of the structure, and this contains permanent seats. The seating arrangement on the main floor is temporary, so that the chairs can be removed in a short space of time, leaving the floor entirely clear. The total seating capacity of the building is said to be 10,000.

The construction is fireproof throughout, the roof consisting of concrete laid three inches thick. There is a basement under the east and north portions of the building, for the electric-light, heating and ventilating plant. The 12 steel arches that support the roof are built with a span at the foundation of 149 feet nine inches, the vertical distance from the center of the arches to the floor being 65 feet. On the east side the auditorium wall runs close to the alley between Michigan and Wabash avenues, while on the west or Wabash avenue side some space is given up to entrances, corridors and offices. There are five large exits on Wabash avenue and other smaller exits on the alley side of the building.

The Coliseum is now practically completed, with the exception of a few minor details. It was formally opened and dedicated on Saturday evening, August 25th. The occasion was a dedicatory concert and musical festival, given under the auspices of the Grand Army of the Republic, whose thirty-fourth annual national encampment was held in Chicago during the week of August 27th. Frank O. Lowden, representing the stockholders of the company which built the Coliseum, made the presentation speech, dedicating the building to public usages, and Mayor Harrison accepted the building on behalf of Chicago and her citizens. The musical programme was carried out by a band of 60 pieces, a chorus of 500 voices and a number of soloists. The ladies in the chorus were gowned in red, white and blue and arranged to represent a United States flag. The large picture given herewith shows the temporary platform built for seating the chorus at the north end of the building.

A striking feature of the new Coliseum, well shown in the illustration on this page, is the arrangement of the electric lamps used for lighting the interior. The principal illumination is afforded by 180 enclosed-arc lamps, 80 of which are suspended from the centers of the 10 middle arches in coronas of eight each. The remaining 100 arcs are distributed around the sides of the building, both above and under the gallery and in the entrances. Twelve others are to be erected on ornamental fixtures on the stone wall, along the front of the building. To reach the arc lamps suspended from the arches for the purpose of cleaning, trimming, etc., a walk has been built along the top of the arches the whole length of the building. Room is afforded for this walk by the lantern of the building. Over the center of each arch is a circular platform, and from the hand-rail of this platform the arc lamps are suspended by iron chains. To trim a lamp it is simply hauled up, hand over hand, to the platform, where ample room is provided for the trimmer to work. All of the arc lamps are of the Adams-Bagnall Electric company's manufacture, and are 500-watt lamps, rated at 2,000 candlepower each, and operated at 110 volts, direct current.

Each of the 12 arches contains a row of 76 10-candlepower incandescent lamps. For the suspen-

sion of these lamps a novel idea was worked out by Charles G. Armstrong, the consulting electrical and mechanical engineer for the Coliseum company. The lamps are all mounted on birch, two by four-inch strips, the wiring running through two covered grooves. Four of these wooden strips are hinged together, and form the suspension for one-half of each arch. The strips are hung on ropes running over pulleys, and each section may be lowered from the arch to the main floor, in case it is necessary to make any repairs or to renew any burned-out lamps. This method of suspending incandescent lamps in large, arched structures is considered an efficient and valuable one. By the permanent suspension of lights under the arches it is generally a very difficult matter to reach and replace burned-out lamps, and often they are left to mar the symmetry of the outlined arches, while, by this new method, lamps can be quickly replaced with but little trouble.

NEW CHICAGO COLISEUM.

Besides the 912 lamps on the arches, there are a number of 16-candlepower incandescents in the offices and basement and a row over the entrance, making in all a total of about 1,200 incandescent lights. The wiring throughout the entire building is open, except the feeders to the coronas of arc lamps, which run up each arch on the east side in circular-loom conduits, a cut-out box being provided at each platform above the lamps. Simplex wire is used throughout, there being upward of 100,000 feet of wire installed.

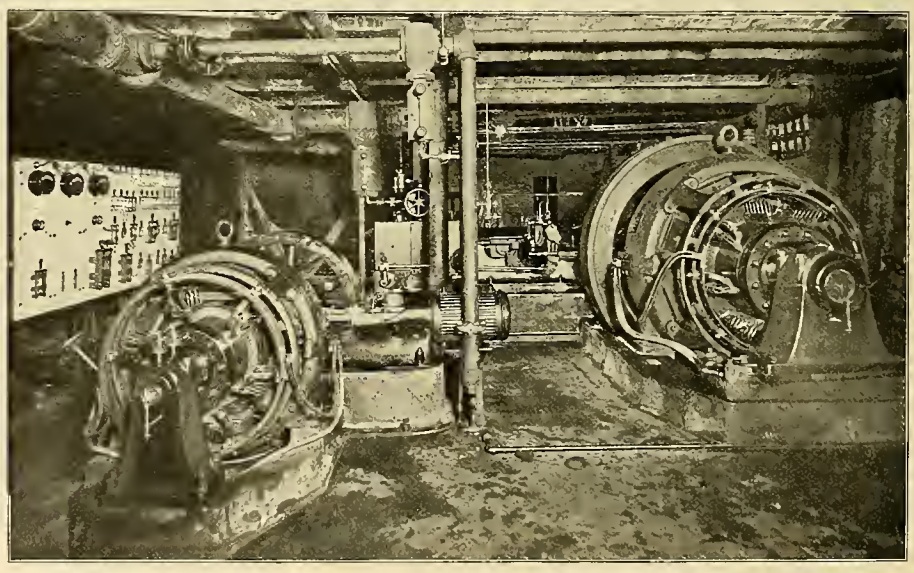
The heating and lighting plant for the Coliseum is situated under the northeast corner of the building. A view in the engine room, showing the two generating units and the switchboard, is given on this page. The smaller of these units, seen at the left, consists of a 50-horsepower simple engine, driving a 30-kilowatt, 125-volt Siemens & Halske direct-current generator at 320 revolutions a minute. The engine of the larger unit is a 230-horsepower simple four-valve machine, and it is direct-connected to a 150-kilowatt multipolar, 125-volt Siemens & Halske generator, running at 200 revolutions a minute. When the Coliseum is lighted, the smaller unit is used the most, so it has been given the name of Aguinaldo, because "it runs all the time," while the larger unit has received the appellation of Oom Paul, for the reason that "it only runs when it has to."

The switchboard has six panels of white Italian marble. The first and third panels are generator panels, and each contains an ammeter, rheostat and switch for one of the generators. A voltmeter panel is installed between these two panels, while the last three panels contain the switches for the feeding circuits. Each incandescent arch is controlled by a switch and all the arches can also be lighted by one large switch. The coronas of arc lamps are also separately controlled by switches, while the side arcs are controlled by four circuits on each floor. Kohler Bros. of Chicago were the electrical contractors on the work and did all the wiring, from the generators to the lamps, including the furnishing of the switchboard and lamps.

The boiler plant consists of a bank of four high-pressure tubular boilers, 66 inches by 16 feet in size, built by the Erie City Iron Work, which company also constructed the engines. Besides supplying the engines with steam, the boilers in cold weather will furnish steam to two steel-plate heating and ventilating fans, which will force the air by the blast system to all parts of the Coliseum. Each of these fans will be driven by a 30-horsepower engine. The offices will be heated by direct radiation.

As the drainage level of the building is four feet below the sewer level, the surface drainage has to be pumped out. A Yeomans centrifugal bilge pump is installed for this purpose. It is driven by a three-horsepower Milwaukee vertical motor, which is operated by an automatic controlling device connected to a float in the pump well. This pump motor is the only apparatus connected with the Chicago Edison companys' service mains, this connection being necessary, as the pump often has to be operated when the Coliseum lighting plant is not running. The remainder of the boiler-plant equipment includes a Baragwanath open feed-water heater and receiver, Smith-Vaile boiler-feed pumps and an ash hoist operated by an electric motor, not yet installed.

Although the building is entirely fireproof, yet, to afford protection against damage to furniture, decorations, etc., by fire, there have been installed 25 Miller hand fire extinguishers, at different parts of the building, and also a system of water piping and fire hose. This system comprises 12 automatic hose reels, each containing 100 feet of hose, the valves having electrical contacts, so that when a valve is opened an alarm is sounded in the basement, signaling the engineer to put on the fire-pump service.



ELECTRIC-LIGHTING PLANT IN THE COLISEUM.

The Coliseum building is owned by the Coliseum company, a corporation organized by Chicago and Iowa capitalists. The following-named gentlemen are officers of the company: President, Charles F. Gunther of Chicago; vice-president, Congressman J. A. T. Hull of Iowa; secretary, Stewart Spaulding of Chicago; treasurer, John Gibson, president of the Iowa State Savings Bank of Creston, Iowa. The architects for the building were Frost & Granger of Chicago, while E. C. and R. M. Shankland acted as consulting civil engineers.

It is planned to build an annex, with ground dimensions of 50 by 173 feet, just south and adjoining the main Coliseum building. On the second floor of this annex, which will be on a line with the gallery, will be a banquet room for large balls and big social events, while on the third floor will be the offices and committee rooms for conventions, etc.

Court of Honor for Grand Army Encampment.

In honor of the thirty-fourth annual national encampment of the Grand Army of the Republic, which was held in Chicago from August 26th to 30th, a temporary court of honor was constructed on Michigan avenue, opposite the Lake Front Park. The court was six blocks in length and ran from Van Buren street south to Harmon place. At each end was erected a large arch, the one at the north end near Van Buren street being dedicated to the army, while the south arch was dedicated to the navy. The sides of the court were formed by columns erected at the curb lines of the pavement. The style of architecture adopted in the designs of the columns and arches, all of which were built of white staff, was the classic Corinthian.

While the court of honor was a work of art as viewed by daylight, the architectural effect was heightened at night by a brilliant illumination of electric lights. On each arch were installed 550 16-candlepower incandescent lamps, while each of the 132 columns was lighted by 13 lamps, thus making in all over 2,800 lamps that were used for the illumination.

The accompanying illustration is a night view of the army arch, showing the court and navy arch in the distance. Each of the arches was 50 feet in height, with a width across the street of 48 feet and a thickness of 20 feet. The open arch through which carriages were allowed to pass was 20 feet wide and 30 feet high. On each pedestal of the army arch was a figure in heroic size, one representing an artilleryman and the other a cavalryman, while at the foot of each were figures allegorical of war and peace. At the top of the arch were four figures representing Victory. Just above the opening were two heralds of peace, each blowing a trumpet, the open ends of which contained electric lights. On the panels at either side were the Grand Army of the Republic emblems, while over the center were the letters G. A. R., outlined by lamps. The names of Sherman, Grant, Lincoln, Logan and Sheridan were mounted on each side of the arch, while the names of Hancock and Thomas were placed on the ends. The two sides of the arch were identical.

The navy arch contained figures at the bases of the pedestals representing a naval engagement and a naval victory. This arch contained the names of Lee, Dahlgren, Farragut, Porter, Foote, Cushing and Worden.

Each of the columns had mounted upon it a shield, with two crossed flags. The shields contained the "Y" of the coat of arms of the city, emblematic of the branching of the Chicago River. This Y consisted of 13 incandescent lamps, significant of the 13 original states. In the spaces between the branches of the Y were the letters G. A. R. The columns were 30 feet in height. The illumination of the arches was especially arranged by Wilson & Marshall, the architects who designed the court of honor, so as to bring out the artistic

features and high lights and not especially to bring the outline into any special prominence.

The electrical work, wiring, etc., was done by the construction department of the Chicago Edison company, and this company also furnished the current for the illumination. As the Edison company has no mains on Michigan avenue, it was necessary to tap its service mains on Wabash avenue and build temporary pole lines to the court. There were three of these feeding circuits, each consisting of three cables, 500,000 circular mils in size. The company also erected 60 arc lamps in the enclosure near the lake front where was presented each night of the week Pain's spectacular "Battle of Santiago." The court of honor was lighted from dusk to midnight each night from August 25th to September 1st. The entire work of building the pole lines and placing the incandescent lamps on the court was accomplished by the Edison company in the space of 10 days.

There is a project on foot in Chicago now to erect a permanent Grand Army arch, of granite or marble, similar to the temporary one herewith illustrated. It has been suggested that this be built on the Midway Plaisance, on the South Side. As an alternative plan, H. R. Wilson, of Wilson & Marshall, the architects, has suggested that it be made a part of a general scheme for the improvement of the Lake Front Park, with the idea of building the arch now and the columns and remainder of the work later. Mr. Wilson says:

The suggestion I have to offer is to set the arch back from Michigan avenue, at about the line of the Illinois Central tracks, facing Jackson boulevard. Pylons could be placed at the line of Michigan avenue, with a fine approach leading up to the arch. The arch would be placed at the west end of a monumental bridge that would span the Illinois Central tracks leading over to the new park on the other side of the same. At the east end of the proposed bridge, broad walks would divide and lead out around a large basin extending out to the lake. At the west end of the basin a beautiful fountain should be placed. This, together with the water of the basin, would form a beautiful vista through the openings of the arch. On one side of the basin, with proper space between, I would locate the future exposition building, and on the other side the Columbian Museum.

ILLUMINATION OF GRAND ARMY COURT OF HONOR.

The Board of Trustees of Monroe, Ind., has decided to erect an electric-light plant in Monroe.

OPENING OF INTERNATIONAL ELECTRICAL CONGRESS AT PARIS.

[Special correspondence of the Western Electrician.]

Paris, August 18.—The International Electrical Congress was opened to-day at 10 a. m. sharp in the Palace of Congresses, under very auspicious circumstances.

The members from different countries commenced to assemble as early as nine o'clock and came in groups up to the very time of opening. Before the exercises began the time was taken up by the distribution of badges and by members registering for the various side trips which are offered by the congress. The meeting was called to order by Mr. Mougeot, under-secretary of the French Postal and Telegraph service, who welcomed the delegates in the following terms:

It is a great honor for me to preside at this meeting and to open your labors. I am well aware of the learning and distinction of the members of this assembly, and no less of the fact that, with you, science is associated with the utmost disinterestedness, that riches of heart are added to qualities of intellect. You are the devoted disciples of science, which is the surest pioneer of civilization, and of which electricity is one of the most marvelous applications. [Applause.]

In fact, is not all progress marked by the discoveries of science and by the labor of the human spirit of which you are the emanation?

Above all, I bid welcome to those noble foreigners among you who have come to Paris to share in a common sentiment of love of science and in a common idea of solidarity, aiming at the amelioration of the lot of humanity itself. [Applause.]

In the name of the government of the republic, I bid you all welcome. I hope your stay among us will be a pleasant one, and I congratulate you in advance on the rich results which cannot fail to issue from the solid and elevated discussions that will take place in this assemblage.

I salute you all, soldiers of science and of peace, who come here moved by one common sentiment and animated with one common desire to labor in the higher interests of mankind. [Applause.]

Before asking you to address the meeting, M. Mascart, I desire, in exercise of my prerogative as president for the moment, to be the first to convey to you publicly the expression of my hearty compliments and congratulations on the high honor which has just been conferred on you by the government of the republic—an honor which everyone here knows is richly merited. [Hearty applause.] All those who have followed your work—all who know what you are and what hopes the scientific world places in your labors—are delighted with this mark of honor, which is reflected by your fellow-laborers. [Renewed applause.]

Prof. Mascart's Address.

Prof. Mascart, the chairman of the committee of organization for the congress, then read (in French) the following address:

The organizing committee of the Congress of Electricity has, first of all, a particularly agreeable duty to perform—that of expressing to our foreign colleagues its profound gratitude for the readiness with which they have come in such large numbers in answer to our invitation. We hope that this congress, in bringing together men of science and the engineers of different countries who have directed their efforts toward the progress of electricity, will aid in drawing closer the bonds of friendship formed in previous reunions and in creating new relations between them.

The applications of electricity are extending today to almost all branches of human activity.

At the beginning of the century, the first consul, after witnessing the experiments of Volta, before the first class of the Institute, gave it as his opinion that this part of physics appeared to be the path to great discoveries. No prediction was ever more completely fulfilled. The discoveries that have followed one another since that time present a character unique in the history of the human intellect.

The first task was to develop the principles and the laws of electrical currents; it was accomplished in 30 years, by the labors of Oersted, Ampère and Faraday. At the same time, Davy showed, by memorable experiments, the resources that chemistry was going to find in these laws; Jacobi established the important industry of electroplating, and the discovery of Arago regarding the magnetization of iron by currents gave birth to electrical telegraphy.

The utilization of this new agent for motors and the production of currents by mechanical means made much slower progress. If the problem was theoretically solved, the practical solutions presented the utmost difficulty.

For certain applications, the alternating motion naturally imparted to induced currents by mechanical means presented no serious inconvenience, but an endeavor was made to set up these currents in such a way as to preserve the same direction outside the machines, on the analogy of those furnished by the Voltaic pile, and the succeeding third of the century did not suffice for the discovery of a completely satisfactory solution. It was then that M. Pacinotti's too-much-neglected machine and the invention of the industrial dynamo by M. Gramme opened up a wholly new path.

The spectacle before us to-day is something marvelous. In place of the petty appliances of the laboratory and the cumbersome electric batteries, we behold machines of every dimension, capable of undertaking the most delicate operations and assuming the work of the most powerful mechanical motors with an ease which defies all comparison. The whole field of labor is thereby transformed. The reserve forces of nature are everywhere better utilized. The course of streams, torrents, waterfalls, all the varieties of what has been called "white coal," are put to profit for human needs by electricity, whether on the spot or at great distances, and enormous resources formerly wasted are now at our disposal.

Lovers of wild scenery may at times regret that industry is invading valleys of smiling beauty or stern grandeur, and is taking possession of picturesque sites, but their complaints are not justifiable, in view of the benefits derived by the human race.

Electricity is similarly working a complete revolution in the industry of transportation. It multiplies the relations between the inhabitants of cities and communication between different localities. In a neighboring country, so beloved of tourists, it conducts to the summits of the loftiest mountains the visitors who desire to enjoy the grand aspects of nature without fatigue.

At the Exposition of 1881 William Siemens showed us for the first time a curious experiment on the refining of iron in a crucible between the carbons of an electric arc. The operation was conducted with only a kilogram of material, and one could hardly have foreseen that that electrical furnace would have such a future.

The powerful means offered by industrial electricity have been employed by chemists in the production of aluminum and the rare metals, in the refining of copper, the direct formation of various substances and the formation of a series of new bodies, to such a degree that one of the masters of science has been able to say: "Mineral chemistry, which appeared to have reached its limits, is only at its dawning. In this domain, also, science has returned with interest the services which industry has rendered it."

Electric lighting has no longer to establish its power to win popular favor; its development progresses from day to day, and the exposition shows us with what magic this light lends itself to the most marvelous decorative effects. Electricity may even lay claim to one of its most recent rivals—acetylene

light—whose place in the general economy is not yet established.

Toward means of transmitting human thought, the telegraph and the telephone are making fresh progress daily. The increase of business has resulted in the contrivance of the most ingenious methods for adding to the service of the lines and utilizing a single wire in the simultaneous transmission of several dispatches, in the same or in opposite directions, leaving to the receiving apparatus the task of separating the messages destined for each particular one.

We are even at the point of setting aside metallic conductors and of intrusting to the air the task of transmitting electric waves. Are we to see the time when the atmosphere, charged with an electricity wholly different from that of the tempest, shall be traversed in all directions by artificial waves, invisible messengers that avoid collisions with one another, like the rays of light propagated in the ether?

But the telegraph no longer suffices for the somewhat feverish activity of our times.

The telephone itself causes much impatience and is powerless for very long distances. No matter; we now write our words on steel wires which repeat them, each in its turn. We shall soon have telephone relays, enabling us to transmit business messages and hear the voices that we love from one end of the world to the other. What have we left to wish for except to see at a distance? However obliging we find electricity, it would doubtless be indiscreet to ask this miracle from it.

I have been able to indicate only in outline the principal applications of electricity. There would still remain to mention the results obtained in physiology and in medicine, in which the use of currents of multiple vibrations has not yet said its last word, as well as the still mysterious properties displayed by the rays emitted by the Crookes tubes and by certain chemical combinations. In this field of investigation much remains to be done, and our ideas of the constitution of bodies will no doubt be very considerably modified thereby.

Such is the immense domain in which you will necessarily have to make a choice for your discussions.

At the moment, when the century is drawing to a close, it is permissible to cast a look behind at the road traversed. The loftiest intellects have devoted their powers to the study of electrical phenomena, and an army of engineers has followed to translate their theories into practice. Electricity has entered into every industry, annihilated distance, overleapt the oceans and brought the nations together; it will play an all-important part in the realization of that dream of peace and brotherhood which is stirring every civilized people. A whole century for the accomplishment of this work seems a good deal to contemporaries, but in the history of the human race it is very little.

When our descendants come to form an estimate of the nineteenth century, they will doubtless be filled with surprise and admiration in recording the accomplishment of so many things in one century.

Allow me to close with a personal recollection. In 1881, not far from here, was held the first congress of electricity, which brought together the most eminent scientists of the whole world. I cannot remember without emotion that many among them have passed away, and I would fain render pious homage to their memory.

Among others were seen there: Representing Germany, von Helmholtz, Clausius Kirchhoff, Du Bois Reymond, Wiedemann; representing England, Spottiswoode, Hopkinson, Hughes, William Siemens; representing Austria, Mach; representing Italy, Rossetti, Govi, Ferraris, and many others, too numerous to mention.

In the famous committee on units, that Areopagus had as its president J. B. Dumas, whose dignity and distinguished bearing inspired universal respect. He seemed to us the last representative of a former generation, that of the founders of the science whose names were surrounded for us with a kind of halo.

It was owing to the general spirit of conciliation and to the common desire to produce useful work that the committee, under the influence of Dumas, reached by a unanimous vote resolutions which have rendered such important services to science and industry.

I would open this congress under the auspices of the congress of 1881, which is in other respects historical, in declaring my assurance that to-day, as then, your deliberations will be inspired by the spirit of mutual concession, of harmony and of desire for the public welfare.

Organization.

Mr. Mascart's address was received with great enthusiasm. At the right of the presiding officer—Mr. Mougeot—during the opening exercises were Mr. Mascart and Sir William Preece, and on the left were Mr. H. Fontaine of France, Mr. Carl Hering of the United States and Mr. J. Lavey. On the platform were also seated the official delegates from the different countries. The time taken by the two speeches was one-half hour, when a short recess was held, after which the following permanent officers were elected:

President—E. Mascart, member of the Institute of France.

Vice-presidents—Messrs. Moissan, H. Fontaine and Gariel of France, and other official delegates as follows: Germany, Professor F. Kohlrauch and Professor Dorn; England, Professor Perry, F. R. S., and Sir William Preece; Austria, Professor Jullig; Belgium, Eric Gérard; United States, Carl Hering and A. E. Kennelly; Hungary, Mr. de Fodor; Italy, Mr. Columbo; Russia, Professor Chatelain; Switzerland, Mr. Turrettini.

General secretary—P. Janet.

Reporter—Mr. Hospitalier.

The presidents of the sections were then proposed and unanimously appointed:

First Section—Scientific methods and measuring apparatus.—Mr. Violle, member of the Institute of France.

Second Section—Sub-section A—Mechanical production and utilization of electricity.—H. Hilairet.

Second Section—Sub-section B—Electric-lighting.—Hippolyte Fontaine.

Third Section—Chemical Electricity.—Mr. Moissan.

Fourth Section—Telegraphy and the telephone.—Mr. Wunschendorff.

Fifth Section—Physiological electricity.—Mr. D'Arsonval.

The president read a letter from Lord Kelvin, in which he expressed regret at being prevented by considerations of health from coming to Paris, and sent his best wishes for the success of the International Congress of Electricity. A telegram of thanks and respectful sympathy was addressed to Lord Kelvin in the name of the assembly. The president intimated that, in addition to the five sections indicated in the programme, a committee consisting of the official delegates of the various governments had been appointed for the purpose of considering propositions of international interest submitted by the sections; the same procedure was followed at the congress in Chicago.

After various announcements had been made Professor Ayrton, F. R. S., delegate of the British government, said:

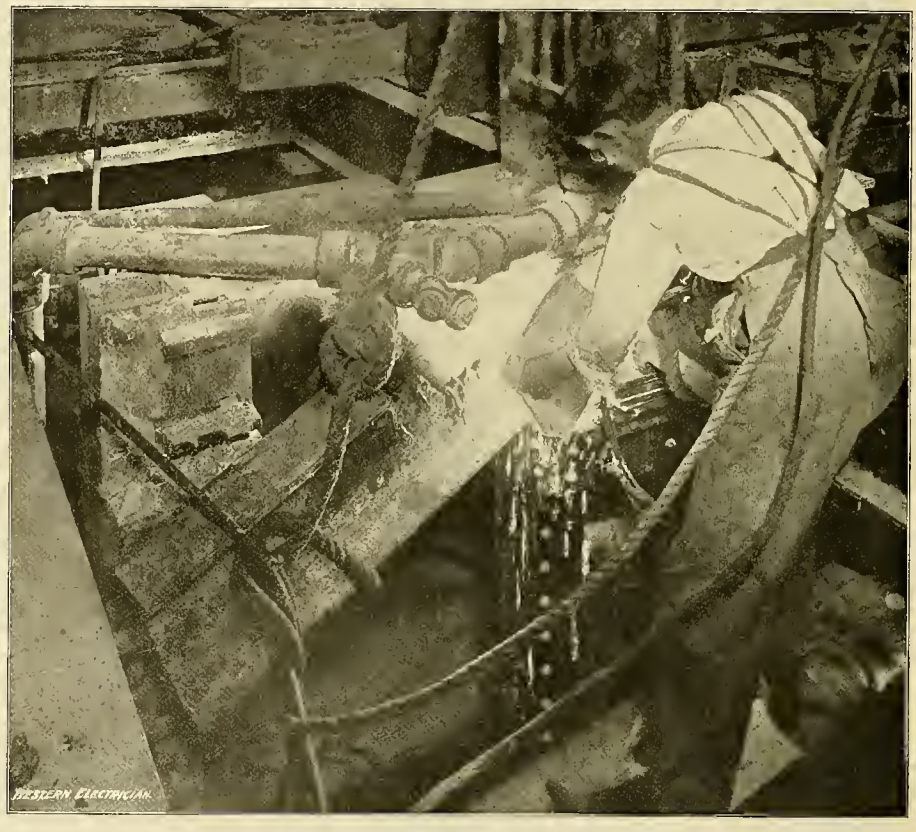
In the name of the strangers, I desire to express our thanks to the government of the French Republic for the reception which it has so graciously given us, and for affording us the opportunity of attending this reunion in the city where the first congress of electricity was held. We owe special acknowledgments to our president and the other persons who have with so much labor made all the preparations necessary to assure the success of this reunion. I am certain that the discussions of this congress will extend the limits of science and of the practice of engineers and electricians in the whole world. [Applause.]

Professor Dorn, delegate of the German empire, also spoke in a similar strain, and President Mascart responded suitably. The opening session was then adjourned.

Among the papers read before the congress were the following: "Cost of Current for Electric Railways," by Mr. Postel-Vinay; "Concerning the Construction of Dynamo-electric Machines," Maurice Leblanc; "Excitation of Induction Machines," Maurice Leblanc; "Utilization of Condensers," P. Boucherot; "Converters and Rectifying Transformers," P. Janet; "Summary of the Decisions of Former Congresses," E. Hospitalier; "Actual Condition and Progress of Telegraphy Without Wires by Hertzian Waves," André Blondel and Gustave Ferrié; "The Electric Furnace," Mr. Keller; "Behavior of Alternators Connected in Parallel," G. Chevrier; "Precise Measurements of Alternating and Polyphase Currents," G. L. Addenbroke; "Photometry," J. Violle; "Concerning Electromagnetic Mechanisms," Silvanus P. Thompson; "Electrochemical Deposition," Henry Bouilhet; "Progress in Electric Lamps," André Blondel.

Twenty-two countries have sent official delegates, the United States being represented by Carl Hering of Philadelphia, A. E. Kennelly of Philadelphia and Captain John Millis, U. S. A. Twenty-five societies and associations are represented, from 12 different countries. The Institution of Electrical Engineers of London has the largest official representation, with the American Institute of Electrical Engineers next. The ordinary members number 758 and represent 26 different countries.

Each member of the congress is supplied with a pass to the exposition, which is good from August 18th to 25th, inclusive. Besides the pass, he is given a metal badge, gold-plated, 1¾ inches long by one inch wide at the top and three-fourths inch wide at the bottom. At the top is represented a collection of clouds, from which the usual arrows project, symbolizing lightning. At the bottom is shown the end view of a bipolar dynamo, and in between is inscribed, with raised letters, "Congres International d'Electricité, 1900." The badge is not at all elaborate, but is rather artistic. It is supported from the top by a black silk ribbon, allowing it to be readily attached to the lapel of a coat.



CUTTING IRON BEAM WITH THE ELECTRIC ARC.

Paris, August 20.—The president and members of the American Institute of Electrical Engineers tendered a reception to the Institution of Electrical Engineers and their French colleagues at the United States pavilion, Quai d'Orsay, on Monday afternoon, August 20th, from 5 to 7 p. m. The reception was well attended and much enjoyed by all. The visitors were received on the second floor of the pavilion, while on the first floor the orchestra discoursed familiar music. On the third floor refreshments were served. Among the American engineers present were Carl Hering, Philadelphia; A. E. Kennelly, Philadelphia; C. O. Mailloux, New York; W. J. Hammer, New York; Captain John Millis, U. S. A.; W. D. Weaver, New York; B. J. Arnold, Chicago; V. R. Lansingh, Chicago; J. M. Hollister, Chicago; I. R. Edmonds, Niagara Falls; A. Oolgaardt, Schenectady, and Professor F. B. Crocker, New York. J. M. H.

Prof. E. Mascart.

Eleuthere Elie Nicolas Mascart, president of the International Electrical Congress held in Paris, August 18-25, 1900, is a physicist of international reputation. He was born in Quarouble (Nord), France, on February 20, 1837, and graduated from the College of Valenciennes, afterward taking a course in the École Normale Supérieure. He evinced a marked aptitude for the natural sciences, and, after teaching at several institutions of learning, he accepted the adjunct professorship of physics at the College of France in 1868. On the retirement of the celebrated Regnault, Professor Mascart succeeded to the full professorship. In 1878 he was appointed director of the Central Meteorological Bureau of France—a position which he still holds, or did until lately.

Professor Mascart has been president of the French Physical Society, of the Société Internationale des Electriciens, of the French Meteorological Society, and of the French Association for the Advancement of Science, and has held many other scientific appointments of prominence in his native country. His writings, especially on optics and electricity, are of eminent value. His well-known work entitled "Lessons in Electricity and Magnetism," in which Mr. Joubert collaborated, has been translated into English and German.

PROF. E. MASCART.

At the Paris Electrical Congress of 1881 Professor Mascart was general reporter, and for his services at that time was made an officer of the Legion of Honor, having been created a chevalier of that order 10 years before. He was president of the International Electrical Congress in Paris in 1889 and was then made commander of the Legion of Honor. At the World's Electrical Congress in 1893 Professor Mascart was one of the vice-presidents and an official delegate from France. The accompanying portrait was taken at that time.

Cutting Iron Beams with the Electric Arc.

To make additional room for the Corn Exchange Bank on the second floor of the Rookery building in Chicago, it recently became necessary to remove a brick partition that stood in the way. In this partition were two cast-iron columns supporting the girders for the floor above, and it was decided to replace these columns with a single steel column which would stand near the center of the room. It was found that the wrought-iron I-beam girders that were formerly supported by the cast-iron columns within the wall would, under the new construction, project below the ceiling line of the room. These girders, therefore, had to be cut off in a slanting direction from the steel column. As the old method of sawing them off would take a great deal of time it was decided to burn through them by means of the electric arc. C. H. Matthews, of the Bankers' Electric Protective company, was given the contract for the job, and he and J. E. Haschke did the work.

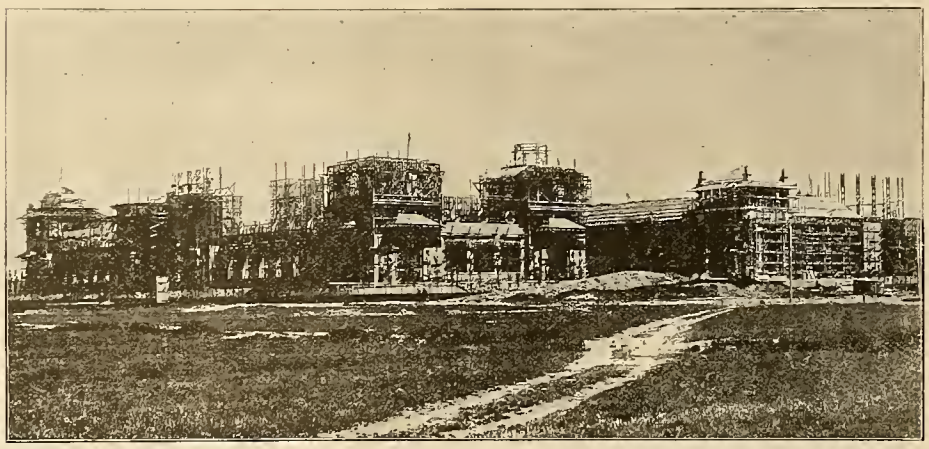
Connection was made by means of flexible cables with one terminal of the smallest generator—a 110-volt, 400-ampere, shunt-wound machine—in the Rookery electric-lighting plant in the basement of the building. A 1½-inch solid round carbon connected with the cable was fastened to a wooden handle by means of a brass ring or holder. As the steel column was grounded in the basement it was only necessary to use one carbon terminal. A water rheostat was put in the circuit. The operator worked the carbon through a sheet-iron box lined with asbestos and held by the left hand while the right hand directed the carbon. The operation consisted in first making a contact with the metal of the girder and then withdrawing the carbon to form an arc, which quickly melted the iron. Holes were burned through the girders in a line conforming to the direction of the desired cut. The accompanying illustration shows a man at work on one of the girders. The end of the girder had been nearly cut away and was secured by a rope while the metal still remaining in the path of the cut was melted away. The rough, jagged edge left by the arc is plainly visible in the illustration. Instead of the sheet-iron box ordinarily used, a piece of asbestos was utilized in this case to shield the arc.

The character of the work in this particular case was very difficult, as the metal was very hard and viscous, so that when it was melted by the arc it would run and stick to the work. It is estimated that the temperature of the arc used is about 15,000 degrees Centigrade. The girders that were cut off were 14-inch I-beams with a web one-inch in thickness. There were six of these to cut off, and it was necessary to melt about 225 holes through the metal to accomplish the work. It required about a half minute to make a hole through the web of the girders. The actual working time spent in cutting the girders through amounted to about 3½ hours. On account of the great brilliancy of the arc the workmen have to wear blue glasses, and sometimes two or three pairs. The task of employing the electric arc in this kind of work is arduous, owing to the heat and glare; but the advantage of the plan is its greater speed, compared with the old method of sawing.

Pan-American Exposition.

All of the large buildings for the Pan-American Exposition, which is to be held in Buffalo next year, are now well under way. The accompanying illustration gives some idea of the progress of work upon the Electricity and Machinery buildings. The picture gives the view of an observer looking southeast from that portion of the grounds which will be occupied by the Midway. It does not clearly distinguish between the two buildings, but the latter are in reality separated by one of the main thoroughfares of the exposition, known as the Mall, 150 feet wide, which runs east and west.

Workmen are already putting on the white staff, with which all the buildings are to be covered. All the exteriors of the buildings are to be finished in color, presenting an agreeable effect upon the eye. It is said of this exposition that it will surpass all former expositions in the extent and variety of its sculpture and plastic decoration. It will also outrival its predecessors in the beauty and completeness of its horticultural and floral effects, and it is to have elaborate electrical effects. The arrangement of the buildings is a symmetrical one, nearly all of the principal structures being grouped about broad courts. About 33 acres of land are comprised in these courts, all of which will receive embellishment. Large pools, with a number of fountains and jets of water, will complete the picture, and at night the water will be made brilliant by means of floating lights and the illumination of all surrounding objects by the use of more than 200,000 electric lamps.



PAN-AMERICAN EXPOSITION.—PRESENT APPEARANCE OF ELECTRICITY AND MACHINERY BUILDINGS.

The installation of the heavier exhibits is to be begun early in November, and the contracts require that all of the principal buildings shall be completed before severe weather sets in.

Electricity will be given special prominence at the Pan-American Exposition, and its utility will be amply demonstrated. There will not only be a large electrical exhibit in the building set aside for that purpose, but electricity will be used on a grand scale for motive power and for effects in illumination. Furthermore, the most striking and attractive structure on the grounds will be the Electric Tower, nearly 375 feet high, resplendent at night with colored lights, sparkling water jets and a great prismatic cascade. The buildings, landscape and waterscape of the exposition will be utilized wherever possible for electrical illumination, and Luther Stieringer, the consulting electrical engineer of the exposition, and Henry Rustin, chief of the Mechanical and Electrical Bureau, are devoting themselves to providing an electrical display which shall be worthy of the place and the occasion.

The area of open space at this exposition to be treated with electrical decorative and illuminating effects will aggregate 1,390,000 square feet. There are really to be two courts, the Court of Fountains and the Esplanade, at right angles to each other, forming a T. At one end of the Court of Fountains will be the Electric Tower, which will have at its base a solid panel of illuminated vari-colored water display, 60 feet in height.

At each end of the Esplanade, directly in front of the Government and Horticultural buildings, respectively, will be a large structural cascade fountain. Each of these cascades will be accentuated and colored with light during the night illuminations, which will be specially attractive, from the fact that, being in a depression, a plain view may be obtained from any quarter. The display features in lighting or hydraulics will not be of a spectacular type in the sense that the ordinary electric fountain is. The lighting-hydraulic-display features of the Pan-American are intended to be a special embellishment to decorate a beautiful picture, not to compete with it; hence, the display will be continuous during the exposition hours permitting it.

The Niagara Falls Power company will furnish 5,000 horsepower for the uses of the exposition. This power will be delivered at approximately 20,000 volts at the terminal house of the Cataract Power and Conduit company in Buffalo, which company in turn will transform the current to 11,000 volts and transmit it to the exposition grounds. In a transforming station which the exposition company will erect on its own premises, the current will be stepped down to 1,800 volts, and then transmitted to 200 transformer pits, which will be built about the grounds. From these pits the current will be used at 104 volts for lighting purposes and for running pumps and other machinery. In addition to this power, there will be steam power furnished on the exposition grounds, and gas, compressed air and waterpower also.

The displays in the Electricity building, which will be in charge of George F. Sever, recently appointed superintendent of electrical exhibits, will be undoubtedly of the most interesting character. They will not only please the public, but will excite the attention of students of electricity as a science and of those interested directly in its practical use. Superintendent Sever has been for the last seven years instructor in the electrical engineering department of Columbia University, New York. Prior to his connection with the university, Mr. Sever was associated with the railway department of the General Electric company.

Tesla Patents Upheld.

An important electrical decision was handed down at New Haven, Conn., on August 29th by Judge Townsend, in the United States Circuit Court, in the case of the Westinghouse Electric and Manufacturing company against the New England Granite company.

It was on a final hearing on bill and answer raising questions of patentability and infringement of three patents granted to Nikola Tesla, May 1, 1888, for an electric-magnetic motor. The patents in suit relate to the art of electrical transmission of power by the use of mechanically generating alternating currents. They cover the rotating magnetic field.

A decree for an injunction and an accounting as to all claims in suit was granted.

The Crawfordsville (Ind.) electric-light plant was partly destroyed by fire recently, entailing a loss of $40,000. The city had contemplated expending $10,000 in improvements on the plant in the near future. The work of rebuilding will be commenced at once.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

Street Railway association of the State of New York, Buffalo, N. Y., September 18th and 19th.

Inter Ocean Automobile Meet, Chicago, Ill., September 18th to 22d.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

A correspondent at Iloilo calls attention in an article on another page to the opportunity for the introduction of American telephone men, methods and apparatus in the Philippines. He describes the existing service in Manila in an interesting manner and gives many valuable hints for American telephone manufacturers who may feel called upon to invade this practically virgin field, where the clash of conflicting telephone interests is unknown, even as though it were not.

Not alone in the United States is an increasing use made of the telephone in transmitting railroad signals and train orders. In Europe, as well, experiments are making in this direction, and it is said that on certain Hungarian railroads the telephone has been already substituted for previously installed "signaling apparatus." It seems reasonably sure that telephony is to be an important adjunct of the railroading of the future, and telephone men should not fail to bear in mind all the possibilities of this important development.

The method of lighting the Chicago Coliseum, described in this number, is of considerable interest. Ingenuity is displayed in the attachment of incandescent lamps to the arches of the large interior, and as the plan has manifest advantages it is likely to come into use in other large buildings of similar style of construction. Current is furnished by a plant in the building, except in the case of a motor driving a drainage pump, which is automatically operated at times when the lighting plant is not in use. This motor is connected to a central-station circuit. Otherwise, all the electricity is supplied by the jocosely-named dynamos of the plant.

American electrical men will extend the heartiest congratulations to their French colleagues on the auspicious opening of the International Congress of Electricity, as reported on another page in this issue of the Western Electrician. In personnel, attendance and interest the gathering appears to have left little to be desired. Professor Mascart was worthily honored by election to the presidency, and he delivered an eloquent address, notable for the concise, graceful style in which the essential facts of electrical development were succinctly reviewed. A touch of the poetic is to be observed in the president's reference to the waterpower of foam-capped torrents as "white coal."

A very striking feature in the presidential address is its positive predictions. "We are even at the point of setting aside metallic conductors and of intrusting to the air the task of transmitting electric waves," is one. Another relates to the telephone relay: "We shall soon have telephone relays, enabling us to transmit business messages and to hear the voices that we love from one end of the world to the other." Experimenters in space telegraphy and telephone men, particularly Mr. Glidden among the latter, should be delighted at these undaunted statements from a scientist of Professor Mascart's standing. Whether these high hopes are destined of speedy realization or whether we are still some distance from the accomplishment of talking from continent to continent through the air, the address remains a luminous and delightful one, worthy of its author and the occasion.

Once more the report of the British postmaster-general shows a deficit in the telegraph revenue of the state. The figures for the year 1899-1900 show that although the telegraph receipts increased £200,347, the expenditures increased £266,916. The net deficit of the year is £288,438, or £66,569 more than last year's deficit. If allowance is made for interest on capital devoted to the purchase of the telegraphs, the total deficit is raised to £587,326—about $2,900,000. An examination of the report—and for these figures we are indebted to the London Electrician—reveals some curious facts. The percentage of salaries, etc., to total revenue in the postal service is 44.52, while that in the telegraph service is set down as 65.87. A similar comparison between the cost of conveyance of mails and that of telegraph maintenance gives percentages respectively of 11 and 20.39. The number of telegrams forwarded was 90,415,123—an increase of more than 3,000,000 over the previous year. A still greater augmentation of business has taken place over the trunk-telephone system, the revenue derivable from which was £191,701—an increase of 14.44 per cent. on the preceding year. The offices open for this class of business now number 299, the trunk lines in use consisting of about 68,657 miles of wire; and 7,250 miles of line is in course of construction.

The British telegraph service is admittedly very good—better, on the whole, no doubt, than that of our private companies. But why should that portion of the British public that does not use the telegraph be taxed to meet the deficit of those who do?

Some of the observations made by United States Consul Halstead of Birmingham in a recent report ought to be of value to Englishmen themselves, although written primarily with the idea of enlightening Americans in relation to one aspect of the industrial situation in Warwickshire. It seems that Birmingham, with its 500,000 inhabitants and important industries, has just now granted the local tramway company the privilege of using, experimentally, on one line, the overhead-trolley railway system. But as the people of Birmingham, speaking generally, are without the slightest conception of what a good electric street-railway system means, and as they appear to be likewise thoroughly inoculated with the drowsy mandragora of municipal ownership, the prospect for the erection of a comprehensive, efficient, modern street-car system is dubious indeed. It will probably be a year, in fact, before the experimental line is in operation. And for this reason it might be a good thing for the slow-going people of Birmingham to benefit by the useful knowledge which the consul promulgates.

Mr. Halstead thinks that the fear of the municipalization tendency exists very largely with serious-thinking people, and points to the rise in the rate of interest for municipal loans as combating the argument that cities can borrow money at lower rates than private corporations. In relation to the ingrained conservatism of British municipal officers—to use a polite term—the consul says: "The facts in the experience of cities in other civilized countries have absolutely no value for consideration in Great Britain. Glasgow sent a commission to study the street-car systems of the cities of the United States, Germany, France and Austria-Hungary, and after its return and favorable report built merely an experimental line. The experience of the rest of the intelligent world meant nothing to the citizens of Glasgow, though the necessity of the Glasgow mind for experimenting with what others had perfected would cause years of delay in the completion of a proper tramway system. Birmingham cares nothing for the newly acquired tramway experience of Liverpool, and is not at all interested in the fact that in neighboring little Coventry there is rather a nice tramway line or that in the adjacent Black Country there are several rather effective lines. In the Birmingham newspapers the other day, the guard rail of an experimental open summer car of the one cable line is described as a novelty, and the fact that the conductor collects fares along the footboard is thought a queer but new proceeding."

Birmingham is surrounded by a network of small suburban towns, with an approximate population of 500,000, thus making a district of a million people. Each municipality is blessed with its own notions on the tramway question. The need for harmonizing these tramway plans is apparent enough, but the accomplishment is difficult. In addition, the people of Birmingham must seek parliamentary authority to municipalize, and to have a bill passed for such purposes is not only expensive in time—sometimes taking years—but in money. In the meantime, the local tramway company is operating antiquated steam cars at a profit. It is controlled by Toronto capitalists, however, and the Canadians have progressive ideas and wish to establish a real street-railway system, profiting themselves by benefiting the city. But they may never gain their ambition, owing to the opposition and conservatism of the municipal officers. American cities are poorly governed; but, after all, we have many things to be thankful for. We have the comforts of life, and live in the present, not in the past.

Canadian Electrical Association.

The tenth annual convention of the Canadian Electrical association was held at the city of Kingston, Ontario, commencing on Wednesday, August 29th, at 10 a. m., and lasting until noon of Friday, the 31st. It had been the intention originally to hold the convention at the city of Ottawa in June, but owing to the fire which devastated a large portion of that city, it became necessary for the executive to decide upon some other place, and, as a result, on the invitation of the mayor and council of the city of Kingston, that place was chosen. Owing to this change in place and date, the attendance of members, although large, was not up to the standard. The president, Mr. A. A. Dion, general superintendent of the Ottawa Electric company, occupied the chair.

After addresses of welcome had been given by Mayor Minnes, Alderman Donnelly and Mr. J. B. Pense, president of the Board of Trade, President Dion delivered the annual address, in which he stated that no city had taken such pains to receive the Electrical association's convention in previous years as Kingston had. He said it was a source of gratification to him that the membership of the association continued to increase, notwithstanding that a considerable number of members dropped out of the association every year, and he submitted for the earnest consideration of the members the advisability of introducing into the constitution a feature of company membership, such as is carried out by the National Electric Light association of the United States, in addition to the individual memberships, which would remain open to those who wished to avail themselves of them. He thought this might be a means of interesting in the work of the association companies which now took no part in it, although all received practical benefit from the labors of the association He stated that the achievements of the legislation committee during the past year had been of incalculable benefit. Through its well-directed efforts the "Conmee bill," in danger of being ruinously amended, was reaffirmed by the Legislature of Ontario, so that this law now bids fair to remain permanently on the statute books of the province. Mr. Dion spoke highly of the work of the committee on papers, referring to the high character of the papers to be read and discussed at the present convention. He said that it was matter for congratulation that the electrical industries of Canada had, during the past year enjoyed a reasonable amount of prosperity, and the year had been marked by extraordinary activity in connection with the development and utilization of waterpowers, the changing from steam to electric motor, the remodeling of electric-light and power stations, the use of electricity in mining, the important extensions and improvements in the telegraph and telephone fields and in many other ways, the pleasing feature of all these undertakings, from an engineering point of view, being the generally scientific design and modern character of the apparatus and work.

The report of the secretary-treasurer showed an increased membership, there being 213 active and 31 associate members. Reports from the following-named committees were received: Statistics, meter inspection, legislation, to confer with Montreal fire underwriters, and the proposed standardization of accounting. The committee on meter inspection reported that it had obtained a concession in the matter of inspection fees, viz., that whenever a meter requires inspection before the expiration of the five years covered by the last regular inspection, it shall be certified by the department for a fee of 50 cents only, instead of the regular fee. This, while it effects a saving to the companies, is also an evidence of the desire of the department to meet the electrical companies half way and make the operation of the act as little irksome as possible.

The city hall (tendered to the association as an exhibition hall) was very prettily and artistically decorated with electrical features. In the center of the hall was a large booth draped with flags and containing a fine exhibit by the Packard Electric company of St. Catharines, Ont., the R. E. T. Pringle company of Montreal and the Hamilton Electric Supply and Construction company of Hamilton, Ont. The display consisted of a working exhibit of type E Scheeffer recording wattmeters, straight-coil type L transformers and upward of 90 varieties of electrical supplies, including a full variety of arc lamps.

The electrical work on the platform was arranged by J. H. Breck of Kingston, Ont. An arch over the steps, built from the floor, contained the word "Welcome," formed of colored electric globes. In the center of the half-circle was a large metal maple leaf, and on the leaf were the letters "C. E. A.," formed of red, white and blue globes. Colored electric lights were also interspersed over the platform. An illuminated fountain, dressed with ferns and plants, occupied the center of the booth.

The papers read at the convention were of a high order. Professor L. A. Herdt, McGill University, Montreal, read a paper on "Conditions Affecting the Wave Form of Alternators;" Mr. F. H. Leonard, Jr., of Montreal, one on "Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Enclosed Arc Lamps;" Mr. A. Gordon Grier, Montreal, "Rotary Converters;" Mr. W. J. Camp, Montreal, "Use of Dynamo and Storage Battery in Telegraph Offices." Owing to the death of his sister in Maryland, Professor R. B. Owens could not be present to read his paper on "Utilizing the Available Central-station Capacity." Probably one of the most important papers read at the convention was that by Mr. F. H. Leonard, Jr., of Montreal, the reading of which elicited a great deal of discussion from many of the prominent members of the association. Professor Herdt, in discussing the paper, asked the following question: "In reference to your saying that power-factor unity with synchronous motor under load is unknown in practice, is this not due simply to the difficulty in obtaining a sufficiently large current in the field, due to the limited range of exciter voltage and safe working current for field coils?"

Mr. Leonard answered by saying he could state that at the end of an experience extending over several years in manufacture and experiments leading up to manufacture of a single-phase, self-starting, synchronous motor, he had concluded, as intimated in his paper, that over-excitation could not be carried too far with a synchronous motor, as, if such a motor is over-excited beyond a certain limit, it begins to make the circuit unstable, and there immediately results a very vigorous pumping and flickering of the lights, which makes the thing utterly impracticable on a commercial system. This, of course, would operate to render decrease and increase of the power factor.

Mr. Gossler, in referring to the statement made by Mr. Leonard in his paper that the preference was altogether in favor of a well-designed induction motor, said that the usefulness of the induction motor was without question, but that the synchronous motor, under certain conditions, when under the control of the station, was one of the most valuable adjuncts to the general supply systems now in use, as is well shown in the Buffalo plant, where the power factor, he understood, was maintained, under commercial conditions, at about 97 per cent., and he did not think there was any claim for the induction motor that it will operate at 97, so that the impression given that the synchronous motor is to be entirely done away with was, he thought, wrong. The discussion on this paper occupied a great portion of the second day.

The social features of the convention consisted of a complimentary searchlight excursion among the Thousand Islands, tendered by the mayor and citizens of Kingston, on Wednesday evening, the annual banquet, which was a brilliant affair, at the Hotel Frontenac, on Thursday evening, and a grand spectacular band concert by the famous Fourteenth Regimental band, introducing an electrical musical fantasy of the Battle of Paardeburg, South Africa, with electrical effects and fireworks, on Friday evening. On Thursday afternoon an early adjournment was taken and the members enjoyed an excursion on the steamer New York, passing through the Thousand Islands as far as Alexandria Bay, returning in time for the banquet in the evening. A feature of the excursion was the gathering together of the members by the president in the dining room of the steamer and the reading by Mr. Blair of his valuable paper, on a railway subject, giving several curves showing up the average power during a day, and maximum and minimum requirements for power called for on the Quebec system. Mr. Blair was thoroughly up in his subject, having for some time been connected with the Quebec Railway and Lighting company of Quebec, Que.

On Friday morning the election of officers and members of the executive committee was proceeded with, resulting as follows:

President—A. A. Dion, superintendent Ottawa electric company, Ottawa.

First vice-president—E. E. Cary, manager Packard Electric company, St. Catharines, Ont.

Second vice-president—P. G. Gossler, Royal Electric company, Montreal.

Secretary-treasurer—C. H. Mortimer, Electrical News, Toronto.

Executive committee—Messrs. A. B. Smith, O. Higman, D. R. Street, J. J. Wright, B. F. Reesor, F. W. Simmons, W. H. Browne, J. W. Camp, John Yule and Edward Slade.

This ended the business of the convention, and the members adjourned, to meet at Ottawa, in 1901.

Controller Suit in Boston.

(Special dispatch to the Western Electrician.)

Boston, September 4.—The Boston Elevated Railway company has filed its answer to suits brought against it in the United States Circuit Court by the General Electric company and Thomson-Houston company, which alleged infringement on electric controllers to be used on the elevated system. The answer denies the validity of the patents claimed by the General Electric company, asserts that the patents named were used only in a series of experiments conducted on its lines by the General Electric company, the Thomson-Houston company and the Sprague Electric company, in conjunction, and that the inventions were then removed and have not since been replaced by the elevated company, and, further, that it has been decided to use other appliances in place of those on which an infringement is claimed. B.

Bids will be received by a committee of the council of Fredericksburg, Va., until September 18th, for the building and equipping of an electric-light plant for 80 arc lamps of 2,000 candlepower each.

American and British Engineers' Meeting in Paris.

The joint conference of the British Institution of Electrical Engineers and the American Institute of Electrical Engineers was held in the American Pavilion at the Paris Exposition on Thursday, August 16th. The meeting was presided over by Professor John Perry, F. R. S., president of the Institution of Electrical Engineers, and by Carl Hering, president of the American Institute. About 100 gentlemen were in attendance, including representatives from the United States, Great Britain, France and Japan. Although President Hering opened the meeting, the affairs of the session were conducted by Professor Perry.

Professor E. Mascart of France addressed the meeting and thanked the British Institution for the honor it had conferred upon him in electing him vice-president. He hoped that the joint meeting would be the forerunner of other meetings of this kind, which would include the electrical engineering societies of all the leading countries.

The subject for discussion, "The Relative Advantages of Alternate and Continuous Current for a General Supply of Electricity, Especially with Regard to Interference with Other Interests," was opened by S. Z. de Ferranti of London. He spoke about the old contention between alternating and continuous currents, and mentioned how things had changed, and that there were great merits and particular uses for both systems. He called attention to the immense amount of underground material that could be damaged by transmitting large quantities of direct current, and intimated that alternating current would produce far less detrimental effects.

B. J. Arnold of Chicago, who spoke next, briefly outlined the practices obtaining in the United States. He stated that direct current was holding its own in the large cities in this country, but he thought that the alternating current would be more generally used in the small towns and in the large cities for outlying work. He spoke of the combined alternating-direct system for railways, and thought that this arrangement would be modified when the alternating current would predominate and the sub-station would be suppressed.

Sir W. H. Preece called attention to the disturbance of alternating currents on telephones and block-signal systems, and spoke of the necessity of standardizing the frequency of alternating currents. Others taking part in the discussion, which was long, and developed many interesting and valuable points, were Dr. A. E. Kennelly of Philadelphia, Prof. W. E. Ayrton of London, M. Corda of Paris, Prof. F. B. Crocker of New York, W. M. Mordey of England, C. O. Mailloux of New York, Prof. silvanus P. Thomson of London and H. Ward Leonard of New York. The discussion was closed by Professor Perry.

Brief descriptions of the principal and more interesting exhibits to be seen at the exposition were then given by E. Hospitalier, General C. E. Webber, J. Gavey and Carl Hering. A vote of thanks was given to the American commissioners for the use of the American Pavilion.

The afternoon was given up to visits to the exposition, the members being divided into groups and conducted over the Palace of Electricity by Mr. Hospitalier and others. The members also visited the moving platform and the electric railway on the exposition grounds, and also the transforming station of the Société Industrielle de l'Electricité procédés Westinghouse, and other points of interest.

Changes in Personnel at Niagara.

Mr. L. B. Stillwell has resigned as electrical director of the Niagara Falls Power company, and Mr. Harold Winthrop Buck has been appointed to the position.

Those who recall Mr. Stillwell's extended connection with the Niagara power development will look upon this change with some surprise. Ever since the Niagara development was projected Mr. Stillwell has had to do with the plans. While electrical engineer and assistant manager of the Westinghouse Electric and Manufacturing company, all the electrical apparatus now in use in the present central station was built by that company under his supervision, and since March, 1897, he has had charge of and has directed the installation as electrical director. It is announced that Mr. Stillwell will go to New York city and there open an office as consulting electrical engineer—a field to which for the last two years he has devoted much of his attention, notably in the equipment of the elevated railways of the Manhattan Railway company, which is now proceeding under his direction.

Mr. Harold Winthrop Buck, the gentleman who succeeds Mr. Sillwell, is a graduate of the Sheffield Scientific School and received his degree as electrical engineer from Columbia University. For the last five years or so he has been in the employment of the General Electric company at Schenectady, N. Y.

Other changes announced by the Niagara Falls Power company are that Assistant Superintendents Paul M. Lincoln and Philip B. Barton have been promoted, the former to be resident electrician and the latter to be superintendent of the operating department.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Work and Prospects in the Philippines.

[Special correspondence of the Western Electrician.]

PART I.

Iloilo, Isle de Panay, P. I., July 13.—One of the principal drawbacks to the development of Manila, Iloilo and several of the larger and more important cities and towns of the islands of the Philippine archipelago, is the lack of means for communication between different points in the islands. There is at present a telephone system working in Manila, and steps have been taken to establish systems in Iloilo and other places, usually the capitals of larger islands, such as Cebu, Negros, Minandoa and Zanboanga. But the telephone system in Manila is defective in its construction and is not adequate to meet the requirements of the increasing business. Its existence only goes to illustrate the success of a telephone line in the Philippines. The Manila system is Spanish, having been introduced by the Spaniards some time ago, since which various improvements have been made to the equipment and methods of use. The company has certainly made rapid strides during the last several months of American occupation, for when the American soldiers first came it was almost an impossibility to secure any benefit from the line. The wires were either in use with no chance to get at the instruments, or the system was broken down and out of service through defects in the tangled system of wire installation. The Spanish wiremen did not make a good piece of work of the system.

It is very singular how these Spaniards erect frail affairs. They seem to build the most excellent churches, convents and bridges, these being of heavy stone, with immense walls and strong masonry which withstand the effects of the climatic influences and the elements for many years. But when it comes to the putting in of a line of wire or some other delicate operation, the Spanish workmen are woefully negligent. The Manila line is always in a tangle, simply because of the frail poles used, the insecure connections made with buildings and the generally defective plan of insulation. The insulators are small and many of them are chipped from rough handling. The wires are all small and too weak for the work intended. And yet this imperfect line of telephones has at each end a busy force of people, established in good offices, with many branch lines, all of which are exceedingly busy the full 24 hours. There is no cessation to the amount of business done over the wires by the business men of Manila and vicinity, the military authorities and the civilians transacting private affairs. One has to wait his turn, and he pays well for the use of the wire.

American System to Be Adopted.

Owing to the great demand for a better and more extensive system of telephone lines, the old Spanish system will soon be superseded by an American and up-to-date service. This news is hailed with much joy among the business men of Manila and vicinity, and it is hoped that the same company will introduce a system in Iloilo and other important capitals of the southern islands of the Philippine group.

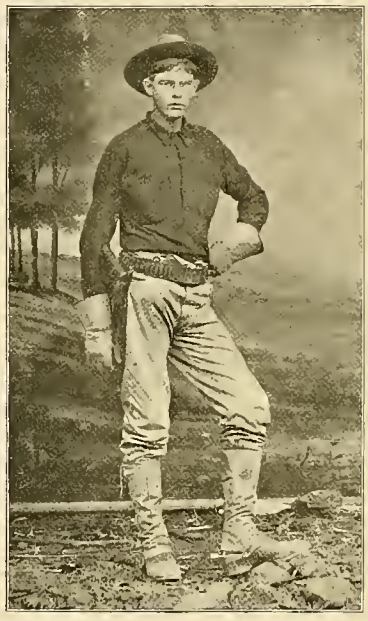
Since the Americans have gained a strong footing in these islands, the business conditions have changed wonderfully. Formerly, if a man wanted to engage in business, he had to consider so many ins and outs of the case that he, ordinarily, gave up the undertaking. Under American rule he is privileged to go ahead with any honest business and build it up without being hampered with duties imposed by anyone. Spain wanted to have a share in every undertaking, and by the time the Spanish officials got through with charging a man his dues for engaging in and carrying on a business of any sort there were no profits left, and the man had to go out of business. Consequently, there was not much improvement made in business enterprises for many years, and the stagnation was felt in every quarter. There was not much need of means of rapid communication between points in those days and couriers, mounted on native ponies, or native runners, did very well for carrying messages from one place to another. But with the advent of American enterprise in the islands, matters took a decided turn for the better, and the conditions of commercial affairs of to-day are such that it is almost as necessary for business men in these islands to have quick communication between points as in America or other industrial countries.

Extent of Mercantile Business a Factor in Rapid Communication.

During the last six months the changes that have been wrought in the business conditions of the Philippines are most remarkable. Your correspondent arrived here about a year ago and accompanied military and other expeditions through nearly all of the southern islands, after first canvassing Luzon. In all of these islands the business men appeared to be slow in their movements, and trade itself was slow. The old caribou drag-sled or bull-cart, which made about four miles a day, was in service for carting freightage from one place to another. The prices on goods were maintained at a high level, and merchants seemed to have everything to their own way of working. But during the last three or four months some important changes have taken place, and the slow methods of transportation have been substituted by faster and better ones. With this change has come a demand for means for communicating rapidly. The whole aspect of affairs has moved in advance. The slower modes of transportation have been changed for quicker ones; stagnant business channels have been opened, goods are turned quicker, and the natural run of events in these islands during the recent months seem to call for the introduction of telephone lines between all important points.

Natives Afraid of the Lines.

The business men of Manila and adjoining cities and towns, where the telephone has been in use for a number of years, are already educated up to the idea of the telephone system, and know how to use it; but in the far southern islands, the people have



TELEPHONE LINEMAN IN THE PHILIPPINES.

never had telephones except such as have been put in by the military Signal Corps men. In many places the natives are afraid of the lines and are likely to do damage to them. The writer accompanied a Signal Corps detachment that put in a telephone line between Leon and Tighauan about two weeks ago, and as fast as the lines were put up, the natives would turn out in force to make an examination. The line itself, the poles and all fittings were left alone, but anything found loose was promptly taken by the natives, who probably supposed that the property was thrown aside and not wanted. For instance, a box of insulators left at the roadside for a little while was taken, also several small coils of wire. Nails, screws and small fittings were picked up everywhere and removed by the Filipinos, some of whom never saw a screw before. But the poles and insulators, once in position, are apparently safe from the average native. Only the rebels of the insurgent army and the ladrones and guerillas make war on the telephone lines, and these men hold the American Signal Corps and line guards in such wholesome respect that they do not dare to approach the lines.

A telephone company planning to put lines of wires and instruments in service in any of the islands of the group need have no concern about the molestation of the system by the natives. The reason is that the lines are feared because the American troops have established so effective a system of guard of the lines and the penalty is so severe to anyone seen about the wires that the natives let the system alone. The penalty for tampering with the poles, wires or fixings of a line is death. Patrols of soldiers are always out in search of offenders, and the aim of the American soldier is good, so that the first thing realized by the native who is trying to cut a piece of wire out of a line is that a bullet is seeking him. He reports the case to other natives, and therefore the lines are shunned. The lines are also shunned by the natives because of the electrical current sometimes developed under certain influences and which currents have shocked some of the natives. The latter have told their story of narrow escape from death, and this serves as an effective warning to others. There is something about the telephone systems and telegraph lines that is beyond the comprehension of the natives, and they keep as far away as possible. Even the insurgents have the same dread, and I have seen them try to cut the communication between American military points by chopping down the poles for half a mile. They will not touch the wires, and as the wires in most of the telephone lines on these islands are made to operate on the ground, the fact that half a mile of poles are down, with the wire uncut, does not break the means of communication.

[*To be concluded.*]

The Telephone as It Is in England.

Mr. James Nelson, writing from the Junior Constitutional Club to the London Times, voices his complaint in the following words: "At 12:45 p. m. I called Newport by telephone, giving number, etc., and, after waiting half an hour, rang up, asking when I might expect to be put through. I continued doing this until a quarter to three, receiving then the same answer as to every previous inquiry: 'We are asking the Postoffice,' but with the addition, 'there are two calls before you.' I then said I did not believe that there could be calls before me, as I had been ringing for two hours, and that I should write to the Times. This announcement had a surprising result, for in two minutes I was through to my friend at Newport."

Mr. W. E. L. Gaine, general manager of the National Telephone company, also had recourse to a letter to the Times. He said: "With reference to the letter which appears in the Times of to-day from Mr. James Nelson, in fairness to the National Telephone company, may I be permitted to say that when messages are sent through the Postoffice trunk wires the responsibility for the delays which take place rests entirely with the Postoffice, and not with the company? Complaints of delays in connection with the trunk wires are received daily from all parts of the country, and are due to the inadequacy in the number of trunk wires to carry the constantly increasing traffic. Unfortunately, the company mostly gets the blame, although it has nothing whatever to do with the matter."

EXTENSIONS AND IMPROVEMENTS.

The Inland Telephone company is building a line between North Yakima and Ellensburg, Wash.

The People's Telephone company, located at Lockport, Ill., has certified to an increase in capital stock from $12,000 to $15,000.

A telephone line is being built to include Lawndale, Polkville, Lattimore and other North Carolina towns with the exchange at Lattimore.

The Mutual Telephone company at Story City, Iowa, has toll-line service with the towns in the southern part of the county, and is about to connect with the towns in the northern part of the county also.

It is stated that capitalists are considering the establishment of a long-distance telephone system connecting Fayetteville, Raleigh, Greensboro and other North Carolina towns and several in South Carolina.

The Citizens' Telephone company of Spartanburg, S. C., has reorganized, with a much larger capital. Steps are being taken to re-equip the plant in the most thorough manner. C. E. Fleming is manager of the company.

The Tidewater Telephone company of Newport News, Va., has just completed its line from Columbus to Gloucester Point, and will begin at once the construction of a line from Gloucester Point to Tappahannock.

The United States Long Distance Telephone company has about completed its line from Columbus by Galloway, Georgesville and Lilly Chapel to London, Ohio, and this will give the company three circuits from London direct with Columbus and to all points in the state. This gives London direct service with over 4,000 subscribers with the new Citizens' Telephone company at Columbus. The lines of the London Telephone company cover almost every part of Madison County, and additions are being made constantly. The London Telephone company is arranging its exchange to handle the large toll business which is increasing every day, and will add a chief operator's toll switchboard, so that all toll business will be handled by one operator, leaving the other four operators free to take care of the local calls and party lines.

Telephone News from the Northwest.

The Citizens' Telephone company of Racine, Wis., has filed articles of incorporation.

The Eastern railway of Minnesota has finally yielded and put in the instruments of the Citizens' Telephone company, at West Superior, Wis., in addition to using the Bell instruments.

Dana Bennett of Chicago succeeds J. C. Sherman as manager of the telephone exchange at Menominee, Mich.

A broken trolley wire in St. Cloud, Minn., burned out 25 wires of the Northwestern Telephone Exchange company recently.

A company has been formed at Mandan, N. D., to establish a local exchange.

A local company to put in a system for Le Roy, Minn., is projected. It will connect with the surrounding farming districts.

A new switchboard is being installed at Spooner, Wis.

The council of Moline, Ill., is exceedingly hostile toward the Central Union Telephone company. A resolution was adopted lately providing for an investigation as to the advisability of repealing the present franchise and of ordering the overhead wires all buried. The resolution declares that the company has promised better service, but instead has grown worse through the installation of an old system.

The Ogden (Iowa) Telephone company is making improvements to its line.

The Carrollton (Iowa) Independent Telephone company has been organized and will build a line 16 miles long.

Owen H. Gray, the superintendent of the Mutual Telephone company of Des Moines, Iowa, says that the introduction of alternating current for electric lighting has practically rendered the telephone systems useless at night.

The Sunset Telegraph and Telephone company has selected a site for its new exchange building in Tacoma, Wash., at Eleventh and E streets.

The Standard Telephone company has bought the Kriebs and Beddow Updegraff line at Elkport, Iowa.

The telephone system just installed at Clarion, Iowa, has been completed and put in operation.

The Greene & Western Telephone company has consented to return its franchise for a local exchange at Mapleton, Minn., to Sellers, Guthier & Laurisch. It now rests with this firm whether a system will be installed or not.

It will take until about October 1st to secure the new switchboard and make the repairs to the exchange at Morris, Minn. The system will be out of use during that time.

The new exchange for Bemidji, Minn., is being installed as rapidly as possible. There are nearly 100 subscribers already secured.

W. J. Power, representing S. J. McGregor and others, has applied to the council of Hibbing, Minn., for a telephone franchise.

The Willow Creek Telephone company has completed a line from Nashville Center, Minn., to Granada, and is building one from Nashville Center to Winnebago City.

A line has been completed between Clearfield and Lenox, Iowa.

An exchange has been completed for Early, Iowa.

The Bishop Telephone company is rebuilding and improving its system at Walker, Iowa.

A movement has been revived at Whatcom, Wash., to secure telephone connection with the mills on the Guide Meridian.

An automatic exchange is projected for Manning, Iowa.

Farmers of Cass Township, near Panora, Iowa, have formed a company to build lines to connect with Panora and Yale.

The Sunset Telephone company has been granted permission by the city of Seattle, Wash., to construct certain underground subways for its new system. R.

Curious Phenomenon at Rochester, Minn.

A peculiar electrical phenomenon was observed during a thunder-shower near Rochester, Minn., recently, says the Minneapolis correspondent of the Western Electrician. A vivid flash of lightning was followed by a sharp report like a pistol shot, and a deafening crash. The stroke shivered a number of telephone poles and several fence poles that supported wires. At the moment of the discharge there appeared a cloud of black smoke about 50 feet in the air, above the telephone wires. It wavered and broke from the action of the wind and the rain. The observers are very sure that the smoke was not the result of the destruction of the telephone poles.

Improvements in Colorado.

The Colorado Telephone company will expend during the present year about half a million dollars in extensions and in constructing new lines. The toll-line service now terminating on the west at Glenwood will be extended to Silverton. A considerable number of new exchanges have already been opened. Considering the vast territory included in the state limits and the comparatively small number of inhabitants, the company is giving an admirable service.

Telephone Business in Chile.

The annual meeting of the Chile Telephone company was held in London on August 10th. The chairman, Mr. George Keith, said that the stockholders met under better circumstances than last year their business in Chile having improved very considerably. The gross revenue for the year had increased $51,442, and the total expenses had been reduced by $10,681. The decrease in the expenses was certainly very satisfactory, more especially as the first half of the year had not been favorable for economical working. Unprecedented storms and inundations which took place in Chile last winter did great damage all over the country. The maintenance of the company's service was made both difficult and expensive. The decrease now shown in the expenses was effected during the second half of the year, and was accompanied by a large increase of revenue. The income in Chile amounted to £18,180, an increase for the year of £4,764. The debenture issue remained unaltered at £56,000, and there was no alteration in the interest payable. The result of the year's business was that, after deducting all expenses and charges, and adding transfer fees, and the amount brought forward, there was a credit balance of £12,347; £4,000 of that had been placed to reserve, and the four per cent. dividend would absorb £8,800, £1,003 being carried forward.

Much uncertainty existed during the year as to whether Chile would issue more paper money and give up the metallic conversion of the currency, the suspension of which was brought about by the monetary crisis of 1898. That had the effect of keeping down the exchange at which the profits of the year were remitted. Toward the end of the year the situation improved, as Chile was adhering to a sound-money policy. The sum of £1,798 had been expended in the erection and equipment of new lines. Some considerable alterations had now become necessary to improve the efficiency of the service at Santiago, which would increase their expenditure for some time to come. Otherwise, the plant was in good order and required no exceptional expenditure. A change had been made during the year in the management at Chile. The former manager resigned, and Mr. Antonio Huneeus, who had acted for the company at Santiago, had since been its adviser. So far as the present year had gone it was showing very good results.

NEW COMPANIES.

The Celestial Mutual Telephone company has asked a franchise in the city of Pekin, Ill.

The Bedford County (Pa.) Telephone company has been incorporated, with $35,000 capital stock.

The Ninety-Six Telephone company of Ninety-Six, S. C., was recently incorporated, by E. M. Lipscomb, A. S. Osborne and R. R. Calhoun.

The Greensboro (N. C.) telephone exchange has been incorporated, for $50,000, by T. J. McAdoo, V. C. McAdoo, C. M. McAdoo and R. M. King.

The Farmland (Ind.) Telephone company has been formed, with $1,000 capital stock, by T. W. Botkin, W. C. West, H. D. Good, J. T. Wright and John Nixon.

The Liter Arcadia Telephone company of Arcadia, Ill., was recently incorporated, with a capital of $1,500, by B. F. Henderson, D. E. Kennedy and L. A. Barr.

The West Jefferson (Ohio) Telephone company was incorporated recently. The incorporators are Carey Millikin, W. E. Postle, W. H. Pence, R. W. Boyd and Calvin Liggett.

The College City Telephone company of Galesburg, Ill., was recently incorporated, with a capital stock of $25,000, by J. L. Hoopes, George A. Lawrence and G. P. Williams.

The F. E. Bell Telephone company of Desplaines, Ill., was recently incorporated, with a capital stock of $10,000, by Frank E. Bell, Edward A. Manuel and William Munn.

The National Telegraph News company of Chicago, with $150,000 capital, has been incorporated, to do a telegraph and telephone business, by L. Martin, F. E. Crawford and W. R. Stewart, Jr.

William Broadhead, S. A. Hayward, A. J. Davis and others have asked franchises for a telephone line from Tremont to Pekin, Ill., and over various streets in Pekin, to connect with the Mutual Telephone company. This would give communication with 40 towns on the McLean County Telephone company's system.

In view of the announcement that the Bell Telephone company will double its rates in Norfolk, Va., several business men in that city are contemplating the organization of a new telephone company. This step is being discussed on the supposition that the Bell company has absorbed the Southern States company and will make a uniform high rate.

The Wisconsin River Telephone company has been incorporated at Stevens Point, Wis., with a capital of $25,000, 500 shares at $50 each. The incorporators are F. L. Dille and John Reton, Stevens Point; A. L. Hutchinson, Weyauwega. The company will be co-operative and operate a local exchange in connection with the Wolf River line.

GENERAL TELEPHONE NEWS.

The Salisbury (Md.) Telephone company has purchased the rights and franchises of the Citizens' Telephone company of Wicomico County.

Charles Gaylord, superintendent of the Independent Telephone company, with headquarters at Salem, Ohio, is said to be missing, and his friends fear that he has met with bodily harm.

The Binghamton (N. Y.) Telephone company has filed a bond for $10,000 with the city clerk guaranteeing that it will perform the work of establishing a telephone system in accordance with the terms of its franchise.

The telephone service between Paris, Frankfort and Berlin was opened to the public last month. The charge for the use of the line for three minutes between Frankfort and Paris is four francs, and between Paris and Berlin, six francs.

The Wicomico Telephone company of Maryland has elected directors as follows: A. J. Benjamin, W. B. Miller, John D. Williams, Salisbury; A. Frank Turner of Nanticoke; John W. P. Insley of Bivalve, and C. Rodney Jones of Quantico.

Clifford Walker, a Ross County constable, was arrested at Chillicothe, Ohio, recently for disorderly conduct, but was permitted to go home after depositing a bond. Two days later he pleaded guilty over the telephone and was fined, over the line, five dollars and the costs.

The directors of the Sea Island Telephone company, recently organized at Charleston, S. C., are F. W. Fowles, Wadmalaw Island; N. H. Blitch, W. C. Geraty and C. M. Gibson of Youngs Island; E. M. Seabrook of Estido Island, and C. Bissell Jenkins of Charleston.

The ordinance of the Harrisburg Telegraph and Telephone company, which has been pending in the Common Council of Harrisburg, Pa., for several months, has been passed by that body. Representative Ward R. Bliss of Delaware County is one of the incorporators of the company.

Telephone communication has just been established between Snow Hill and Berlin, Md. Now the principal towns of Worcester, Wicomico and Somerset are connected, and it is said that the service will soon be in good working order. Snow Hill is also connected with towns in Accomac County, Va.

The Interstate Telephone and Telegraph company, owning exchanges in all cities of North Carolina except one, has signed contracts to connect its system with the Long-distance Telephone company of Virginia. The Interstate company will build about 350 miles of lines in Virginia, giving about 700 miles of Independent long-distance lines in that state.

The telephone evidently finds favor in royal eyes in England, as a telephone has been established between Windsor Castle and Cumberland Lodge, which is situated some distance away in the Windsor Park. In former times it was usual to send a mounted courier with messages from the queen to Prince and Princess Christian, but under the new order of things this messenger has been found to be needless. The telephone had previous to this been installed between Windsor and Buckingham Palace, Marlborough House and the principal government buildings.

The Knickerbocker Telephone and Telegraph company, recently incorporated under the laws of New York, has filed a mortgage for $5,000,000 upon its property. The mortgage was made in favor of the City Trust company and is given to secure an issue of 5,000 gold bonds of $1,000 each, payable in 50 years from September 1, 1900, with interest at five per cent. per annum. The mortgage was executed by William H. Eckert and Arthur Phillips as president and secretary respectively of the Knickerbocker Telephone and Telegraph company. The company, it is said, proposes to start operations at once in Brooklyn. Its purpose is to cut down the present telephone rates to $120 per year for unlimited office service and $60 per year for unlimited private-residence service.

MANUFACTURERS AND DEALERS.

The Couch & Seeley company, 212 Summer street, Boston, Mass., calls attention, on a neat card, to its "97" desk telephone, fitted with C. & S. microphone and bipolar receiver, and adapted for either battery or magneto call.

The National Telephone Equipment company of Detroit, Mich., reports having secured a contract from the People's Home Telephone company of Birmingham, Ala., for the equipment of the following-named exchanges: Birmingham, 4,200 lines; Bessemer, 500 lines; Ensley, 400 lines; Pratt City, 400 lines; Woodlawn, 200 lines, and Avondale, 200 lines. The securing of this contract is particularly gratifying to the National company, as it says that the business was awarded at a figure several thousand dollars higher than the equipment could have been purchased for from some of the company's competitors. The company has also made a contract with the Oakland County (Mich.) Telephone company for the entire apparatus and supplies for the equipment of Oakland County. It is making for the Oakland company now a 300-line switchboard and 600 telephones for Pontiac, Mich. A 100-line exchange at Woodland, Mich., has also been contracted for.

Periodicity in Alternating-current Apparatus.[1]

By James M Andrews.

The subject selected for this paper is one which I trust will prove of some slight interest to those present, especially as the electrical distribution of power by alternating-current apparatus is increasing to a very marked extent. It is somewhat strange to think of the odd way science often reverts to an original plan or scheme after having gone through various changes and modifications. For instance, the earliest example we have of an engine of war using gunpowder is a breech-loading cannon. This was discarded for the muzzle-loading type, and it is only comparatively recently that the original form was again taken up. I do not claim that the same will hold entirely true of electricity, but the first electric generators were alternating, and these were laid aside for the really more complex direct-current types. Owing to increased knowledge of the correct way of interpreting Ohm's law to make it apply to alternating currents, we are to-day constantly increasing the proportion of alternating-current apparatus manufactured as against that for direct current. I do not think that direct-current machinery will ever be entirely superseded by alternating-current apparatus, but I do think that the direct-current field of usefulness will be more and more encroached upon and circumscribed as time goes on.

There are but few cases to-day where the alternating system cannot be used with equal satisfaction, or even preferably, to the direct, the principal use of the latter being where variable speeds and heavy starting torques are required, such as railway service, hoists, cranes, etc. One of the principal uses of direct current, and where the alternating system cannot be conveniently used, is where the load is so very fluctuating that the use of storage batteries becomes necessary or desirable.

In cases where the alternating system of distribution is applicable or desirable, the choice of frequency or periodicity becomes a matter of great importance, and this can only be decided after all the conditions of the problem are thoroughly understood. In this country we are fortunate in having but few standard periodicities, but abroad there seems to be no recognized standard, every conceivable frequency being used.

All alternating-current apparatus, whether single or polyphase, can be classed under the two heads of high or low frequency, but it is with low-frequency machinery we have most to do. All periodicities of 100 or more cycles per second are termed high; all below that, low. The only standard high frequency that we shall touch upon is 125 cycles, although in certain old plants the periodicity is much higher. The lowest frequency to be referred to will be 25 cycles, though there are plants to-day operating at a much lower periodicity. An instance of this is a railway system in Italy, which is built for 15 cycles. This road is about 60 miles long and the current is supplied to the car at a potential of 3,000 volts.

It is doubtful if alternating motors will be employed in street-railway work in this country for some time to come, since the expense of the apparatus is far greater than the direct, and there is at present no necessity of departing from our standards.

In order to present this matter as clearly as possible, and to cover all probable conditions which may arise, I shall take each periodicity separately and discuss its value as regards transformers, line losses, induction motors, synchronous motors, rotary converters, incandescent lamps, arc lamps, parallel operation and the different systems.

125 Cycles.

The principal field for systems operating at this frequency is in small distributions of scattered load, and where individual customers or groups of customers are supplied over their own primary lines, or, in other words, where the secondary networks, if any at all, are of relatively small importance. This frequency is used almost entirely for lighting alone, although a small percentage of motor load can be carried without trouble. The generators operating at this frequency are usually of small capacity, rarely exceeding 200 kilowatts, and, due to their necessarily high speed, they are usually of the belt-driven type or directly connected to high-speed waterwheels.

Transformers.—It may be stated, as a general rule, that the higher the frequency the smaller can a transformer be made, or, in other words, for transformers of the same size, a high-frequency transformer can be made with better efficiency than a low-frequency one.

Line Losses.—As stated before, the principal field of the 125-cycle system lies chiefly in distributions where the load is scattered and where there is but little or no secondary distribution. This being the case, the effect of the relatively large reactance in 125-cycle wiring is not very objectionable, and, in fact, it can often be disregarded, whereas, in an extensive secondary network, using large conductors, a considerable increase in line drop takes place, and, therefore, for a given loss, the amount of copper has to be increased. For example, No. 0 wire has 0.114 ohm reactance per thousand feet at 60 cycles, and 0.24 ohm at 125 cycles, with a resistance of but 0.1 ohm, showing that reactance is more than twice as large as the resistance, and, therefore, the effect decidedly noticeable. These figures on the reactance are based on the assumption that the wires are placed 18 inches apart. Such a size of wire, however, would probably never be used in a primary line, but something smaller, say, No. 4 B. & S., which has about the same reactance as resistance. With the larger wire and cross-section of copper, the drop in voltage in the line is 45 per cent. greater in the 125-cycle installation than the 60-cycle installation, practically independent of the power factor of the load, whereas, with the smaller wire, it is but 20 per cent. more, depending upon the power factor.

To compensate for the increased amount of copper necessary for the same drop in voltage, it is to be remembered that the size of transformers, motors and condensers, and, in general, the load on the system, is smaller than at the lower frequency, so that it will sometimes be found commercially advantageous to use the higher frequency, notwithstanding the increased line drop and expense in line copper.

Induction Motors.—Induction motors operated on high-frequency circuits usually run at higher speeds than those of lower frequency. This is more marked with single-phase induction motors, which type is undoubtedly the most commonly used for 125-cycle installations. The constants of these high-frequency single-phase motors are very good, if built of the definite or polar-wound armature type and used in connection with condensers. These motors can also be built of the squirrel-cage type and started with, say, one-third full-load torque, even with a comparatively moderate amount of current and condenser capacity. By using the most favorable portion of condensers, the power factor of these motors is as high, or, indeed, higher, than that obtained in any other type of motors, approaching 100 per cent. at almost all loads. The efficiency, however, is necessarily somewhat lower, with the result that the apparent efficiency, or the ratio of the watts output to the volt-ampere input is the same, or lower than with the corresponding three-phase type of motor. In general, it may be stated that, due to the necessary complications, such as condensers and compensators and the attendant chances for trouble, single-phase motors are not to be recommended or used where the polyphase type of motor can be employed.

Synchronous Motors.—This type of motor is more satisfactory when supplied with power from turbine-driven or belt-driven generators. As a rule, it is not advisable to install any high-frequency synchronous motors, as there is a tendency to "hunt," and since high-frequency systems are primarily lighting systems, any motors which take or tend to take a pulsating current under certain conditions of load must be very objectionable.

Rotary Converters.—The above discussion applies also to rotary converters, but it should be stated, in addition, that it is very difficult to build a converter to be used on circuits of this frequency, on account of the necessarily high commutator speed and the short neutral incident to the great number of poles. Small units can, however, be made, but they can hardly be considered commercial at the present time.

Arc Lamps.—The power factor of arc lamps decreases as the periodicity increases, but the change is so slight as to be negligible and the lamps are perfectly satisfactory at this frequency.

Incandescent Lamps.—Incandescent lamps have been used for so many years on high-frequency systems that there is no necessity of stating that their operation is perfectly satisfactory. The higher the frequency, the more uniform is the light obtained, and the pulsating brilliancy, which is noticeable on some low-frequency circuits, cannot be detected on 125-cycle circuits.

Parallel Operation.—In the case of generators operating from independent engines and running from belts, or directly connected to high-speed turbines, it may be stated that they will operate very satisfactorily in multiple, but at present it seems improbable to obtain reciprocating steam engines which will regulate closely enough to insure satisfactory parallel operation of direct-connected, slow-speed, high-frequency alternators.

Systems.—Due to the reasons given above, this frequency is almost entirely chosen in single-phase distributions, although two-phase, three-phase and monocyclic systems of periodicity have been brought into commercial use.

In general, it may be stated that the only reason why plants of this frequency should be purchased is the fact that, originally, only 125-cycle apparatus was manufactured, and as it will not always pay to throw out a plant already installed, the additions and enlargements will be of the same frequency.

60 Cycles.

This frequency is particularly suited for power transmission where the chief load is lighting, and the lighting is in defined and dense districts, so that the secondary distribution can be conveniently and commercially installed in such a manner that the cost of the relatively few large-size transformers will not amount to more per kilowatt than the cost of a great many high-frequency transformers in a system with scattered load. This system is also very suitable for induction-motor work and fairly good for synchronous motors and rotary converters.

Transformers.—What has already been said with reference to 125-cycle transformers applies also to those for this periodicity; that is to say, that for the same losses, the transformers are somewhat larger for this frequency.

Line Losses.—In smaller wires the line drop is about 15 per cent. greater than the "CR" loss, but with larger wires, such as No. 00, assuming 18 inches between them, the drop would be about 40 per cent. greater, depending upon the power factor. This shows that in laying out the secondary network every effort should be made to use the smallest wires possible, and that when large wires are necessary, they should be placed as close together as can safely be done, when the effect of reactance becomes negligible.

Induction Motors.—These are usually of the multiphase type and should, therefore, be compared with other low-frequency motors. As built to-day, the speeds of 60-cycle motors are approximately the same as those for 40 cycles, even in the smaller sizes, but the power factor, however, is somewhat lower. The maximum output of the 60-cycle motor is approximately 15 per cent. less than with 40-cycle motors, although large enough, averaging more than double-rated output.

Synchronous Motors.—On circuits of very uniform frequency, and particularly in systems using turbine-driven or belted generators, 60-cycle synchronous motors, as a rule, operate very satisfactorily. Considering, however, that any sudden fluctuation in load is liable to cause a large flow of current and somewhat unstable operation, particularly when the synchronous motor is fed over a line of high resistance, they are not so well suited on most 60-cycle systems which have considerable lighting load.

Rotary Converters.—Although a great many 60-cycle rotaries have been installed during the last few years, it seems to be conceded that they are not as successful as those of lower frequencies. Their commutator speed is high, the width of segments a minimum, and the distance between brushes short, all of which features are undesirable. If they are to operate on lighting systems where any pulsation in current caused by even a slight hunting is objectionable, it is readily seen that they cannot be recommended, except in cases where all the conditions are extremely favorable.

Incandescent Lamps.—Incandescent lighting, as far as light is concerned, is undoubtedly satisfactory, and the most scrutinizing investigation can hardly detect any difference between 60-cycle and 125-cycle lamps.

Arc Lamps.—Due to the higher power factor of 60-cycle lamps, they are preferable to 125-cycle. Theoretically, however, as stated before, the difference is immaterial.

Parallel Operation.—All turbine or belt-driven generators operate in parallel without any difficulty. With direct-connected, slow-speed units, however, difficulties will arise, provided the engines are not built with the very closest speed control and favorable governing mechanism.

Systems.—All systems are now used with this frequency. Indeed, this is the only standard frequency which is used as often for single-phase as for two or three-phase installations.

40 Cycles.

In very many places, and particularly in industrial districts, the greater percentage of power is used for motors, yet lighting is desired and must be accomplished with the least amount of complication. Under such conditions 40-cycle systems are preferable to all others.

Transformers.—Assuming the same electrical constants, 40-cycle transformers of moderate capacity are somewhat larger than 60-cycle transformers and smaller than 25-cycle transformers.

Line Losses.—With average size of wires and the usual distance between them, the drop is but five or 10 per cent. higher than the ohmic loss, but with the larger sizes, for instance, No. 00 B. & S., it amounts to as high as 25 to 30 per cent. more than the ohmic loss under the same conditions. In this connection, however, it must be remembered that self-induction is often not only not objectionable, but advantageous. This is the case in rotary converter and synchronous-motor installations where potential control is desired.

Induction Motors.—As may be already anticipated from the discussion of induction motors for 60 cycles, we would judge that the 40-cycle motors should be somewhat heavier than 60-cycle motors, with the advantage of one or two per cent. higher power factor at full load. The maximum output is about 2½ times the rated output.

Synchronous Motors.—Although synchronous motors for 40 cycles are not quite as stable as those built for the lower frequency, 25-cycle system, no difficulty should be anticipated, particularly if the generators are turbine or belt-driven, and even with power supplied from direct-connected, slow-speed engines, very little, if any, difficulty whatever need be expected. This is the more so when several induction motors are installed on the same system, when the effect of the lagging current caused by induction motors neutralizes the leading current caused by the synchronous motor.

Rotary Converters.—Converters of this frequency combine the advantages of the 25-cycle machines without the disadvantages of the 60-cycle rotaries. In other words, they are rated at a moderate speed, can be operated on circuit having considerable losses, but need somewhat more attention than slow-speed, direct-current machines, but much less than higher-frequency rotaries. On circuits of high

1. Paper read before the Ohio Electric Light association at Toledo, August 15, 1900.

losses, and, in general, on circuits where the power of the generating apparatus is not large, compared with the power of the rotary converters, the lower frequency is preferable.

Incandescent Lamps.—Incandescent lighting, at least on circuits of moderate voltage, requiring lamps with large filaments, is quite satisfactory with 40 cycles. With very high-voltage lamps, however, some flickering may possibly be noticeable, particularly with a fast-moving object in front of the light. For all general work, however, this is not objectionable, and it is only when we get as high as 220 volts that any trouble will be experienced.

Arc Lamps.—Arc lamps, as at present designed, are satisfactory on 40 cycles for outside work, but for interior lighting, it is a matter of personal opinion. Below this frequency, however, the lamps cannot be considered as meeting all requirements, as there is annoyance caused by the flickering, with an object moving at a very moderate speed in front of the lamp.

Parallel Operation.—If care is taken to secure close speed-regulating engines, no difficulties need be anticipated in parallel operation of slow-speed, directly connected units, and this being the case, it is self-evident that belted or turbine-driven generators can be run in multiple without the slightest trouble.

25 Cycles.

Twenty-five-cycle systems are largely recommended in distributions where practically the entire load consists of a power or direct-current load through rotary converters, with the possible exception of a very small alternating-current load, in which case motor-generators or frequency changes are used. Due to the low frequency, even moderately good engines will permit of operating directly connected generators in multiple, and synchronous motors and rotary converters will run satisfactorily without hunting.

Transformers.—Twenty-five-cycle transformers are seldom used in small sizes, but mostly in large units and of the air-blast type. Transformers for this frequency are, for the same electrical constants, about 15 per cent. heavier than for 40 cycles.

Induction Motors—Twenty-five-cycle induction motors are necessarily heavier than those built for 40 or 60 cycles, and have a very high power factor, reaching 94 to 95 per cent. in fair-sized units.

Synchronous Motors.—Twenty-five-cycle synchronous motors have been used and are used to a great extent, and they are perfectly feasible on almost any system. It is, however, always advisable to investigate the generating station before determining to use synchronous motors, for the reason that if the synchronous motor is large, compared with the power of the station, it may be found difficult to maintain constant voltage, due to some slight hunting, which might occur. From belt or turbine-driven generators no trouble should occur, provided the losses between the station and synchronous motor are not too excessive.

Rotary Converters.—This frequency is naturally best adapted for rotary converters, and the converters themselves are built with essentially the same mechanical constants as direct-current generators. The peripheral speed of armature and commutator is as low as is used in many of our direct-current machines, and they require, if anything, less attention than they. One of the greatest advantages, from the operating point of view, of the 25-cycle rotary, compared with the rotaries designed for higher frequency, is that very little care, if any, need be taken in synchronizing. As a rule, the rotaries might be driven up to a fair speed and then their fields opened and the alternating current thrown on and no disturbance on the commutator will take place, and the effect on other rotaries operated on the same system is not serious. Twenty-five-cycle rotaries, being decidedly stable machines, permit of being operated with phase control; that is to say, they can be built with considerable series field and used in connection with reactive coils for maintaining constant potential, or even increase their voltage with the load. This latter feature is rarely possible with 40 or 60-cycle converters.

Incandescent Lamps.—Twenty-five-cycle incandescent lighting can hardly be considered a commercial success, except for street lighting at low voltages with poor economy. Flickering can be noticed even with 52-volt lamps, and this is, of course, more pronounced in lamps of higher voltage.

Arc Lamps.—Arc lighting at this periodicity is out of the question, and there is but little possibility of its ever being accomplised satisfactorily.

Parallel Operation.—Parallel operation of 25-cycle generators, even when running at low speeds and directly connected to engines, has rarely ever involved any difficulty if the engines have reasonably close regulation. In fact, almost any engine seems to be good enough for the purpose, although we naturally prefer to get engines of fair regulation as to rate of rotation per revolution.

Systems.—Twenty-five-cycle installations are usually three-phase, and, of course, always of one of the multiphase systems. It is advantageous to build rotary converters with six-phase connections, but six-phase power can, of course, be supplied directly from two or three-phase systems, by means of transformers.

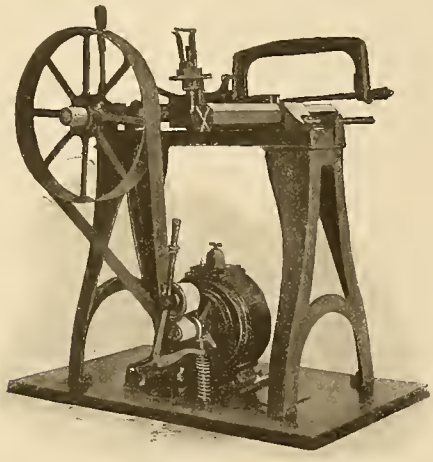
Summary.

It will be seen from the foregoing that a great deal of thought must be given to the work required for a given installation before the proper periodicity can be settled upon, but, in a general way, it may be stated that, for small plants doing lighting alone, with scatterd load, high frequency and single phase would be selected; for general lighting, with a moderate amount of power, 60 cycles, multiphase, and for general power, with a moderate amount of lighting, 40 cycles, and for power alone, using rotary converters, 25 cycles. Of all the frequencies mentioned, the one which seems to be the most universal in its application, where power is required, is 40 cycles.

Emerson Electric Hack Saw.

In many places where metals of any description have to be cut, the electric hack saw shown in the accompanying illustration may be found useful. It is said that no special knowledge or skill is required to operate this machine satisfactorily, and every part has been designed with the object of making the complete outfit simple, reliable and efficient. While this class of machine is particularly useful in iron stores or blacksmith shops, where steam power is not in use, the manufacturer states that it will also be found very convenient in fully equipped machine shops, as the outfit is entirely self-contained and can be used in any location where it is possible to procure electric current for operating the motor.

The outfit illustrated consists of a No. 1 Q. & C. hack saw furnished with an alternating-current induction motor adapted to operate on a 7,200-alternation current. Outfits are also furnished with a larger saw and with motors suitable for any alternating current of usual voltage and frequency and also for direct current of 110 and 220 volts. The hack saw shown is recommended for general use, as it is supplied with both gravity and positive automatic



EMERSON ELECTRIC HACK SAW.

feed, and is claimed to be a thoroughly satisfactory machine for work within its capacity, which includes the cutting of metal up to four-inch squares.

The direct-current motors furnished are of the highest quality of workmanship. They are furnished with a suitable starting rheostat. Each outfit is supplied with the number of saw blades regularly furnished with these saws, extra blades being procurable from the Q. & C. company or its agents. These outfits are supplied by the Emerson Electric Manufacturing company of St. Louis.

American Street Railway Association.

In a circular issued by Secretary Penington it is stated that, at the forthcoming annual meeting of the American Street Railway association, to be held at Convention Hall in Kansas City, on October 16th to 19th, inclusive, papers will be read on the following-named subjects:

"Double-truck Cars; How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions."

"Comparisons of the Various Systems of Electrical Distribution for Street Railways."

"Consolidation of Street Railways and Its Effect Upon the Public."

"The Store Room and Store-room Accounts."

"Painting, Repainting and Maintenance of Car Bodies."

The association expects to have a large exhibition of street-railway supplies. Friday, October 19th, has been set apart as a day for the examination of the exhibits. No session of the association will be held, so that all may have plenty of time to view the display. It is earnestly requested that managers have their heads of departments present on that day. The annual banquet will be held at the Coates House, on Friday evening, when the officers-elect will be installed. The headquarters of the association will be at the Midland Hotel. Other hotels, in addition to the Coates and Midland, in close proximity to the hall, are the Savoy and the Baltimore. The passenger associations have granted a rate of 1 1-3 fare, on the certificate plan, provided 100 or more tickets are purchased.

Owensboro, Ky., will build an electric-light plant for municipal lighting.

PARIS EXPOSITION NOTES.

The Show a Financial Failure.

The long list of awards in the different sections of the Paris Exposition is proof of the catholicity of the juries, writes the London correspondent of the Western Electrician. The jurors had to examine the displays of 75,531 exhibitors, more than half of whom have received recompenses, the exact number being 42,790. In many cases the juries' decisions are admirable. The unfortunate financial failure of the exhibition is cause for genuine regret. France has strained every nerve to make the exposition worthy of the splendid traditions of an artistic nation. Every grace that art could devise has been displayed; the imaginations of genius have been materialized. Outwardly a notable success has been achieved. Every visitor to Paris is loud in admiration of the wondrous beauty of the scene. True, the pavilions internally lack the exquisite finish which the exteriors suggest. This falling off is the first shadow of that financial gloom which now envelopes this national enterprise. The failure of the exhibition will be widely felt all over France.

Decorative Lighting.

The electric-lighting effects at the Paris Exposition have moved the enthusiastic correspondent of the Boston Transcript to the following description:

Suddenly the form of the tower's basal arch stands out in dotted lines of fire against a background of black, precisely as if an iron curtain shutting off a fire had been perforated by a single blow of an invisible die. Another stamp of the die, another and another, and the outline is complete, clean-cut and graceful and perfectly flat; it seems but a pretty little toy till the readjusted eye restores it to its real proportions, and the reason recalls its claims to be something other than a plane surface.

The signal for the illumination thus given, a flaming topaz appears where before was Ponsin's crystal pavilion; a crowd of rubies, emeralds and sapphires, where was the Palace of Algeria; a gigantic yellow bird poising for a dip in a cascade of gold, where were the grim and sprawling Trocadero and its terraced fountain. Flames playing at tag scurry along the two long sides of the Champ de Mars quadrangle, revealing the ornate sky lines of the industrial buildings. Stars, circles, triangles and polygons of light wanton over the colonial exhibition's entire area. At the lower end of the Champ de Mars exquisite, elaborate, incandescent lacework (circles within circles, scrolls within scrolls, arabesques within arabesques) thwarts the sky. Over it hovers a vague, milky phosphorescence, mild and intense at one and the same time like the opal, half-nebula and half-star; star-dust, as it were, in process of becoming a star.

Finally, the blackness beneath the luminous lacework and the straining star-dust glows into a dark red. The red brightens by graduations for which no names exist in the colorist's vocabulary—such quivering chromatic triumphs and succumbings as are seen in molten metal, San Juan pottery, Venetian glass and the dying cuttlefish—into orange, the orange pales into yellow, and the yellow saddens away into blue.

No painter has ever attained the subtle, penetrating and shifting charm of the mobile, hesitating hazes and halos which accompany these color transitions, though Bernard and Gaston Latouche, of living men, have cleverly hinted at them in certain of their works.

Largest Direct-current Dynamo.

The great dynamo, built by Siemens Brothers of London, excites much interest, as it is probably the largest direct-current dynamo ever made. It is driven by a 3,000-horsepower engine built by Willans & Robinson of Rugby, England. Some of the power necessary for driving machinery in the buildings on the Champ de Mars is distributed from this large unit. Galloways of Manchester, and Mather & Platt of Salford, England, have together supplied, toward the electric-power supply for the exhibition, another engine-dynamo, capable of generating 800 amperes at 250 volts (direct current), and Robey & Co. of Lincoln also assist in the general supply. Each of these English plants has its own condensing arrangements and is provided with a switchboard, from which connections are carried direct to the main distributing boards in the Palais de l'Electricité.

British Association.

The British association is at present holding its seventieth annual meeting at Bradford, England. Sir William Turner, a famous anatomist, is president of the association. Among the papers on the programme to be read at the meeting are: "Animal Electricity," by Prof. F. Gotch; "Recent Tramway Construction," with special reference to the Demerbe system, by W. H. H. Dawson; "Power Generation; Comparative Cost by the Steam Engine, Water Turbine and Gas Engine," by J. B. C. Kershaw; "The Liverpool and Manchester Electric Railway," by Sir W. H. Preece, F. R. S.; "The Design and Location of Electric Generating Stations," by A. H. Gibbings; "A Maximum Demand Meter," by J. W. Binnie; "The Automobile for Electric Street Traction," by J. G. W. Aldridge.

Electric Power in Bridge Building.

By Orrin E. Dunlap.

The adaptability of electric power is well shown in a work that is now under way on the state reservation at Niagara Falls. Ever since the Niagara free park was taken in hand by the government of New York state, there has been a constant aim to beautify it at all points and to remove all unsightly objects or structures. Furthermore, the endeavor has been to improve the appearance without, even temporarily, if possible, developing unsightly features, or features that might in any particular create annoyance or mar the beauty of the scenery.

For this reason the main power used in operating the pumps and concrete mixers employed to aid in the construction of new concrete arch bridges to connect the mainland with Green Island, and Green Island with Goat Island, is electricity. The power is taken from the wires of the Buffalo and Niagara Falls Electric Light and Power company, and two 7½-horsepower, one 10-horsepower and one 25-horsepower motor are supplied with current. Thus there is no cloud of smoke hovering over the upper rapids at the point where the work is in progress, neither is there any soot filling the air to fall upon the clothing of the tourists that daily congregate at Niagara. Small buildings cover the motors, and the wires running to them are practically unnoticed. Belts transmit the power to the mixers or pumps, and the work proceeds with a smoothness that is remarkable. As soon as the work has progressed to that point where it is possible to run night shifts, arc lamps will be placed, and the scene of operations thus lighted.

Outside of this use of a portion of Niagara's electrical supply, the building of these new bridges has very interesting features for the engineering fraternity. To make their construction possible, the state of New York appropriated $122,000. The contract was awarded to W. H. Keepers & Co. of New York for $102,070. R. S. Buck is consulting engineer. John M. Braly is the engineer of the contracting firm, and has Charles W. Danforth as assistant, while D. D. Waldo represents the state engineering department. C. H. Turver is superintendent for W. H. Keepers & Co.

The new concrete arches are being built to replace an old-time iron bridge, standing on three piers, and a bridge between Green Island and Goat Island, of similar pattern. The length of the bridge between the mainland and Green Island will be 371 feet, which length includes the approaches. This bridge will have three spans. The end spans will be 103½ feet long and the center span 110 feet long. The end spans will have rises of 10 feet and the center span will have a rise of 11½ feet. The length of the piers will be 53 feet six inches and the width 13½ feet. On the up-stream end of each pier there will be a granite nose or ice breaker. The roadway will be 20 feet wide, and on each side of it there will be walks 9½ feet wide.

The smaller bridge of the two will be located between Green Island and Goat Island. It will be 198 feet long and will have three spans. The end spans will be 50½ feet long and the center span will be 55 feet long. The rises of the end spans will be nine feet, while the rise of the center span will be 10 feet. The length of the piers will be 50 feet five inches and the width eight feet. In dimensions and finish the walks and roadway will be identical with those of the bridge between the mainland and Green Island.

The arches are to be stone-faced in all parts, and will make an appearance similar to bridges constructed of stone in a rustic way. This style is quite appropriate to the Niagara locality, and gives a good impression as being appropriate to the general surroundings. In the concrete will be embedded steel ribs having three-foot centers.

Spanning the river, between the mainland and Green Island, a cableway 600 feet in length has been erected. This cableway has towers having a width of 54 feet, and the maximum height of which is 70 feet. A track on top of the towers allows a truck to move back and forth the full width, and as the carrier travels the full length of the structure from the mainland to Green Island, it is possible to deliver material where needed. The material for the bridge between Green Island and Goat Island will be handled by two derricks.

During the time the new concrete arches are building all carriage travel to Goat Island and Green Island is suspended, and even pedestrians are forced to cross from the mainland on temporary bridges. The erection of these temporary bridges was a feat that excited attention. To throw a temporary bridge across the upper rapids of the Niagara was deemed a difficult task, but the work was accomplished easily and skillfully. Cribs, triangular in shape, were built on the old bridge and lowered from that structure into the river at the point where they were to be located. They were held in position by ropes and cables, and were filled with stone. In all there are 17 cribs in the temporary bridge between the mainland and Green Island, and they hold from two to eight cords of stone each. The piers thus placed, a wooden truss bridge was built out from Green Island toward the mainland, from pier to pier, finally spanning the entire distance and making a structure quite safe to cross. This temporary bridge has a width of six feet, and thousands of people have crossed it during the summer. All show a disposition to stand on the bridge and watch the interesting features of the new bridge construction, but watchful officers keep the crowds moving, in order that the safety of the structure be not endangered by a big gathering of curious humanity.

The site of the work is but 600 feet from the brink of the American Fall, right over the upper rapids of the Niagara. The current runs fully 30 or 40 miles an hour, and the water has an average depth of six feet. The maximum depth, however, is over 11 feet. The rapids toss wildly, and should any of the workmen be so unfortunate as to fall into the current and not succeed in catching the lifelines or buoys, he would be swept over the brink of the fall and into eternity in a twinkling. However, great care is exercised. Every known precaution is being taken, and the commissioners of the state reservation are hopeful that the work will be carried to completion without the loss of a human being.

Consolidation Completed in Seattle.

A new franchise has been delivered to the Seattle Electric company of Seattle, Wash., which practically completes the consolidation of the street-railway and electric-lighting business in Seattle. There were originally nine separate street-railway systems, three lighting companies, one steam heat company and a gas company, each doing a certain amount of electric-lighting business. In addition there were two street-railway companies not in operation, making a total of 20 corporations. Of these, says the Boston News Bureau, the Seattle Electric company now owns 14, the ones not controlled being the gas company, three street-railway companies (operated as two systems) and two street-railway companies, not in operation. These were not purchased, because the syndicate believed they would not add to the strength of the company at the price at which they were held.

The properties owned and consolidated are as follows: Seattle Traction company, Union Trunk Line, James Street Construction company, First Avenue Cable Railway company, Grant Street Electric Railway company, Third Street and Suburban Electric Railway company, Madison Street Railway company, West Street and North End Electric Railway company, Green Lake Electric Railway company, North Seattle Cable Railway company, Burke Block Lighting company, the Union Electric company, the Consumers Electric company, and the Seattle Steam, Heat and Power company.

The gross earnings of the consolidated system for 1898 were $747,000, and for 1899 they were $874,000. If the present rate of increase is continued, it is estimated the 1900 earnings will be over $1,000,000. The company will have $3,735,000 first-mortgage bonds, $1,250,000 preferred stock and $5,000,000 common stock, which securities are largely owned in Boston.

Policemen Killed by Electric Shock in St. Louis.

By the crossing of electric-light and police telephone wires in St. Louis on the night of September 3d two patrolmen were instantly killed and 11 others were badly shocked. When the policemen went to their respective patrol boxes in the fourth district of the city to call up their central station they received electric shocks upon taking hold of the telephone instruments. Runners were sent out from the central station on electric cars, on horseback and in wagons to notify all policemen to keep away from the patrol boxes. Responsibility for the disaster had not been placed the next morning nor had the voltage the men received been ascertained.

New German Cable Service.

Direct telegraphic communication between Germany and the United States was opened on August 30th through the new German cable, in conjunction with the Commercial Cable company's system, from New York to Fayal and thence to Emden, Germany. Congratulatory messages were exchanged between Emperor William of Germany and President McKinley.

A charter has been issued at Harrisburg, Pa., to the Philadelphia, Glenside and Willow Grove Railway company, to build a line from Cheltenham to Abingdon Township, Montgomery County, a distance of six miles. The capital of the company is $100,000, and the president is W. T. B. Roberts of Ogontz, Pa.

CORRESPONDENCE.

London Letter.

London, August 21.—Although progress is being made with the work of installing the electric light at St. Paul's Cathedral, several months must elapse before the public will have the opportunity of seeing the interior lit by electricity, for the laying of the large number of wires required is a business which takes a long time in this leisurely metropolis. Although St. Paul's will be the largest ecclesiastical building illuminated by electricity in this country, St. Matthew's, Brixton, claims the distinction of being the first place of worship so lighted in England. The installation there took place in 1882.

Professor Kennedy, who is to act on the boiler committee recently ordered by the House of Commons, was professor of engineering at University College, London, from 1874 to 1889. Though he was apprenticed to marine engineering, he has since 1889 devoted himself chiefly to electrical engineering, and has designed systems for lighting, among other places, Glasgow, Edinburgh, Aberdeen, Belfast and Chester. He is joint engineer of the Waterloo and City railway and electrical engineer to the London County Council.

Electricity is playing a leading part in the construction of the harbor at Dover. The contractors have adopted the use of some ingenious electrical machines, which have been found to expedite the work considerably. Among these machines are electrical mixers employed for making the huge forty-ton blocks used in the deep-sea work. The big harbor is beginning to take the shape it will eventually present.

The members of the Institution of Junior Engineers have just completed their annual tour. Among the many works visited perhaps that of the Newcastle and District Electric Lighting company, which divides with another company the lighting of Newcastle, and which owes much of its capacity to the inventive power of the Hon. C. A. Parsons, president of the company, was the most interesting. It was explained that the works when opened in January last had three Parsons turbo-electric generators of 75 kilowatts' capacity each, and that more recently a 500-kilowatt turbo-alternator had been erected. In fact, had it not been that the Parsons steam turbo-generator occupies so little space, and is so free from vibration that practically no foundation is required for the machinery, the site could not have been utilized for the works. The company has at present turbo-generators representing nearly 1,720 kilowatts in place, and has provision for 3,200 kilowatts.

The reconstruction of the Liverpool tramroads—the change from horse to electric haulage—is being carried on at a rate which, it is claimed, has not been equaled anywhere. The city corporation having decided to adopt the overhead trolley system, an experimental line from St. George's Church to Dingle (about 2½ miles) was opened on November 16, 1898. The experiment proved a great success, and the work of reconstruction commenced. Last year some 30 miles of track was relaid. Up to date 80 miles of track has been reconstructed with overhead installation, and the officers hope to complete the electric-tram system over the whole city this year. At first it was hoped to lay a mile of track a week, but during the last few months the rate of progress has been two miles a week. Powers have been obtained to lay 114 miles of track, but Mr. Bellamy, the general manager, informs me that he doubts whether the whole will be constructed. He says, however, that by the end of this year the corporation will have cars adequate to carry 100,000,000 passengers a year, while by the early summer of next year it will be able to cope with 150,000,000. As to fares, passengers can now travel from two to 2½ miles for two cents. At the end of the year two cents will take a passenger from the pierhead to the old borough boundary and four cents to the extreme bounds of the extended city. It is hoped that in another year a uniform two-cent fare will be established, when passengers will be able to travel nearly 8½ miles for two cents.

Some alarm was caused on the City and South London Electric Railway on Wednesday by an accident which occurred on the motor-car of a train proceeding from Clapham common terminus to the city. The outbreak took place when the train, which was a heavily laden one, was between the Elephant and Castle and Borough stations. The accident appears to have been caused by the failure of one of the motor armatures. The insulation of the wire is supposed to have been defective, thus causing a short-circuit. A flash followed, and a portion of the engine woodwork was set afire, raising a quantity of dense smoke. W. H. B.

New York Notes.

New York, September 1.—Some attention has been excited by a sensational story in the New York Journal to the effect that Mr. Edison "is reported to be almost ready" to make public a new invention "for the generation of electrical power without the use of engines and dynamos." The article is very general and indefinite, but the idea conveyed is that by the application of heat to a combination of metals electricity is produced. This recalls a familiar experiment; but technical men, knowing the character of the newspaper and the probable fact that Mr. Edison had nothing what-

ever to do with the publication of the article, will still believe that the enormous difficulties in the way of solving the problem of "electricity direct from coal" have not been met. It is true, however, that, in common with many others, Mr. Edison has lamented the present uneconomical method of generating electric current and has given considerable attention to the possibility of doing something better. It is unlikely, however, that the New York Journal has given to the world his solution of the problem, if he has one.

The first shipment of structural steel for the rapid-transit subway has arrived and has been laid down at One-hundred-and-thirty-fifth street and Broadway. The steel is intended for section No. 13 which begins at One-hundred-and-thirty-third street and ends at One-hundred-and-eighty-first street, 2.12 miles distant. Only 0.48 mile of this distance is to be of steel construction, while the remainder will be a masonry arch tunnel through rock. Subcontractor Edward Farrell, who is to build the section of the subway under the northwest corner of Central Park and the section immediately north of it in Lenox avenue, began his work in the park Thursday at One-hundred-and-tenth street and Lenox avenue. From that place he will work southwest under the solid rock to Eighth avenue and One-hundred-and-fourth street. Chief Engineer Barclay has planned the work for the park section so that most of it will be out of sight, and the tearing-up process in the park itself will be of short duration and limited to the width of one driveway. The contract for constructing the section of the subway in Park avenue between Thirty-third and Forty-first streets has been awarded to Ira A. Shafer. He has to dig a tunnel through solid rock and under the Metropolitan Street Railway tunnel in Park avenue.

The submarine torpedo boat Holland was given an important night test at the naval torpedo station last night. It was a searchlight test upon a night attack by the Holland, and was also the first time the boat had been exclusively operated by a naval crew. An attempt was made to locate the Holland by means of searchlights from the United States tug Leyden and the torpedo station, but it was impossible to find the boat which was running awash. The Holland approached near enough to the Leyden to fire a torpedo and then turned across the bay and went within a short distance of the flagship New York without detection.

Satisfactory progress is being made in the work of equipping the Second avenue branch of the Manhattan Railway company's system with electricity. To make room for the third rail, which is to convey the electric current, it has been found necessary to replace the old ties with new ones. These project from the track toward the center of the street for a distance of from two to three feet. The amount of work now going on all over the system is said to be greater than was ever done at one time in the history of the company.

The four storage-battery cars now being operated on the Thirty-fourth street crosstown line of the Metropolitan Street Railway company are said to be giving perfect satisfaction, and as fast as more can be secured they will be used to replace the horse cars still in use. The cars are large and of the closed type, room being had for the batteries beneath the seats. The General Electric company furnished the motors and controllers. A complete charging station has been fitted up at the car house in Forty-second street, and the system is expected to satisfactorily supply the needs of crosstown traffic in that section of the city. M. S.

From the Buckeye State.

Columbus, Ohio, August 31.—John W. Keegan, formerly with the supply department of the Hocking Valley railway, has gone to Chicago, where he has accepted a position with the Westinghouse Electric and Manufacturing company.

The Columbus Street Railway company received a shipment of five new motor cars, which are now in the yards ready to unload. They are five feet longer than the longest cars now in service, and are elegantly fitted up. The company expects to put them into service at once.

The Columbus, Buckeye Lake and Newark Traction company has made application to the State Canal Commission for the lease of the berm bank of the canal in the city of Newark for several squares' length.

William S. Spencer has been transferred from the Zanesville office of the Postal Telegraph-cable company to Auburn, Ind., where he has taken charge of the local office. E. R. Collins of Uniontown, Pa., succeeds Mr. Spencer at Zanesville.

Hon. Tom L. Johnson, the Cleveland street-car magnate, has returned from Europe, and will now take the stump for Mr. Bryan.

Samuel L. Nelson of Springfield has commenced an action against the Springfield Railway company. He alleges that, on the 15th day of May, 1900, he commenced an action against the American Railways company, a foreign corporation, organized under the laws of the state of New Jersey, in the sum of $72,750, with interest on $63,250 thereof from August 28, 1899, and on $9,500 from November 15, 1899, for a commission on account of services rendered by him to the American Railways company in negotiating the purchase by it of the capital stock of the People's Railway company of Dayton and of the Springfield Light and Power company of Springfield, Ohio, the services being rendered in pursuance of verbal contracts. He asks the court for a judgment in the sum of $72,500, together with interest and costs.

The commissioners of Muskingum County (Zanesville) have granted the Zanesville, Adamsville and Coshocton Electric Railway company permission to construct its line over the public highways of this county to the Coshocton County line. The franchises have not all been secured yet, but the company does not anticipate any serious trouble on that score. The length of this line is, approximately, 40 miles, all of it through territory untouched by railroads of any sort. Going from Zanesville to Coshocton, it passes through the villages of Sonora, East Greenwood, Adamsville, Otsego, Plainfield and West Lafayette.

The temporary injunction granted by Judge Williams last week against the Columbus, London and Springfield electric railway, on the petition of certain obstructionists, was decided Thursday in favor of the electric company, and the restraining order heretofore allowed was dissolved. The persons who tried to impede the progress of the road have utterly failed in their efforts and it is now thought will offer no further opposition to the road, which is favored by a large percentage of the people. As soon as it was announced that no appeal would be taken to the Circuit Court, work was immediately resumed. The ties and rails will now be put down at once, and the deplorable condition of the streets will soon be a thing of the past.

The Columbus Street Railway company expects soon to extend its line to Arlington, a pretty suburb of this city. The company is now engaged in getting the consents of the property owners, and permission of the Board of Public Works will be asked next week.

City Engineer Griggs has had somewhat of a controversy with the officials of the Columbus, London and Springfield electric road, with reference to the manner of putting down the tracks on the improved streets of this city. An amicable agreement has been reached, by which the company will lay its ties and rails in a solid bed of concrete eight feet wide.

A panic resulted on a street car at Silver Lake, a summer resort near Akron, Thursday night, caused by a fuse burning out and flames bursting up through the car floor. The passengers became frantic and made a rush for the door. Ferdinand Bargetz, Jr., was killed in jumping, having struck his head against a trolley pole. Three ladies were seriously injured in the excitement.

A war is on at Lorain between two street railways, the Cleveland, Elyria and Western and the Sandusky Interurban lines. Some time ago both companies were granted a franchise on Erie avenue in that city. The two companies tried to come to an agreement among themselves as to trackage, but failed. The first-mentioned company was ready to put in a track in the middle of the street, but before it was aware the Sandusky Interurban had a double track laid for about two squares.

Director Crum, of the city law department, is soon to begin an action against the Columbus street railway, to test the validity of a number of franchises which the company claims are perpetual. Director Crum is now in the country, but it is known that he is working on the case. A number of well-informed people are of the opinion that the company could be ousted from some of the streets, on the grounds that its franchises are not valid. O. M. C.

The News in Colorado.

Denver, August 30.—The Lacombe Electric company, which is to build an electric plant which is eventually to be acquired by the city of Denver by annual payments, has already finished considerable pole-line construction. The poles are the best ever used in the city, the largest being 75 feet high and 12 inches in diameter at the top. The company, perhaps because of litigation, is not ready to give out any information regarding its plans, but Mr. Lacombe authorized the statement that the company would be able to start operations this fall. The litigation referred to came in the way of an application for an injunction to prevent the city from carrying out its contract to pay for the lighting of streets and public buildings a certain amount, and finally acquire the entire plant. The action was instituted by Perry L. Hubbard, who sues as a taxpayer, asserting that his property interests will be affected by the city's action. Mr. Hubbard alleges that the municipality has no right to enter into such an agreement, because, as alleged, such a contract is prohibited by the charter, because it would create a debt in excess of the constitutional limit; because, further, it would be a surrender of the right of the city officers to take advantage during the life of the contract of any decrease in the cost of lighting, by reason of the invention of improved machinery, and, because, finally, it would create a monopoly. The answer of the city set forth that the city charter empowers the city to provide for lighting the streets and public grounds, and that the city is not limited as to the time it may contract with a private corporation for public lighting. The case was tried in the District Court, and Judge Le Fevre recently handed down a decision in favor of the city. The plaintiff has appealed to the Court of Appeals, and a decision, in all probability, cannot be expected for a year.

It was announced before the Common Council in Colorado Springs recently that a control of the Colorado Springs Rapid Transit company's railway had been secured by W. S. Stratton and J. R. McKinnie. Mr. Stratton is the millionaire mine owner identified with the famous Independence mine in the Cripple Creek District. The railway connects Colorado Springs, Broadmoor, Colorado City and Manitou. It has given good service, but its equipment and roadbed are somewhat out of date. It is said that the new owners will devote over $200,000 to improvements. New cars will displace those now in use. A considerable part of the line now laid with single track will be double-tracked. A new franchise for the company is now pending in the council extending the present privilege 25 years. It provides that several extensions shall be made. Provisions in regard to commutation tickets and transfers are included in the ordinance.

Work is soon to be begun on a power station to be erected for the city of Loveland, Colo. The plans were drawn by E. Y. Sayer, city electrician of Denver. The contract for the electrical equipment was awarded to Gilbert Weeks & Co. of Denver, who will install General Electric machinery. The Hendrie & Bolthoff company will furnish the steam equipment. An Ames engine will be used. The street lighting will be furnished by enclosed-arc lights and 32-candlepower lamps, and 800 incandescent lights will be provided for use in private houses.

The plant of the People's Light and Power company at Aspen, Colo., has been purchased by the Roaring Fork Electric Light and Power company. The consideration is said to have been about $40,000.

Word is received from Walsenburg, Colo., that an electric plant, principally for operating ventilating fans, will be installed at the McMillan mines in the Sierra Blanca District.

The Telluride Power Transmission company will build a second electric plant, of 2,000 horsepower, at Telluride, Colo. The company will furnish power for most of the mills for 20 miles around and for several towns.

The Colorado Electric Power company is progressing rapidly with its pole-line construction in Canon City, Colo. The company was granted a franchise about a year ago, but has been prevented from beginning work by injunction proceedings. From the power station of this company in Canon City a considerable proportion of the producing mines in Cripple Creek is now supplied with power. J. W. D.

Northwestern Notations.

Minneapolis, September 1.—The electric-light plant at Kasson, Minn., was burned recently, with a loss of about $2,000. The station will be rebuilt at once, of brick.

The city electric-light line of Blue Earth, Minn., will be rebuilt. New poles will be set and the wires restrung.

It is reported that the Postal Telegraph company will extend its wires from Sioux City, Iowa, to Sioux Falls, S. D. The line will eventually be extended into North Dakota.

M. McCarthy, who was shot by E. G. Holmes in Detroit, Minn., as a result of a quarrel over the installation of a municipal light plant, has sued Holmes for $10,000 damages. Holmes is the manager of the local light plant.

The Oskaloosa Street Railway and Land company has made a proposition to the council of Oskaloosa, Iowa, to construct a street-railway system.

A deal is under negotiation at St. Cloud, Minn., to utilize the Hertig steam-heating and power plant to furnish power for the electric-light plant.

The projected interurban line between Two Rivers and Manitowoc, Wis., is expected to be in operation by next April.

Shawano, Wis., has voted for an electric-light and waterworks plant.

The Twin City Rapid Transit company is negotiating with the postal authorities at Washington, with a view to instituting mail cars on the street-railway lines, similar to the steam-railroad mail cars. It is probable that Minneapolis and St. Paul will have street-railway mail cars in operation soon.

The Hughes Electric company has received electrical equipment for the light plants about to be installed at Bismarck and Dickinson, N. D. Both plants will be set up as rapidly as possible, and will be in operation this fall.

The Britt (Iowa) Light and Power company has filed articles of incorporation, with $12,000 capital stock.

Eastern parties have been looking over the field at Fargo, N. D., with a view to opening a trolley line there.

Several years ago the city of Des Moines, Iowa, voted bonds for the construction of an electric-light plant. The funds were secured, when the courts held that the city could not construct the plant. Ever since the city has been striving for a way to utilize the money thus collected. It is for a specific purpose and cannot be diverted to anything else. It is said it would take the consent of every taxpayer interested to use the money for any other purpose.

The Glass block department store, Minneapolis, has recently enlarged its building. To celebrate the expansion, the windows of the entire structure have been encircled with incandescent globes, which have been illuminated at night. There are over 4,800 lights in use, and the effect is indescribably beautiful.

The Supreme Court of Washington holds the

franchise granted the Seattle Electric company by the city of Seattle, Wash., to be valid. The council granted a franchise and taxpayers sought to prevent its becoming operative on the ground that it was illegal. The company now proposes to make numerous extensions and improvements.

The village of Shakopee, Minn., has rejected all bids for the installation of an electric-light plant.

An electric-light plant is projected for the new town of Selby, near Bowdle, S. D.

The city solicitor of Des Moines, Iowa, holds that the street-railway company has the right to haul brick to the railroads, under certain restrictions. The company's charter allows it to connect with other railroads. The right is limited to one car of freight to each train drawn by a motor, and must be drawn only between 6 p. m. and 6 a. m. Violation of the provisions of the franchise means a penalty of $5 for each offense. The matter was brought up by the Teamsters' union.

The work on the improvements to the street-railway systems of Duluth and Superior will be started very soon. Double-truck cars will be placed on the interurban line between the two cities by May 1st. Tracks will be relaid next season on a number of lines.

Robert R. Macgregor has bought the only remaining interest of an English syndicate in the Yankton (S. D.) General Electric company, and is now the sole owner of the plant. Next season he expects to make extensive improvements in the machinery of the plant.

The City Council of Stillwater, Minn., will insist that the Twin City Rapid Transit company live up to the provisions of its franchise and construct the South Stillwater line. The company asked permission to take up the Wilkin street line, and to defer the South Stillwater line until spring. This the council and citizens generally opposed vigorously. The city attorney was instructed to begin proceedings against the company to require it to live up to the franchise.

Bertha Niesen, widow of the late William Niesen, has brought suit against the street-railway company in Tacoma, Wash., to recover damages to the amount of $20,000 for the death of her husband.

A stripped gear wheel in the plant of the electric-light company at St. Cloud, Minn., resulted in shutting off all the lights in the city. It was Saturday night and the accident caused a good deal of interference with trading. Repairs were made as quickly as possible.

It is understood the Postal Telegraph company will extend its wires from Sioux City, Iowa, to Sioux Falls, S. D., soon. Eventually the line will be continued northward to North Dakota, where it will connect with the line from the Twin Cities.

Work has been begun on the new power station for the street-railway company at Appleton, Wis.

An electric-light plant is projected for Armstrong, Iowa.

A lighting plant is projected at Madison, Wis., to furnish light for the state buildings, including the university buildings, state library, capitol building and insane asylum across the lake at Mendota.

R.

PERSONAL.

Mr. J. A. Dawson, an electrical supply dealer in Montreal, was a visitor in Chicago early in the week.

H. C. Dodge, formerly with the Victor Electric company and the American Electric Telephone company of Chicago, has accepted a position with the Williams-Abbott Electric company of Cleveland.

Mr. W. D. Weaver, editor of the Electrical World and Engineer, was recently married in Germany to Miss Mildred E. Niebuhr of Bremen. Mr. and Mrs. Weaver will return to this country in October.

Paul W. Bossart, who has been connected with the American Electric Telephone company of Chicago for the last five years, has resigned his position to take charge of one of the departments of the Kellogg Switchboard and Supply company of Chicago.

ELECTRIC LIGHTING.

The City Council of Fort Scott, Kan., has decided to erect an electric-light plant.

The municipal electric-lighting plant at Spencer, N. Y., was recently destroyed by fire.

The City Council of River Falls, Wis., has let a contract for the city electric-light plant, to cost $23,000.

The Port Arthur (Texas) electric-light plant was completely destroyed by fire recently, the loss being $12,500.

The Union Light and Heat company of Cincinnati has been incorporated with a capital stock of $200,000.

S. E. Drinkwater of Memphis, Tenn., has received a franchise for the erection of an electric-light plant at Searcy, Ala.

The City Council of Jefferson City, Mo., has rejected all bids for lighting the city and will erect its own electric-light plant.

The City Water company of Shelbyville, Ill., was recently incorporated, with a capital stock of $112,500, by Henry C. Wood, Thomas C. Clark and James S. Handy, for the purpose of operating water and electric-light plants.

Hewitt & Warden have been awarded the contract to install an electric-light plant for lighting the village of Sayville, N. Y.

City Engineer O. W. Pfouts of Alliance, Ohio, is preparing plans and specifications for a new electric-lighting plant for the city.

The Redbud (Ill.) City Council has appropriated $10,000 for the purpose of erecting an electric-light plant, to be owned and operated by the city.

The Franklin (Ind.) Water, Light and Power company will erect a new power house at the new grounds of the company, at a cost of $30,000.

The City Council of Richmond, Ind., has engaged J. Nelson of Indianapolis to prepare plans and specifications for a proposed municipal electric-lighting plant.

The New Process Lighting company of Cleveland, Ohio, was recently incorporated by J. D. Climo, F. R. White and R. A. Wilbur, with $60,000 capital stock.

The Compress company of Hamlet, N. C., it is said, has contracted with the Seaboard air-line railway to secure 40 arc and 700 incandescent lights, thus giving the town a large electric plant.

The Citizens' Electric company of Clinton, Ill., was recently incorporated, with a capital stock of $15,000, to operate electric-light, heat and power plants. The incorporators are E. S. Nixon, Titus Hinchliffe and W. W. Newman.

The Shiawassee Light and Power company of Corunna, Mich., has filed articles of incorporation, with $12,000 capital stock. This company recently purchased the waterpower at Shiawasseetown, which it will improve and enlarge. The company intends to utilize the waterpower to operate its electric plant in Corunna, and also furnish power for similar plants in Vernon, Durand and Bancroft.

Bids will be received by the City Council of Billings, Mont., until October 2d, for the furnishing of 50 or more electric street lights, for a period extending from July 1, 1901, to March 1, 1907, according to specifications, copies of which may be had upon application to City Clerk J. B. Herford. The successful bidder acquires the right, under the city ordinances, to carry on a general electric-lighting business in the city.

Options on the properties of the Youngstown (Ohio) Gas and Electric Light company were closed recently by New York and Chicago capitalists and the transfer will be made about October 1st. The deal involves about $500,000. It is said to be the purpose of the syndicate to acquire also an important lighting plant and a steam-heating plant in Youngstown, besides one or two suburban roads now under construction.

ELECTRIC RAILWAYS.

All the right-of-way between Rockford, Ill., and Beloit, Wis., is said to have been secured by the Beloit and Janesville electric railway.

The Interurban Construction company has been awarded the contract for building an electric line between East St. Louis and Edwardsville, Ill.

J. and R. Higgins, principal promoters of a prospective interurban electric line, to be built between Two Rivers and Manitowoc, Wis., have asked the City Council of Two Rivers for a franchise.

The Northern Ohio Electric company, which is to build an electric railway from Wheeling to Wellsburg, W. Va., has effected a permanent organization, with H. Hazlett as president. The road will be 15 miles long.

After an evening political mass-meeting, held recently in the Twenty-seventh ward of Chicago, a trolley parade was given. There were 45 cars in line and they were gaily decorated with colored lights, flags, etc.

The Fairmont and Clarksburg Electric Railway company is a new company just incorporated, with a capitalization of $100,000, at Parkersburg, W. Va. The company is to build a line from Fairmont to Clarksburg. Ex-Senator J. N. Camden is said to be the largest stockholder of the company.

The first electric-railway system of Santiago de Chile was formally opened on September 2d in the presence of President Errazuriz and the local authorities. It is said that the public was greatly delighted at the outcome and that the installation of similar roads will take place in the near future.

Work has been started on an electric railway connecting Tarentum, New Kensington and Springdale, Pa. The corporation building the new line is known as the Creighton, New Kensington and Springdale Street Railway company, and is composed of J. M. Guffey and other Pittsburg capitalists.

It is stated that the Coffenberry-Bishop syndicate of Cleveland, Ohio, has purchased two electric street-railway lines in Fort Worth, Texas, those of the City Street Railway company and the Fort Worth Street Railway company, for, approximately, $400,000. The syndicate's Fort Worth lines and its lines in Dallas, Texas, will be connected, it is said, by 32 miles of road, to be built between the two cities, at a cost of $1,000,000.

A charter has been granted to the Philadelphia, Glenside and Willow Grove Railway company of Philadelphia to build an electric railway from Cheltenham to Abington Township, Montgomery County, a distance of six miles. The capital stock of the company is $100,000, and the president is W. T. B. Roberts of Ogontz, Pa.

The Chicago Union Traction company has filed an answer to the mandamus petition of the city to compel the lowering of the tunnels under the Chicago River. The traction company declares that the opening of the drainage channel has lowered the level of the river three feet and that the company is in nowise responsible for the resulting damage to the river traffic. The answer contains a specific denial of the city's right to compel the company to do the work. The matter is to be settled in the courts.

Two new electric street-railway mail routes have been established on the North and Northwest Sides of Chicago. They will be a great advantage to those districts and also to Evanston. Five cars have been built especially for this service. Two will replace cars on the Milwaukee avenue cable line and will run to Logan Square, while the other three replace the North Clark street cable cars, and will serve the suburbs of Buena Park, Sheridan Park, Argyle, Ravenswood, Edgewater, Rogers Park, Calvary, South Evanston and the City of Evanston. Fourteen trips a day will be made between Chicago and Rogers Park and three to Evanston.

City Engineer W. W. Reed of Fond du Lac, Wis., with a crew of about eight assistants, has begun the survey of a new electric railway. The road is to be extended from Menasha to Fond du Lac, along the east shore of Lake Winnebago, a distance of 45 miles. The company, which is formed of eastern capitalists, is known as the East Shore Electric Railway and Light company. The line will extend from the city of Menasha, through Harrison, High Cliff, Stockbridge, Brothertown, Calumet, Winnebago Park, town of Fond du Lac to Fond du Lac. A branch road will also be constructed from Brothertown over the Stony Brook road. The line will cost about $750,000.

AUTOMOBILES.

The Chicago Tribune has heard rumors that one of the political parties is considering the plan of chartering a number of large automobiles and sending them out through the country as movable headquarters for political orators. With automobiles in use, it is argued that it would be possible to hold meetings at villages off the railroad, while at the same time the automobile itself would attract a large crowd of persons who might come to satisfy their curiosity and remain to be converted.

PUBLICATIONS.

The Falcon Electric Manufacturing company, 432 East Seventy-first street, New York, has issued a September bulletin descriptive of the Falcon direct-current arc lamps for 100 to 125-volt circuits.

A little folder published by Benjamin F. Kelley & Son, 91 Liberty street, New York, dwells upon the merits and operation of the Kelley patent improved Berryman water-tube feed-water heater and purifier.

Lundell electric motors for blowing pipe and reed organs form the subject-matter of an August bulletin issued by the Sprague Electric company of New York. Illustrations and dimensional diagrams of the motors and reduction gearing are given, as well as a wiring diagram and descriptive matter.

The General Electric company of Schenectady, N. Y., has recently published a useful pamphlet on "Transformer Testing for Central-station Managers." As an introduction to the work is given a short description of the company's type H transformers, with illustrations of the different parts and sections. The subject of transformer testing is then taken up and mention is made of the apparatus and instruments required for the tests. To determine the characteristics of a transformer, six tests are enumerated, as follows: Insulation test, measurement of core loss and exciting current, measurement of resistance, measurement of impedance, heat test, and ratio and polarity test. Each of these subjects is gone into quite fully and the text is explained by means of formulæ, curves, diagrams and tables. Regulation and efficiency are also treated at some length. In its entirety this 46-page pamphlet should be of much use to the central-station manager.

One of two recent publications of the Westinghouse Electric and Manufacturing company, Pittsburg, Pa., contains a paper on "Drop in Alternating-current Lines," written by Ralph D. Mershon, and a supplemental description of the Westinghouse type F compensator. Illustrations and diagrams of connections of the compensator are given, while the paper contains a number of diagrams and curves. The second publication referred to is entitled "Electric Power," and contains views of Westinghouse motors applied to stationary service. The illustrations are all full-page views and the installations

selected cover a wide range. Most of the pictures are of the Westinghouse polyphase type C induction motors, the remaining views illustrating direct-current, multipolar motors and direct-current, dust-proof motors. The descriptions are printed in French, English, German and Spanish, and the book is intended for distribution at the Paris Exposition. The typographical and engraving work on the book is of the best, and it is bound in a handsome colored double cover.

In its new fall catalogue, No. 156, the Chicago House Wrecking company has compiled one of the most complete, yet unique, publications ever issued by a mail-order house, and the supplies and materials listed in the 180 pages would seem to fill about every known want. The company recently purchased the boiler outfit formerly used by Armour & Co., and the Hastings (Neb.) electric plant, consisting of dynamos, engines and boilers, all of which are in excellent condition and offered for sale at bargain prices.

SOCIETIES AND SCHOOLS.

At the convention of the American Society of Municipal Improvements, held in Milwaukee last week, Niagara, N. Y., was selected as the place for holding the next annual meeting. The following-named officers were elected: President, Robert E. McMath, St. Louis; first vice-president, Bernard Saunders, Toronto; second vice-president, Edward A. Fisher, Rochester, N. Y.; third vice-president, John A. Mason, New Bedford, Mass.; secretary, D. L. Fulton, Allegheny, Pa.; treasurer, F. J. O'Brien, Oswego, N. Y.

ELECTRICAL SECURITIES.

The directors of the South Side Elevated have declared the regular dividend of three-fourths of one per cent. for the quarter recently ended, payable September 29th to stock of record September 18th, the books opening October 1st.

MISCELLANEOUS.

A mountain of copper is reported to have been recently discovered at Howe Sound, within 30 miles of Vancouver, B. C., by prospectors engaged by H. W. Treat of New York and Sir Charles Tupper of Vancouver. Assays from all over the mountain have been taken, and the ore runs five per cent., it is said.

Included in the electrical equipments of the U. S. S. Kentucky and Kearsarge, which have more complete electrical installations than has been supplied any previous battleships, is the following apparatus: Two 50-horsepower motors installed in each turret for turning the turret; 20-horsepower motors for operating the ammunition hoists to the 13-inch guns and six-horsepower motors to perform the same service for the eight-inch rifles. There are also special electrical motors for elevating the guns, working the rammers and blowing the gases out of the bores of the eight-inch and 13-inch guns. In addition to the plant connected with the turrets, electric power is utilized in the operation of 10 endless-chain, ammunition hoists for the five-inch and six-pounder guns. There are also six electric deck winches, and the four big boat cranes, which project above the superstructure, are also operated by electric motors. The ventilating of the ship is performed by 13 electrically driven ventilating fans.

TRADE NEWS.

The Jeffrey Manufacturing company of Columbus, Ohio, was awarded a gold medal at the Paris Exposition for its line of elevating, conveying and mining machinery.

The Advance Machine company of Chicago, capitalized at $2,500, was recently incorporated, by B. M. Davis, C. C. Travis and J. F. Larson, to manufacture electrical machinery and appliances.

The Star Brass Works of Kalamazoo, Mich., announce that the United States Circuit Court for the Western District of Michigan, in the matter of the General Electric company's suit against them, has modified its order and now permits the Star company to sell trolley harps. The order of the court was made on August 16th.

George S. Crane, formerly of Athens, Ga., has bought an interest in the Gate City Electric Supply and Construction company of Atlanta, Ga., and will hereafter act as general manager for the company. The Gate City company says that it will, in the future, be found even better prepared than in the past to fill all orders for electrical work and supplies.

The Triumph Electric company, Cincinnati, Ohio, is gratified by the receipt of the following unsolicited letter from the J. A. Fay & Eagan company: "We have used five of your 220-volt motors, aggregating 100 horsepower, to operate our exhibits at the Paris Exposition. Up to date we have not expended one cent in repairs of any kind, and our operators give the motors no attention beyond keeping them clean and the bearings supplied with oil. I feel highly gratified with their performance and take pleasure in so advising you."

Announcement has been made that the Chicago, Burlington and Quincy Railroad company's new line between Alliance, Neb., and Brush, Colo., will be formally opened to general traffic on September 15th. The new branch is 149.69 miles long, and is laid with 85-pound steel rails. It will make a short route between Denver and the rich mining districts of South Dakota and Montana. The new line connects with the system's Guernsey extension at Northport, Neb., and practically opens up a new transcontinental railway between Colorado and points in Montana, Washington and the North Pacific coast.

The Cutler-Hammer Manufacturing company of Milwaukee has purchased the plant, patents, good will, etc., of the Iron Clad Resistance company of Westfield, N. J., retaining its entire engineering force. The business of the latter company will hereafter be carried on under the name of the Cutler-Hammer company, and both the Westfield and Milwaukee factories will be operated with increased facilities. "This consolidation," says the Cutler-Hammer company, "giving us, as it does, the best rheostat engineering talent in the country, will enable us to offer to the trade an unequaled line of electric controlling devices, with either the open or enclosed type of resistance. The policy of the company will remain unchanged, and it will always be our aim to please our customers in every possible respect."

BUSINESS.

The Electric Appliance company, Chicago, has been appointed general western agent for a new socket extension tap, and is now engaged in sending out circulars and information regarding the article.

The prices of scholarship in the International Correspondence Schools, Scranton, Pa., will be increased on October 1st. Before that date new students will have the benefit of the lower prices in force at the time of enrolling. Payment may be made in installments, or a discount will be given to students paying in advance.

The Great Western Smelting and Refining company, Chicago, has just completed its new laboratory, and it is said to be a fine acquisition to the company's works. As a direct result of its policy to have its products at all times uniform, the Great Western company reports a trade with electrical concerns on its nickel babbitt that has taxed its capacity to the utmost.

Hugo Reisinger, 11 Broadway, New York, the sole importer of Electra highest-grade Nuremberg carbons, reports that business for the past season has been exceedingly satisfactory. Mr. Reisinger, who just returned from Europe, states that in consequence of the enormously increasing demands for high-grade carbons, the European factory has been again compelled to enlarge its extensive works, which are said to be the largest carbon works in the world, giving now employment to about 1,200 men. In its efforts to maintain the standard quality of its carbon products, the factory has been eminently successful, and it is claimed that the Electra carbons remain unexcelled in quality and efficiency. With the larger facilities, Mr. Reisinger will be able to respond promptly to an expected increase in the demand for Electra carbons for the coming season.

An unprecedented demand for the Noxall annunciator is reported by the Western Electrical Supply company of St. Louis, Mo., which says that its annunciator trade has increased over 200 per cent. since it has been supplying the Noxall, which is said to be an annunciator of high quality and low price. The Western Electrical Supply company, on account of its great increase in floor space, which it has gained in its large new building, just erected under its direct supervision at Seventh and Clark avenue, has taken advantage of the situation and is now carrying in St. Louis stock what it says is one of the largest stocks of annunciators of the highest order in the United States. Among the company's selection are such well-known annunciators as the Ross & Rival. But for popular-priced apparatus the Noxall is in demand.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 28, 1900.

656,635. Electric-motor Suspension. George Gibbs, Philadelphia, Pa. Application filed February 28, 1898.

An electric-car truck is combined with two motors having their field magnets between the axles of the truck and respectively sleeved upon the axles, and a cradle for the motors flexibly supported at its respective ends from extensions of the motors outside the axles.

656,636. Electric-motor Suspension. George Gibbs, Philadelphia, Pa. Application filed May 11, 1900.

A balanced cradle for suspending a pair of axle-mounted car motors is described. It consists of a quadrilateral frame on which the motor bodies normally rest, the frame being connected at the middle of two of its opposite sides to the rear or outer ends of the motors through the medium of springs acting in opposite directions.

656,647. Lamp-shade Holder. Albert E. Kearsley and Henry C. Bowman, Manchester, England. Application filed October 10, 1899.

An electric incandescent lamp holder has studs at opposite points on the outer periphery of the holder with laterally projecting pin, a thimble-like presser over each stud with small slot into which the pin on the stud projects, a spring within each presser and between the closed end of the presser and the end of the stud, and segmental grips of channel formation attached to each presser.

656,650. System of Electrical Distribution. Alexander D. Lunt, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed June 30, 1900.

Combined with a plurality of alternating-current dynamo-electric machines free to adjust their phase relations to each other, is a synchronous receiving machine having a number of phases different from that of any of the first-mentioned machines. (See cut, page 160.)

656,652. Carbon Brush. William A. Markey, Saginaw, Mich., assignor to Emmet T. Bowen. Application filed March 30, 1900.

An electrical conductor is described which is made from porous material, and a conducting medium in the pores of such material, such medium forming zones of varying conductivity.

656,672. Animal-releasing Device. Frank A. Sprenger, Chicago, Ill. Application filed September 30, 1899.

The device comprises a casing having a socket to receive a halter ring, a pivoted hasp confining the ring in the socket, an armature normally attracted by an electric magnet, a spring-controlled trigger moved by the armature to engage the hasp and hold it in locking position, and means for depriving the magnet of current to effect the release of the armature and permit movement of the trigger to release the hasp.

656,680. System of Electrical Distribution. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed June 12, 1899.

Combined with a transformer are an electromagnetic circuit-breaker in the primary circuit for opening the primary lines, and a connection from the transformer to ground including the coils of the circuit-breaker, the connection being closely related to the primary circuit but normally insulated therefrom.

656,681. Circuit-breaker. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed June 12, 1899.

In a system of alternating-current distribution, is the combination of a transformer, the primary circuit of which includes a thermal cut-out and the secondary translating devices, a leakage branch, and magnetic means controlled thereby, to admit an operating current through the cut-out.

656,688. Locking Coat Hook. John C. Backus, Smethport, Pa., assignor of one-half to William H. Hungerford, Smethport, Pa. Application filed June 13, 1899.

The inventor describes the combination with a support for an article, of a locking device therefor, an electric signal, and means operated by the article being supported for controlling the signal.

656,700. Battery Box. Leon W. Pullen, Camden, N. J., assignor to the Pullen Battery and Electrical Manufacturing company of New Jersey. Application filed September 16, 1899.

The invention consists of a box structure having its walls built up of a thin sheet of asbestos completely coated on both sides and impregnated with asphaltum or equivalent insulating and waterproof substance and wrapped upon itself in tubular form, whereby the body of the completed box is several plies in thickness and coated both on inside and outside with an insulating and waterproof compound.

656,703. Telephone System. Frank G. Rugh, Briar Bluff, Ill., assignor of one-fourth to Wilson W. Adams, Atkinson, Ill. Application filed June 28, 1899.

In the telephone system are a normally closed main circuit, a normally open main circuit, and a plurality of stations thereon, in combination with a signal at each station on the normally open circuit, a telephone receiver and an induction coil in a shunt from the normally open circuit at each station, a circuit containing a telephone transmitter passing through the primary winding of each induction coil, a selective mechanism and a circuit-breaker on the normally closed circuit at each station, and a source of electrical energy.

656,716. Fluid-operated Electric Switch. Charles A. Eck, Newark, N. J., assignor to the Autoelectric Air Pump company, New York, N. Y. Application filed February 12, 1900.

In the switch are combined a stationary electrode, with a movable electrode, an arm carrying the movable electrode, loosely pivoted, a tilting weight attached at the same point as the arm, a fluid-actuated mechanism adapted to lift the weight back and forth to effect the movement, on a quick action, of the movable electrode to and from the stationary electrode, and means whereby the arm carrying the movable electrode is locked when acted upon by the tilting weight to assume its open position, and to be released when the tilting weight acts upon the arm to close the circuit.

656,744. Device for Lighting Lamps by Electricity. Svend M. Meyer, New York, N. Y. Application filed March 3, 1898.

In a device for lighting oil lamps by electricity are a wick tube having a plurality of contact points, a chimney gallery capable of concentric rotation around the wick tube, insulated contact point carried by the rotatable chimney gallery and engaging with either of the contact points by the rotation of the chimney gallery, and a suitable source of electricity having its poles connected with the contact points.

656,762. Apparatus for Taking and Reproducing Animated Scenes and Sounds. Auguste Baron, Asnières, France. Application filed October 31, 1898.

In an apparatus for recording or exhibiting simultaneously occurring visible and audible effects, are combined a phonograph with electrical means for driving the same, a kinetographic camera, a current-distributing commutator operated by the kinetographic camera apparatus and circuit connections intervening between the current-distributing commutator and the electrical means for driving the phonograph so as to effect the operation of the phonograph in synchronism with the kinetographic camera.

656,780. Lightning Arrester. William E. Athearn, New York, N. Y. Application filed February 16, 1898.

The arrester comprises a block of non-conducting material having elongated ends bearing connections for the line and fuses, a central portion to which the ground plate and ground connection are secured, and intermediate sections wound with coils of wire that constitute part of the line circuit, and a ground plate secured to the central portion and extending contiguous to the coils to each of the end sections.

656,790. Trolley. Morris T. Schaffer, Bethlehem, Pa., assignor of one-half to Edwin J. Lichtenwalner, Allentown, Pa. Application filed May 4, 1900.

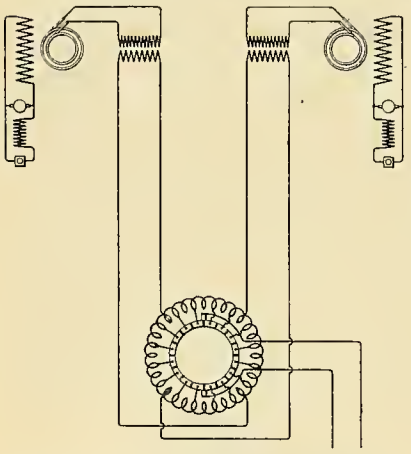
Combined with the base block are a frame pivotally mounted thereon at one end, wheels supported by the frame, and a spring acting on the latter for holding it normally in an inclined position in relation to the base block.

656,796. Signal-receiving Relay. George K. Thompson, Malden, and Ernest C. Robes, Medford, Mass., assignors to the American Bell Telephone company, Boston, Mass. Application filed March 12, 1900.

The relay comprises a vertically mounted electromagnet having laterally projecting pole pieces; a gravity-retracted armature fulcrumed at one end in the lower pole piece, and having its other end extended into the field of the upper pole piece and adapted to swing between limiting stops in the field; a conducting point or stop and a non-conducting stop mounted in juxtaposition to one another on the armature near its fulcrum, the latter being slightly longer than the former, and a spring bearing on the stops alternatively, according as the armature is attracted or retracted, and thereby exerting constant pressure upon the armature, regardless of the position thereof, in opposition to the retracting force and in reinforcement of the attracting force; the spring and conducting stop constituting mutually complementary terminals of a controlled circuit.

656,806. Alternating-current Generator. Charles S. Bradley, Avon, N. Y., assignor to the General Electric company of New York. Application filed June 22, 1896.

An induction generator is described which comprises a power-driven member magnetized by a rotary field and including a condenser in the circuit, and a generating member in inductive relation to the power-driven member (See cut.)



NO 656,650.

electric-lamp globe, and a catch having a socket for engaging the neck of the globe hinged to the frame, whereby the protector may be secured on a globe without connection with the lamp socket or other support.

656,870. Electric Switch. Reinhold H. Wappler, New York, N. Y., assignor to the Wappler Electric Controller company, New York, N. Y. Application filed December 8, 1899.

Combined in the switch are a foundation of insulating material and metal conductors connected thereto and spaced apart, a rotary circuit-closing metal roller having a raised flat surface normally in contact with the surface of one conductor and which, by a partial rotation of the roller, shifts the same surface also into simultaneous contact with the other metal conductor to complete the circuit.

656,882. Charging Stand and Contact for Storage Batteries. George H. Coudict, New York, N. Y., assignor to the Electric Vehicle company, New York, N. Y. Application filed July 18, 1898.

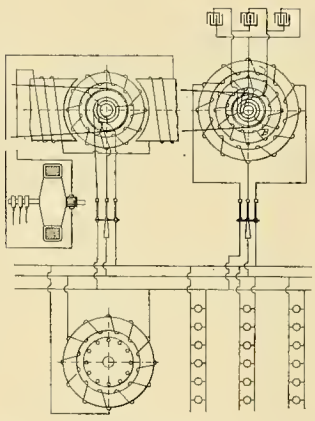
In combination with a storage battery including a tray are contacts therefor, a movable member comprising a contacting portion and a battery-engaging portion, the engaging portion lying in the path of the battery and adapted when engaged by the battery to cause positive engagement of the contacting portion and battery contact.

656,907. Telephone Signaling Appliance for Party Telephone Lines. Josef Steiner and William H. Tuck, New York,, N. Y., assignors to the Western Electric company, Chicago, Ill. Application filed January 8, 1900.

A party-line ringing appliance for telephone switchboards comprises a series of keys or plungers disposed one behind the other in a row, switches operated by the plungers when depressed, a bed plate and a series of shields adapted to slide to and from the bed plate, each plunger passing through one of the shields, and means, operated by each plunger when depressed, for moving the shields apart and causing a gap or opening to be made in the row of shields, to indicate the identity of the plunger which has been depressed.

656,923. Cable Hanger. Clement E. Beard, Columbiana, Ohio. Application filed July 6, 1900.

The hanger comprises two members pivotally connected with each other and having prongs for engaging a cable, and hooks for engaging the hanger support, the hooks being arranged to overlap one another when the hanger is closed. (See cut.)



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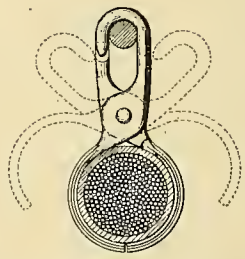


NO. 656,923.

engaging with the arm to close the circuit alternately at opposite sides.

656,977. Electric Lamp for Miners' Use. Leo Horwitz, Berlin, Germany. Application filed February 21, 1899.

The invention comprises two glow lamps, a hand switch, a battery and casing therefor, contacting strips for the battery and casing, and an automatic switching device.

656,982. Electrolytically Treating Scrap Tin. Edward D. Kendall, New York, N. Y. Application filed November 20, 1899.

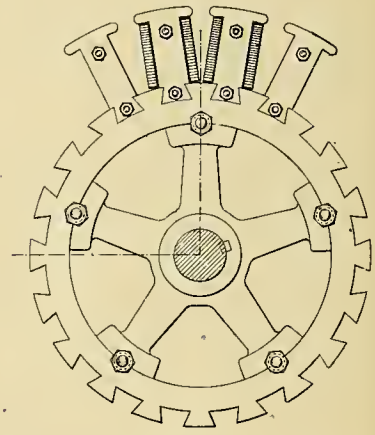
The first claim reads: The improvement in the art of electrolytically dissociating the iron and tin of so-called "scrap tin plate," which consists in the preparation of an electrolyte composed of an aqueous solution of a nitrate of an alkali metal or a nitrate of an alkaline-earth metal, the introduction into the electrolyte of an anode consisting of a mass of scrap tin plate; the electrical connection of the mass with one terminal of a charged electric circuit and the establishment in contact with the electrolyte, of a suitable cathode electrically connected with the other terminal of the charged electric circuit.

656,996. Supervisory Signal for Telephone Switchboards. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed July 25, 1898.

Combined with two telephone lines united by conductors into a continuous circuit and a telephone switch at each station for closing the line during the use of the telephone, the circuit of the united lines being broken at one point, are an electromagnet in a closed circuit together with a source of current in one of the lines, a supervisory signal controlled by the electromagnet, and switch contacts of the magnet closed when the magnet is excited adapted to complete the break in the circuit.

656,997. Signal for Telephone Trunk Lines. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed January 29, 1900.

The inventor describes the combination with a trunk line between A and B offices, a subscriber's line connected with the B terminal of the trunk line, a switch at the substation controlling current in the line and a source of current in the trunk line, of a clearing-out signal at the B terminal of the trunk line, a magnet in a branch from the trunk line controlling the clearing-out signal, and a magnet in series in the trunk line in the path of current controlled at the telephone station also controlling the clearing-out signal, the last-mentioned magnet being adapted to break the branch when excited.



NO. 656,961.

656,808. Lock. Henry G. Carleton, New York, N. Y., assignor to the Carleton Electric company, New York, N. Y. Application filed February 10, 1900.

The lock combines a movable engaging part, a locking member therefor, controlling means for the locking member including a part extending outside the lock casing, means independent of the controlling means for operating the locking member, and an electromagnet for also operating the locking member.

656,821. Means for Controlling Energy Delivered to Electrical Translating Devices. Harry W. Leonard, New York, N. Y. Original application filed January 31, 1896. Divided and this application filed January 13, 1900.

In a system of electrical distribution combined with a main source of supply and a circuit extending therefrom, are two dynamo-electric machines, the armatures and field magnets of which are independently connected in series across the circuit, an intermediate conductor extending from the armature circuit of the machines from a point intermediate the two armatures, a translating device connected in a circuit extending from the intermediate conductor to one of the conductors extending from the source of supply, and a rheostat shunted around the field magnets of the two dynamo-electric machines, by the adjustment of which the strength of each of the field magnets is varied to vary the potential upon the intermediate conductor.

656,828. Telautographic Apparatus. Foster Ritchie, London, England. Application filed January 29 1900.

656,832. Telegraphy. Henry D. Bartholomew, Newark, Ohio. Application filed October 12, 1899.

In a superposed current telegraph are a transmitting coil in the main line having its terminals connected to front and back key contacts, a key co-operating with the contacts and a battery having its poles connected to the key and to an intermediate point of the coil respectively, whereby operation of the key in one direction sends an impulse of a given polarity to line, and operation of the key in the opposite direction sends an impulse of the opposite polarity to line.

656,840. Protector for Electric Lamps. Frank B. Garretson, Worcester, Mass., assignor to himself and William J. Gindele, Worcester, Mass. Application filed March 8, 1900.

The protector comprises a frame having spring wires with bent-in portions for engaging the outer portion of an

656,930. Electric Furnace. Wilhelm Borchers, Aix-la-Chapelle, Germany. Application filed April 12, 1900.

In the furnace are oppositely disposed electrodes, a water jacket on the discharge end of the furnace, and a chisel movably arranged transversely in the wall of the furnace opposite the discharge end of the water jacket.

656,940. Engraving Machine. Charles Chevalier, New York, N. Y. Application filed March 9, 1900.

An apparatus for reproducing patterns is partially operated by an electromagnet.

656,957. Electric Signaling Apparatus. Edward B. Ellicott and Louis E. Oehring, Chicago, Ill., assignors to the Western Electric company, Chicago, Ill. Application filed May 2, 1899.

The apparatus combines a pair of line-circuit terminals having contacts associated therewith, a contact spring extending from one to the other and adapted to make and break electrical connection between them, means for normally maintaining the spring out of engagement with its coacting contact, a pivoted lever upon which the spring is mounted, and a rotating disk having teeth upon its periphery for engaging the lever and causing the same to oscillate, whereby the condition of the circuit is altered at each oscillation of the lever.

656,961. Means for Securing Pole Pieces. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed October 6, 1898.

Combined with a rotatable member adapted to detachably receive independent members, and provided with one or more bolt holes, are a movable ring fitting the rotatable member and also provided with one or more bolt holes offset from the bolt holes of the rotatable member, independent members attached to the rotatable member and to the ring, and tapered bolts adapted to be forced through the bolt holes to move the ring circumferentially and lock it to clamp the independent members rigidly to the rotatable member. (See cut.)

656,972. Electric Motor. Edward A. Henry, Crestline, Kan., assignor to Edward A. Henry and J. Lewis Griswold, Crestline, Kan. Application filed March 21, 1900.

In the invention are a series of electromagnets arranged in the arc of a circle, a pendulum arm, an armature carried by the arm, for coacting with the electromagnets, circuit closers carried by the arm, and a circuit controller for

657,012. Apparatus for Electrolysis. Paul Schoon-Wildegg, Switzerland. Application filed August 17, 1899.

An apparatus for electrolyzing solutions comprises a base of insulating material having a series of long, narrow channels therein through which the solution to be electrolyzed is caused to flow, the channels being arranged parallel to each other and close together, double electrodes each extending from one channel into the next adjacent one and electrical connections with the electrodes at the ends of the apparatus from opposite poles of an electric generator.

657,020. Portable Electric Lamp. Franklin W. Brooks, Washington, D. C. Application filed June 9, 1900.

The lamp embodies a non-conducting battery case provided with an electrical conductor terminated at one end in contact with a metallic band and with its opposite end adapted to contact with one pole of a battery, a ring or band secured around the forward end of the case and formed with interlocking devices, one or more batteries located within the case, and a lamp holder provided with a reflector, lens and lamp, and provided with a switch, and means for interlocking with the devices on the band

657,032. Apparatus for Electrolyzing Ores. Albion M. Rouse, Denver, Colo., assignor of one-half to William G. Shedd and Frank Brooks, Denver, Colo. Application filed November 1, 1899.

The apparatus described has an anode and a cathode suitably arranged therein, combined with a tank having an outer compartment, a tube located within the tank having an open upper end and provided at its lower end with communication from the compartment, a driving shaft projecting within the tube, inner and outer cups carried by the shaft and wings arranged intermediate of the cups.

657,046. Multiple-motor System for Automobiles. John Trier, Chicago, Ill., assignor to Donald Grant. Application filed April 26, 1900.

The system comprises an axle having a traction wheel mounted thereon, a shaft, a plurality of motors carried by the shaft for rotating the same, and gearing connecting the shaft and axle.

DESIGN.

33,131. Battery Cell. David H. Darling, Jr., Rye, N. Y., assignor to the United States Battery company, New York, N. Y. Application filed July 19, 1900. Term of patent, 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, SEPTEMBER 15, 1900. No. 11

Automobiles in Buffalo.

Buffalo has an automobile club, the members of which find much pleasure in getting together with their machines on Sundays and taking a run here and there about the vicinity. The accompanying illustration shows the line starting out on the second run of the season, Dr. Pierce's machine being at the head of the line. It is expected that Buffalo will make great advances in the use of automobiles next year during the Pan-American Exposition season. The city has many places in the surrounding locality to which a run in the horseless carriages will prove a most delightful trip. The picture on the next page shows some of the horseless vehicles in one of Buffalo's parks.

The officers of the Buffalo Automobile Club are: President, Dr. V. Mott Pierce; vice-president, Dr. Truman J. Martin; secretary, George S. Metcalfe; treasurer, Dr. Lee H. Smith; consulting engineer, D. W. Sowers; directors, Charles J. Shepard, J. T. Budd and Charles R. Huntley. The directors and the officers will form the board of governors. About 40 members have been enrolled.

Automobile Race Meet at Newport.

The first race meet of the National Automobile Racing association was held on September 6th at Aqueduct Park in Newport. Nearly 9,000 persons were in attendance, and it was made a social event by the cottagers. The judges were Herman Oelrichs, Melville Bull and Charles F. Robinson. The course was five miles or 10 times around the track. A. L. Riker won the electric-vehicle race in 13 minutes five seconds, although he won a preliminary heat in 10 minutes 44 seconds. A race between motor tricycles was given to A. K. Skinner, while J. H. McDuffee won the race for steam vehicles. In the gasoline-vehicle event William K. Vanderbilt, Jr., won with his French machine, the time being eight minutes 53½ seconds. The most interesting event was the championship race which was won by Mr. Vanderbilt. The entries and time made in this race were as follows: W. K. Vanderbilt, Jr., gasoline, eight minutes 54 seconds; A. K. Skinner, motor tricycle, nine minutes 22 seconds, second; A. L. Riker, electric, 10 minutes 28½ seconds, third; McDuffee, steam, did not finish.

Chicago Automobile Exhibition and Race Meet.

The International Automobile Exhibition and Race Meet which is to be held at the Washington Park Club grounds, Chicago, from September 18th to 22d, promises to be a successful event. The show is to be given under the auspices of the Chicago Inter Ocean, and everything that goes to make up a successful exhibit seems to have been provided. The grounds at the Washington Park Club's driving park are well suited for racing facilities, as there are two tracks, and ample room is provided for exhibition purposes. Brooke's Chicago Marine band has been engaged for the entire five days. The joint passenger associations have granted a rate of 1 1-3 fares on all railroads entering Chicago.

Competent and experienced judges and officers have been selected, so that the different events may be decided impartially. William D. Ray will be the special expert representing the Inter Ocean. The technical judges include the following-named gentlemen: H. M. Brinckerhoff, manager Metropolitan West Side Elevated Railroad company; L. L. Summers; R. H. Pierce; Professor C. V. Kerr, Armour Institute; Professor Henry Crew, Northwestern University; Professor Paul Mellen Chamberlain, Lewis Institute; Professor John E. Sweet, Syracuse, N. Y. The observing judges will be M. M. Kirkman, second vice-president Chicago and Northwestern Railway company; Paul Morton, second vice-president Santa Fe system; Arthur J. Eddy, F. S. Fish and Henry W. Tiernan. Charles T. Yerkes will be chairman of the racing judges, the other judges being Laurence A. Young, president Washington Park Club; Arthur Caton, C. K. G. Billings, William J. Davis, Brode D. Davis and J. Ogden Armour. As starter, Richard J. Dwyer, the well-known starter of the Washington club, has been engaged. Other officials of the meet are as follows: Clerk of course, Hugh Keough; handicapper, Frank Fowler; supervisor of track entries, Lew M. Houseman; weigher-in, Charles D. Graves; purser, Charles Gray.

Among the professional operators expected to compete at the races are C. G. Wridgeway, the champion automobilist of Great Britain; Albert Champion of France and Kennett A. Skinner of Boston. Included in the list of non-professional operators will be William K. Vanderbilt, Jr., who won the recent Newport race, and Captain Albert Bostwick. Alexander Winton of Cleveland will represent the non-professional and manufacturers' class.

The Chicago Automobile Club will have headquarters at the Victoria Hotel, and the entertainment of the visiting clubs will be in charge of Dr. Milton B. Prine, chairman of the reception committee. It is expected that the automobile clubs of Baltimore, Buffalo, Cleveland and New York will attend in bodies.

The official programme of the exhibition and race meet is as follows:

TUESDAY, SEPTEMBER 18TH.

Grand Automobile Parade for Manufacturers—First prize, gold medal, manufacturers, for greatest number of practical designs; second prize, gold medal, manufacturers, for greatest number of automobiles in line; third prize, gold medal, for most practical design.

One-mile Race, Flying Start, Free for All—For steam automobile; first prize, gold medal; second prize, silver medal.

One-mile Race, Flying Start, Free for All—For gasoline automobile; first prize, gold medal; second prize, silver medal.

One-mile Race, Flying Start, Free for All—For electric automobile; first prize, gold medal; second prize, silver medal.

Obstacle Race—Prize of a gold medal for best time in passing through obstacles.

Grand Automobile Parade for Private Owners—Gold medal prize for most elegant turnout; gold medal prize for automobile carrying the greatest number of seated passengers.

Ten-mile Race, Free for All—First prize, gold medal, to winner; second prize, silver medal, to most dexterous operator; third prize, gold medal, to best-appearing vehicle.

Fancy and Trick Driving Contest (open to all types of vehicles)—Gold medal prize for most difficult tests and practical demonstration.

Five-mile Race for Motor Tricycle—First prize, $150 cash; second prize, $50 cash.

WEDNESDAY, SEPTEMBER 19TH.

Manufacturers' Practical Utility Test—Prizes, gold and silver medals.

Heavy Draft Contest for Manufacturers and Merchants—Prizes, gold and silver medals.

Automobile Gun Carriage Demonstration for Government Use (open to all kinds of motive power)—First prize, gold medal; second prize, silver medal.

Mail Race (30 miles)—First prize, gold medal, to manufacturer of mail wagon for best time in finishing and making 40 mail-box collections; second prize, $25 in gold to driver of prize-winning wagon; third prize, gold medal for most practical and best adapted wagon.

Pulling Contest—One prize, gold medal, for best application of motive power of acetylene, alcohol, kerosene, compressed air and liquid air.

Ten-mile Quadricycle Race—First prize, $150 cash; second prize, $50 cash.

Great Automobile Equestrian Race—Being an event in which a running horse, ridden by Fremont Sloan, will compete with an automobile; prize, gold medal.

Pioneer Contest—Prize, silver cup for oldest automobile, steam, gasoline, or electric power, to be exhibited.

AUTOMOBILES IN BUFFALO.—A CLUB MEET.

THURSDAY, SEPTEMBER 20TH.

Grade-climbing Tests—Automobiles will be tested each in its class of motive power for greatest per cent. of grade climbed from still position, greatest per cent. of grade climbed from flying start, and test of speed climbing 15 per cent. grade, 10 minutes' duration. Tests also on declines. Prizes, gold and silver medals.

Fifty-mile Race—For manufacturers using carriages carrying four grown people; prize, silver medal.

Fifty-mile Race—For private owners using carriages carrying two grown people; gold medal.

Five-mile Ladies' Race—Prize, silver cup.

Ten-mile Ladies' Race—Gold medal.

Ladies' Obstacle Race—Silver cup.

Three-mile Merchandise Delivery Race—First prize, $50 in gold; second prize, $25 in gold.

Fifteen-mile Motor-pacing Tandem Races—First prize, $150 cash; second prize, $50 cash.

In the heavy draft contest the following ratio of points will be established for winning values:

	Points.
Construction	20
Best motive power	20
Carrying capacity	20
Design for practical utility	10
Control and manipulation	10
Safety and emergency devices	10
Power per ton per mile	10

(Per ton mile to include weight of passengers as well as tare—cost of electricity, gasoline, or oil to be based on current market rate of products.)

In the mail race each driver will be required to stop at each mail box on his route, unlock the box, take out the contents, lock it, and return to the

AUTOMOBILES IN BUFFALO.—A RUN IN THE PARK.

Automobile Manufacturers' Congress at Wellington Hotel at 8 p. m.—Addresses of welcome, etc.

FRIDAY, SEPTEMBER 21ST.

Ten-mile Road Race for Vehicles Carrying Four People—Prize, silver cup.

Ten-mile Road Race for Vehicles Carrying Two People—Silver medal.

Grand 100-mile sweepstakes event for Inter Ocean challenge cup.

One-mile Novelty Race—Automobiles running backward. First prize, silver cup; second prize, silver medal. Entries limited, several heats if necessary.

Grand floral parade, 3 p. m.

Twenty-mile Motor Bicycle Race—First prize, $150 cash; second prize, $50 cash.

SATURDAY, SEPTEMBER 22D.

Ten-mile Manufacturers' Race for Steam Vehicles—First prize, silver cup; second prize, silver medal.

Ten-mile Manufacturers' Race for Gasoline Vehicles—First prize, silver cup; second prize, silver medal.

Ten-mile Manufacturers' Race for Electric Vehicles—First prize, silver cup; second prize, silver medal.

Twenty-mile Combination Race to Respective Winners of Above Ten-mile Races—Gold medal.

Five-mile Transfer Express Race—Prize, silver medal.

Novelty Design Contest—Being a contest for designs in automobiles which will depart radically from the carriage type; prize, silver cup.

Gold medal prize for most original conception in an automobile that will still leave the vehicle acceptable and practical.

Grand illuminated automobile parade, 8 p. m., silver cup for most attractive display.

All the cash prizes will be $150 for first prize and $50 for the second.

The public will be permitted to examine the automobiles on exhibition, subject to the owners' approval. A few vehicles will be placed at the disposal of the public, and a competent driver will accompany each of them. In the obstacle races the track will be prepared with dummy figures representing men and women, trunks of trees, large stones and such things as might be met with in ordinary country road or street traveling.

Practical utility will be the main feature in all the mechanical tests. The tests will be for friction, economy of power, speed, power in hill climbing, mechanical construction, safety devices, accessibility of brakes for repairs, noiselessness, etc. Vehicles not completed will be allowed upon the grounds, but will not be considered by the judges. In these contests of practical utility each of the manufacturers who enter will be allowed to exhibit three vehicles, having in view the following principles: 1. One vehicle carrying two people, operated by the owner. 2. One vehicle carrying four or six people, operated by the owner or by a servant in livery. 3. One vehicle designed for commercial or merchandise delivery, carrying a load of not less than 1,000 nor more than 2,500 pounds, including driver. In these contests the following ratio will be established for winning values:

	Points.
Ease of control, noiselessness, etc. (to be determined by a two-mile run)	20
Carriage design and practicability	10
Arrangement of brake and control of speed	10
Best climbing power on grades	10
Best safety device for operating vehicle on grade or level	10
Best, simplest and most accessible mechanical construction	10

wagon. In all, 40 stops will be made, and the contest will be under the supervision of Charles U. Gordon, postmaster of Chicago, and the Honorable Perry S. Heath, ex-first assistant postmaster-general.

A pulling contest will prove the power of motor vehicles, and will be demonstrated by attaching them to powerful springs and pulling the limit of the strength of the spring or machine. This will take place immediately in front of the spectators and the power expended will be indicated by a dial in plain view of all. Special charging apparatus will be provided for such of the automobiles as may be propelled by electricity.

For the merchandise delivery-wagon contest eight stations have been arranged for on either side of the track at Washington Park, where each driver of an automobile truck will be required to deliver a package weighing not less than 20 pounds. Each driver will be allowed an assistant. The vehicle winning the race must arrive at the finishing point after having delivered all packages intrusted to its care. Among the concerns that have entered vehicles for this contest are Siegel, Cooper & Co., Pabst Brewing company, Swift & Co., Mandel Bros and Ruppert, the shoemaker.

The manufacturing companies entering their goods in the different events and for exhibition include the following-named concerns:

Western Wheel company (American Bicycle company)	Chicago
Chicago Motor Vehicle company	Chicago
Triumph Motor Vehicle company	Chicago
Crowdus Automobile company	Chicago
Gormully & Jeffery (American Bicycle company)	Chicago
Waverly Branch American Bicycle company	Indianapolis
Hewitt-Lindstrom Motor company	Chicago
Canda Bros., Auto, Quadricycle company	Chicago
Woods Motor Vehicle company	Chicago
C. C. Hill Automobile company	Chicago
Locomobile company of America	New York
De Dion-Bouton Motorette company	New York
Riker Motor Vehicle company	Elizabethport, N. J.
Winton Motor Carriage company	Cleveland
E. R. Thomas Motor company	Buffalo
World's Dispensary Automobile company	Buffalo
Hub Motor company	Chicago
Eastman Automobile company	Cleveland
Olds Motor Works	Detroit
McMullen Power company	Chicago
Friedman Automobile company	Chicago
Kokomo Rubber company	Kokomo, Ind.
Helios-Upton company	Peabody, Mass.
St. Louis Motor Carriage company	St. Louis, Mo.
Giddings & Stevens Motor Vehicle company	Rockford, Ill.
United States Ball Bearing company	New York
Consolidated Rubber Tire Wheel company	Springfield, Ohio
New York and Ohio company	Warren, Ohio
Buffalo Gasoline Motor company	Buffalo, N. Y.
Mobile company of America	Philipse-Manor-on-Hudson, N. Y.

Chicago Automobile Club.

The first association of automobilists in Chicago was known as the Automobile Club of Chicago. Early in August several of the prominent private automobile operators decided to form the Western Automobile association. On more mature deliberation, however, this name was not deemed suitable by all the members, as it might conflict with the name of any association of western automobile clubs that might be formed in the future, and as the Automobile Club of Chicago agreed to combine with the new club, giving to the latter its charter, the name of Chicago Automobile Club was decided upon. So now there is but one automobile club in the city and its membership includes most of the prominent automobilists of the city.

The principal objects in organizing the club were to bring together all who are interested in the operation of automobiles for the exchange of ideas, to arrange and take charge of runs and meets, to provide for the social entertainment of the members and to be prepared to act together, should it be necessary, for the welfare of the sport. Another reason for the existence of the club is to forestall unjust and discriminating legislation that over-anxious lawmakers may attempt by endeavoring to place arbitrary restrictions on the construction and operation of the motor vehicles. The club will, on the other hand, further laws for good roads and the improvement of street paving in the city and also for the protection of operators.

There are probably over 400 automobiles in use in Chicago at the present time, and fully one-third of these are pleasure carriages operated by gasoline, electricity or steam. A number of varieties of carriages are represented, including styles from the light runabouts, victorias, stanhopes, etc., to the coaches, breaks, dos-a-dos, and park wagons seating from four to a dozen or more. The prevailing mode of propulsion used in the city is electric, although the steam and gasoline vehicles are in great favor.

Arthur J. Eddy, President. Dr. D. Cottrell, Treasurer. Charles T. Jeffery, Secretary.

OFFICERS OF THE CHICAGO AUTOMOBILE CLUB.

The first run of the Chicago Automobile Club was held on August 11th, and the route followed was from the Auditorium north on Michigan avenue and Rush street to the Lake Shore drive, and through Lincoln Park to the Bismarck garden, where a short stop was made. The return run ended at the Edelweiss, Fifty-first street and Cot-

tage Grove avenue, where dinner was served. There were 16 vehicles in the run, which was headed by A. J. Eddy and F. C. Donald in a Winton phaeton.

During the forthcoming Chicago automobile meet the automobile club will have its headquarters at the Victoria hotel on Michigan avenue, where it will entertain its friends and members of visiting automobile clubs. Invitations have been issued to the automobile organizations of the country, and of these the Automobile Club of America, located at New York, will attend in a body, two or three of its members bringing their machines with them. Members of other clubs are also expected. The 100-mile race, which is to be given on Friday of the race meet, will be conducted under the rules of the Chicago Automobile Club. The winner of this event will receive the Inter Ocean challenge cup, valued at $500.

The officers of the new club include some of the pioneer automobilists of the city. Arthur J. Eddy, a prominent attorney, is the club's president. Mr. Eddy holds the first license issued by the city to automobile operators. Charles T. Jeffery, who holds No. 7 of the city automobile operators' certificates, is secretary of the club. Mr. Jeffery is an enthusiast in the use of automobiles. He imported one of the Panhard-Levassor racing machines from France last winter. Last week he made a successful run to Milwaukee and back with an assistant in a new gasoline machine. The treasurer of the club is Dr. D. Cottrell, who is said to be the first physician in Chicago to adopt the automobile for his professional visits. Dr. Cottrell and Mr. Jeffery were the gentlemen who started the movement that led to the organization of the present club. The other officers of the club are: First vice-president, Samuel Insull, president of the Chicago Edison company, and second vice-president, F. C. Donald, manager of the Central Passenger association. It is the intention of the club to elect an electrical engineer and a mechanical engineer.

The following-named gentlemen are members of the club:

Arthur J. Eddy,
William Weare,
Oscar J. Friedman,
J. E. Scully,
Robert N. Dickman,
William D. Ray,
H. B. Babson,
H. M. Brinckerhoff,
J. R. Hall,
L. C. Fuller,
John W. Bate,
J. B. Burdette,
A. B. Porter,
M. B. Pine, M. D.,
F. C. Donald,
Charles H. Ferguson,
J. K. Robinson, Jr.,
C. E. Woods,
F. S. Washburn,
J. S. Howell, M. D.,
Charles C. West,
F. C. Greene, M. D.,
B. F. Schlesinger,
Samuel Insull,
P. McPherson, M. D.,
D. Cottrell, M. D.,
Charles T. Jeffery,
E. F. Brown,
Andrew R. Sheriff,
E. Walter Herrick,
T. K. Polsiffer,
J. A. Hamlin,
J. Wesley Allison,
W. E. Mack.

Conditions Affecting the Wave Form of Alternators.[1]

By L. A. Herdt and E. M. Archibald

In what is given below it is not intended to consider the question of wave form as affecting successful distribution, but rather the extent to which the electromotive-force wave of certain machines may change under not unusual commercial conditions.

In alternator specification, along with regulation, heating and other clauses, it is often argued that a clause relating to wave form should be included, but as comparatively little is known of the extent to which the wave forms of modern alternators change with amount and character of load—to say nothing of the effect of such changes on the operation of the receiving machinery—it seems advisable that more information be accumulated before very rigid wave-form requirements are inserted. However, with a view of throwing more light on the subject, a series of experiments were undertaken in the electrical engineering laboratories of McGill University during the last winter, and though not complete, certain results already obtained may be of interest.

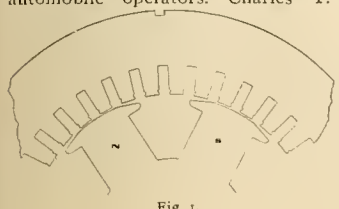


Fig. 1.

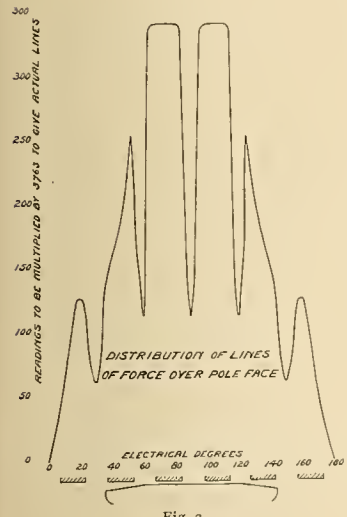


Fig. 2.

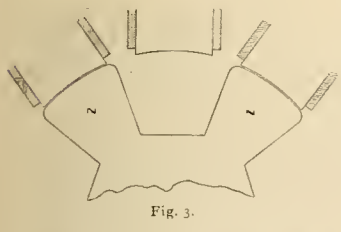


Fig. 3.

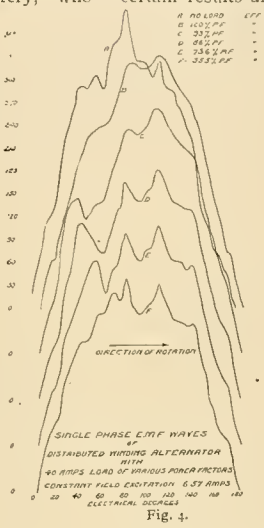


Fig. 4.

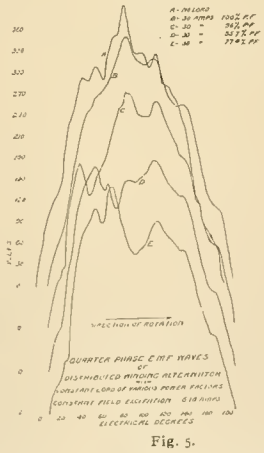


Fig. 5.

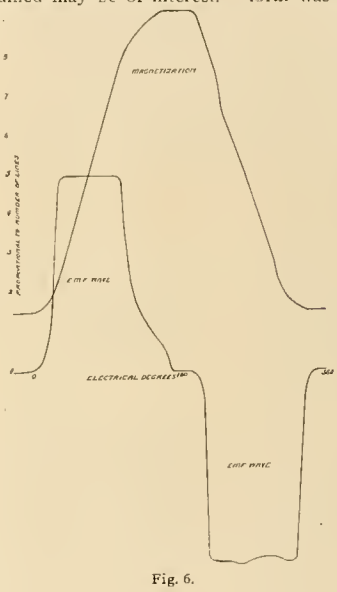


Fig. 6.

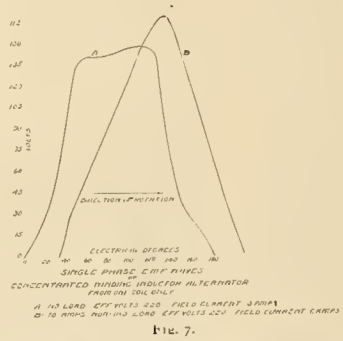


Fig. 7.

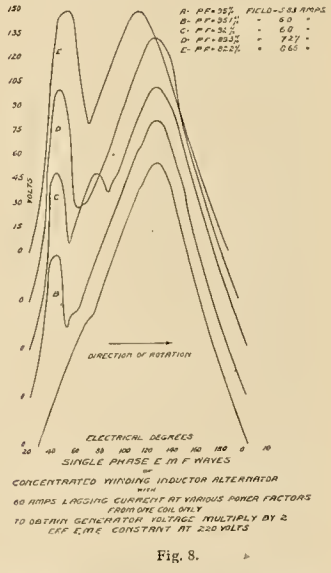


Fig. 8.

CONDITIONS AFFECTING THE WAVE FORM OF ALTERNATORS.

For the purpose in hand a number of different types of alternators were available, some with a concentrated armature winding, and some with distributed windings of the revolving-armature, revolving-field and inductor types. The electromotive-force waves were obtained from each at different field excitations, different armature currents and different power factors, lagging and leading. The distribution of induction in the air gaps under different conditions was also obtained by means of small test coils, suitably placed. As illustrating the general effect of lagging and leading armature currents in relation to type of machine upon induction distribution and consequent wave form, the results obtained upon a revolving-field, distributed-winding alternator, part of the magnetic circuit of which is shown in Fig. 1, and upon an inductor-type machine with a concentrated winding and poorly shaped inductor lug, shown in Fig. 3, may be cited.

In Fig. 2 is seen the distribution of induction in the air gap of the first machine for the particular position of the field pole shown. As might have been expected, the larger part of the induction enters the armature through the teeth, but about one-third, in the case of those teeth immediately opposite the pole, passes into the armature by way of the slot due to the practical saturation of these teeth. The no-load electromotive-force wave of each coil of the distributed winding may be constructed from the no-load induction distribution curve by the method of tangents and for any group of coils by taking the algebraic sum of the instantaneous electromotive forces of the individual coils. This has been done, and the results found to check quite well with experimental values.

Fig. 4 gives a series of electromotive-force waves for this machine connected as a single-phase alternator at no-load and full-current load of different power factors, lagging current, the field excitation being kept constant.

Fig. 5 shows the electromotive-force waves of the same machine connected as a quarter-phase generator under similar conditions. It is to be noted that while the wave form and terminal volts both change in a marked degree with power factor, the change is not nearly so great as in the case of the second machine having a concentrated winding and comparatively weak field.

With a concentrated winding, the conditions are different, the wave form not being a function of the angular displacement of the armature coils.

In Fig. 6 is given the no-load induction distribution in machine No. 2 at normal field excitation. It is to be noted that, due to poor design, the armature induction at minimum points is a considerable fraction of its minimum value, which would not be the case in rightly proportioned machines of this type. With this machine also the no-load wave form was readily predetermined from the curve of induction distribution and found to agree with the experimental values.

In Fig. 7 is shown the no-load and load electromotive-force waves at different power factors. The change of wave form with character of load is, to say the least, startling, especially to those who have been accustomed to regard the sine-wave assumption as to alternating electromotive forces sufficiently near for practical purposes. The effect upon the operation of synchronous and induction machinery designed for sinusoidal electromotive forces of such waves as shown can be pretty well anticipated. Several synchronous motors were in turn operated from a generator whose wave form was made to vary by changing the character of an auxiliary load. In every case, as might be expected, the energy absorbed and the idle current to the motor increased with dissimilarity of wave. Also the tendency to fall out of step with slight provocation was very marked when the wave shapes were greatly different, but, as above indicated, such experiments are not yet complete. It is hoped, however, that enough has been said to induce a discussion of this certainly important subject, particularly from the standpoint of the purchaser and operator of alternating-current apparatus.

We desire to acknowledge our indebtedness to Professor R. B. Owens for the suggestion of the work carried out and for valuable assistance.

1. Paper read before the Canadian Electrical association, at Kingston, Ont., August 29-31, 1900.

Automobiles to Be Used During Street-railway Strikes.

At a meeting of the executive board of the International Street Railway Men's association, held in Detroit recently, President W. D. Mahon recommended that the board start in at once raising funds by assessment to buy automobiles for the purpose of putting them to work in cities where the companies treat the men unfairly or where transportation facilities are meager. President Mahon's idea is to put a complete automobile service in operation in a city as soon as a strike is declared, and to have the automobiles operated by the men who formerly operated the street cars. The board approved of the idea and authorized the president to draft a plan of assessment to be submitted to the local organizations of the association and to get legal authority to equip and run the machines.

Association of Edison Illuminating Companies.

The Twenty-first convention (sixteenth annual meeting) of the Association of Edison Illuminating companies was held at Saratoga Springs, N. Y., September 4th to 6th. The convention was a pronounced success and the sessions were well attended, there being an average of 90 per cent. of the delegates in attendance at all the meetings. The programme of the convention (page 130, Western Electrician of September 1st) was carried out as published, the reading of papers and the discussions completely filling six long sessions.

An incident of the second session was the appointment of a special committee, composed of Samuel Insull, Charles L. Edgar and Hoyt Post, to prepare resolutions, later to be incorporated in the minutes, expressing the great loss to the association by the death of Mr. S. Dana Greene.

Two notable changes were made in the committees of the association. The committee on Welsbach light and acetylene gas was discharged from further consideration of the subject, the association evidently being of the opinion that the special interest in these subjects had ceased for the time being. An additional committee was ordered appointed, to be known as the committee on standardizing of switches and similar apparatus, the duty immediately assigned to this committee being the correlation of the practice in respect of the smaller switches and cutouts used by the member companies.

An elaborate programme of entertainment for the ladies in attendance at the convention was carried out, and on Friday the delegates and ladies visited the works of the General Electric company at Schenectady, where they were well entertained.

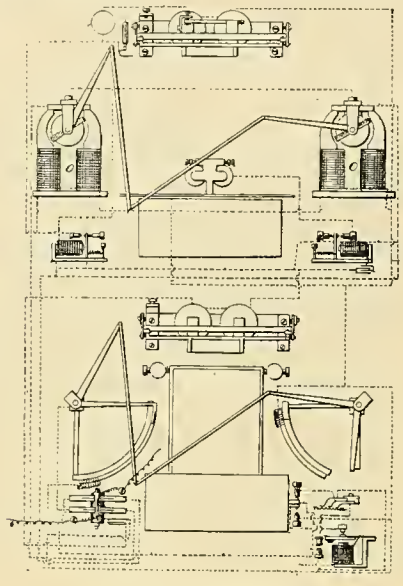
The following-named officers of the association were elected for the ensuing year: President, John W. Lieb, Jr., New York; vice-president, A. W. Field, Columbus, Ohio; treasurer, W. S. Barstow, borough of Brooklyn, New York; secretary, Wilson S. Howell, Newark, N. J.; executive committee, John W. Lieb, Jr. (chairman), Alex Dow, Detroit, Mich.: Charles L. Edgar, Boston, Mass.; W. C. L. Eglin, Philadelphia, Pa.; Samuel Insull, Chicago, Ill.; T. E. Murray, New York, N. Y., and as ex-officio members, A. W. Field, W. S Barstow and Wilson S. Howell.

The following-named delegates were present at the convention:

Samuel Insull, Chicago Edison company, Chicago; P. O. Keilholtz, consulting eogineer, United Electric Light and Power company, Baltimore; Charles R. Price, treasurer, New Bedford (Mass.) Gas and Edison Light company; Philip Torchio, New York Edison company; Luther Stieringer, Boston Edison company; Arthur F. Walker, superintendent, Edison Light company, Grand Rapids, Mich.; L. G. White, superinteudent, Columbus Edison Electric company, Columbus, Ohio; Charles R. Stetson, president and general manager, New Bedford (Mass.) Gas and Edison Light company; J. T. Maxwell, president, Edison Electric Light company, Philadelphia, Pa.; George Ross Green, Edison Electric Light company, Philadelphia, Pa.; W. H. Johnson, Edison company, Philadelphia, Pa.; F. P. Cox, General Electric company, Lynn, Mass.; Charles T. Hughes, New York manager, General Electric company, New York city; H. W. Hillman, General Electric company, Schenectady, N. Y.; Charles P. Steinmetz, General Electric company, Schenectady, N. Y.; W. S. Andrews, General Electric company, Schenectady, N. Y.; J. W. Howell, engineer lamp works, Harrison, N. J.; Joseph D. Israel, Philadelphia Edison company; Caryl W. Haskins, General Electric company, Schenectady, N. Y.; E. H. Mullin, General Electric company, Schenectady, N. Y.; F. W. Wilcox, General Electric company, Harrison, N. J.; Alex Dow, Edison Illuminating company, Detroit, Mich.; Henry L. Doherty, assistant to president, St. Paul Edison company; W. S. Barstow, general manager, Edison Electric Illuminating company, Brooklyn; John F. Gilchrist, Chicago Edison company; Henry W. Darling, president, Des Moines Edison Light company, Des Moines, Iowa.; George P. Magner, manager, Newport Illuminating company, Newport, R. I.; George E. Emmons, General Electric company, Schenectady, N. Y.; Thomas E. Murray, New York Edison company; General Eugene Griffin, General Electric company; W. F. White, general manager, Cincinnati Edison Electric company; Fred M. Kimbal, General Electric company, Boston, Mass.; William C. D. Eglin, Philadelphia Edison company; W. H. Wirt, General Electric company, Schenectady, N. Y.; T. D. Boyles, General Electric company, Schenectady, N. Y.; W. L. Emmet, Schenectady, N. Y.; Charles R. Huntley, Buffalo Electric Light company, Buffalo, N. Y.; E. W. Rice, General Electric company, Schenectady, N. Y.; B. E. Sunny, General Electric compaoy, Chicago, Ill.; Herbert A. Wagner, Missouri Edison Electric company, St. Louis, Mo.; George A. Redmond, Rochester, N. Y.; George D. Rosenthall, General Electric company, St. Louis; J. W. Reeves, superintendent, Johnstown Electric Light company, Johnstown, Pa.; Thomas G. O'Dea, Edison Electric Light and Power company, Erie, Pa.; J. W. Ellard, manager, United Electric Light and Power company, Baltimore, Md.; H. T. Edgar, manager, Edison Electric Illuminating company, Brockton, Mass.; G. W. Brine, secretary and treasurer, Edison Illuminating company, Atlanta, Ga.; Charles L. Edgar, president, Edison Electric Illuminating company, Boston, Mass.; C. C. Perry, secretary and treasurer, Indianapolis Light and Power company, Indianapolis, Ind.; A. W. Field, secretary and manager, Columbus Edison Electric Light company, Columbus, Ohio; J. W. Lieb, Jr., third vice-president and general manager, Edison Electric Light company, New York; J. R. Lovejoy, Schenectady Illuminating company, Schenectady, N. Y.; Leon H. Schercke, Edison Electric company, New Orleans, La.; W. F. White, general manager, Cincinnati Edison Electric company; E. J. Bechtel, superintendent, Toledo Consolidated Electric company, Toledo, Ohio; D. L. Huntington, secretary and general manager, Washington Water Power company, Spokane, Wash.; E. B. Greene, superintendent, Edison Electric Illuminating company, Altoona, Pa.; Ernest H. Davis, treasurer, Edison Electric Illuminating company, Williamsport, Pa.; Daniel McCoy, president, Edison Light company, Grand Rapids, Mich.; F. M. Noecker, general manager, Renovo Edison Light, Heat and Power company, Renovo, Pa.; Henry G. Stolt, engineer, Buffalo General Electric company, Buffalo, N. Y.; William Chandler, vice-president and secretary, Edison Sault Electric company, Sault Ste. Marie, Mich.; G. K. Hutchins, United Electric Light and Power company, Baltimore, Md.; G. F. Perin, United Electric Light and Power company, Edison Illuminating company, Baltimore, Md.; Louis A. Ferguson, Chicago Edison company; Wilson S. Howell, secretary of association and bureau testing officer; H. M. Edwards, auditor, Edison Electric Illuminating company, New York; Arthur Williams, general inspector, Edison company, New York; Hoyt Post, director, Edison Illuminating company, Detroit, Mich.; Robert A. Cantor, director, Edison Electric company, New York; Calvin W. Rice, Edison Electric Illuminating company, New York.

Ritchie Telautograph Patented.

United States letters patent (No. 656,828) were granted August 28th, to Foster Ritchie, London, England, for his telautographic apparatus. The invention comprises transmitting appliances including a tracer, receiving appliances arranged at a distant station, a line wire connecting these appliances, a rheostat comprising resistance coils, the coils being arranged in series in the line circuit, and



RITCHIE TELAUTOGRAPH.

an arm connected to move with the tracer and carrying a brush arranged to move over the rheostat, whereby the line current is varied in strength. There are also provided paper-shifting mechanisms at the receiving and transmitting stations, and means whereby the mechanisms are inactive during the writing operation. Means arranged at the receiving station, and actuated by the variations in strength of the line current, actuate the receiving appliances. The accompanying illustration is a reproduction from one of the patent drawings.

Large Consolidation in South Jersey.

The merger of eight gas, electric-light and electric-railway companies into the new South Jersey Gas, Electric and Traction company was accomplished at a meeting held in Camden, N. J., August 31st. The meeting was attended by the stockholders of the Camden Gas company, Camden Gaslight and Fuel company, Camden and Burlington County Gas and Electric Light company, East Side Gas company, Gloucester City Electric Light company of Camden County, Consolidated Gas company of Woodbury and the Woodbury Electric Light and Power company. The stockholders of the South Jersey Gas and Electric company voted to purchase a majority of the capital stock of the Camden, Gloucester and Woodbury Railroad company.

It was decided to issue $6,000,000 worth of five per cent. bonds, to be held by the Fidelity Trust company of Newark, as trustee. Of the total amount $2,000,000 will be issued at par to pay for the plants of the various companies, and the majority of the capital stock of the Camden, Gloucester and Woodbury railroad; $654,000 will be issued to redeem a like amount of bonds now held against the Camden and Burlington Gas and Electric Light company, and $90,000 will be used to take up a like amount of bonds now outstanding against the Camden Gas company. The balance of $2,840,000 will be used to improve the gas and electric-light plants of Camden, Merchantville, Moorestown, Mount Holly, Haddonfield, Gloucester City and Woodbury, and for betterments for the Camden, Gloucester and Woodbury trolley road.

The officers and directors of the company are: President, Anthony A. Kuser, Newark; vice-president, W. J. Bradley, Camden; secretary and treasurer, Thomas N. McCarter, Jr., of Newark; directors, Uzat H. McCarter, Forest F. Dryden, Chandler W. Riker, all of Newark; Thomas A. Nevins, East Orange; John L. Kuser, Bordentown; William J. Thompson, Gloucester City; John J. Burleigh, Camden; Herbert W. Johnson, Merchantville; Charles Watson, Camden; Barker Gummere, Trenton; Frank Bergen, Elizabeth; Thomas Barr, Orange; Frank W. Montgomery and Maitland F. Griggs, of New York. The new corporation is said to be trying to secure control of the Camden and Suburban Railway company, and if it does not succeed in this undertaking, it is rumored that it will endeavor to secure a franchise to operate a rival trolley line in Camden. The company is capitalized at $6,000,000.

Some Swiss Exhibits at Paris.

By Frank C. Perkins.

Some of the most interesting electric generators at the Paris Exposition are operated by engines manufactured by Sulzer Bros. The works of this firm are located at Winterthur, Switzerland, and at Ludwigshofen, on the River Rhine. The former plant was established in 1834 and the latter in 1881. The exhibits of this concern are well worth considering. Among them is a 1,700-horsepower, four-cylinder, triple-expansion engine, direct-connected to the polyphase dynamo furnished by the firm of Brown, Boveri & Co. of Baden, Switzerland. Views of this unit may be seen in Figs. 1 and 2. The diameter of the high-pressure cylinder of this engine is 600 millimeters, while that of the middle cylinder is 850 millimeters. The two low-pressure cylinders have a diameter of 1,025 millimeters each. The stroke of the piston is 1,500 millimeters and the speed is 85 revolutions per minute. There is also in the exposition a 700-horsepower tandem Sulzer engine, operating a polyphase generator fur-

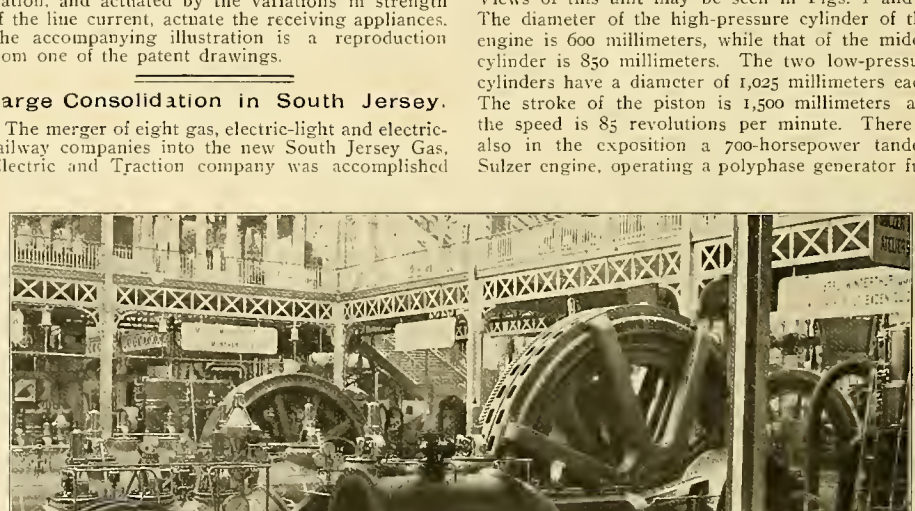


FIG. 2. SOME SWISS EXHIBITS AT PARIS.—BROWN, BOVERI & CO.'S 1,700-HORSEPOWER POLYPHASE GENERATOR

nished by the firm formerly known as J. J. Rieter & Co. of Winterthur. The high-pressure cylinder of this engine is 525 millimeters in diameter, while the diameter of the low-pressure cylinder is 875 millimeters. The speed of this engine is 100 revolutions per minute and the stroke is 1,100 millimeters.

The large alternators have their fields excited by a direct-connected, continuous-current outfit,

seen in Fig. 3. The generator of this set is operated at 300 revolutions per minute. The engine cylinder is 200 millimeters in diameter, and the piston has a 200-millimeter stroke. Sulzer Bros. have also a fine exhibit of ventilating apparatus, steam-heating apparatus and centrifugal pumps, the latter operated by electric motors.

The tandem-compound engines shown in Fig. 4 was built by Escher, Wyss & Co. of Zurich, Switzerland, and has a capacity of 1,000 horsepower. It

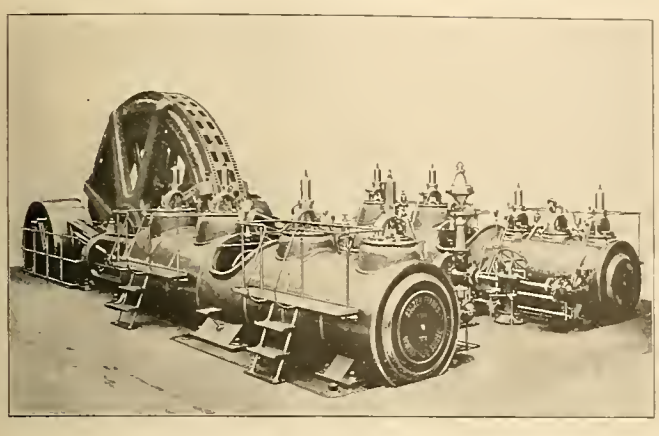


Fig. 1. Sulzer Four-cylinder Engine Driving Polyphase Generator.

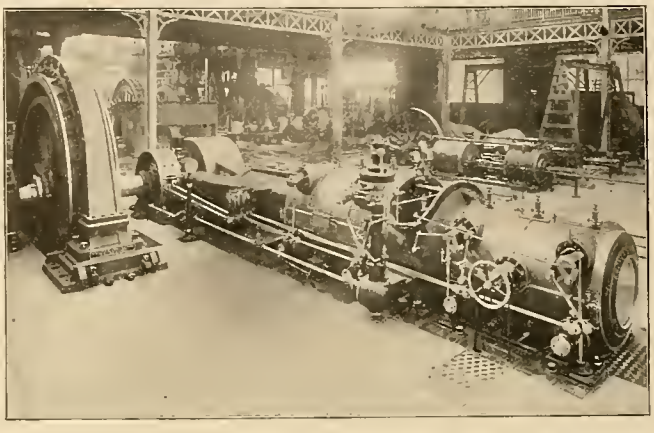


Fig. 4. Escher, Wyss & Co.'s Engine Driving Three-phase Generator.

SOME SWISS EXHIBITS AT PARIS.

is direct-connected to a three-phase alternator built by the Oerlikon Electrical Works of Zurich, Switzerland. This engine operates at a speed of 105 revolutions per minute, under a steam pressure of from 135 to 150 pounds. The diameters of the high-pressure and low-pressure cylinders are 650 millimeters and 1,100 millimeters, respectively, while the stroke of the piston is 1,200 millimeters. Directly connected to this tandem-compound engine, which is provided with a Corliss valve gear, is a three-phase alternator, which delivers a current of 1,300 kilowatts at a potential of 5,500 volts. It is so constructed that it may be operated as a monophase generator, with the armature windings connected in parallel, and it then has an output of from 1,000 to 2,000 horsepower at a potential of 2,200 volts.

The armature frame, seen in Fig. 4, has a diameter

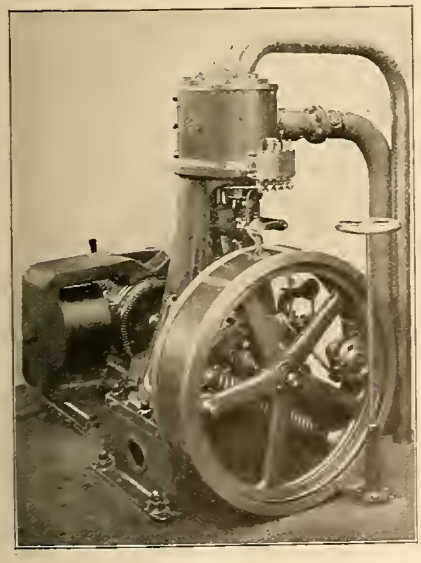


FIG 3. SOME SWISS EXHIBITS AT PARIS.—DIRECT-CONNECTED EXCITER.

of 6,200 millimeters and is made of cast-steel, with laminated iron cores mounted therein, the sheets being 35 millimeters in thickness. The frame of the armature is made in two parts and a special arrangement is provided for adjustment in all directions, for centering. The field magnets revolve and act as a flywheel, being directly connected to the engine. The field-magnet wheel is constructed of cast-steel, and upon it are mounted 64 pole cores of laminated iron sheets, each one millimeter in thickness.

The exciter is a direct-current generator, with 12 poles. The armature of the exciter has a Gramme winding and is direct-connected to the same shaft as the alternator field magnet. A good idea of the special construction of valve gear, designed by Escher, Wyss & Co., may be noted in Fig. 4.

EXCELLENT PROSPECT FOR FALL BUSINESS.

Despite the fact that a presidential election is to be held within two months, electrical business men are very generally agreed that the prospect for the fall and winter season is most encouraging. The trade in electrical apparatus held up better during the summer than had been expected, and from the number of new buyers that are known to be in the field, and from the inquiries from old customers that have been received, there is every reason to anticipate a most successful season. In a presidential year, when business is usually in an unsettled condition, this fact is especially notable and gratifying. That the Western Electrician is not alone in reaching this conclusion is shown by the following expressions of opinion:

E. H. Belden, general manager of the Belden-Larwill Electric and Manufacturing company of Fort Wayne, Ind.: "We can say regarding the prospects of our business for the balance of 1900 that we are running our factory to its full capacity both night and day, and can see no prospect for a falling off of our present business. We are now making arrangements to double our capacity in view of a still further increase in business."

Chicago House Wrecking company (by M. Rothschild): "We are more than satisfied that the conditions prevalent in the electrical machinery line are more encouraging to-day than they were at any time for a year back. We are fairly inundated with inquiries of all kinds. We have made numerous sales on dynamos of all sizes. The inquiries that are pouring in on us seem to come from all parts of the country, and while the sales are not so numerous as we should like to have them, it indicates to us the fact that preparations to buy are apparent everywhere."

C. W. Farr, president of the Farr Telephone and Construction Supply company, Chicago: "The telephone and electrical business has kept up much better through the summer months than we anticipated. We have had an exceedingly large correspondence from our customers from all parts of the United States within the last six months, much more than we ever had before during the summer months. Our customers seem to be all contemplating new work, and we hold the opinion that the electrical trade in general will be very heavy a little later on. We think there are very bright prospects ahead."

G. W. Hart, president of the Hart Manufacturing company of Hartford, Conn.: "We are hardly in a position to form a correct opinion as to the prospects for the general electrical trade. As you know, we have recently commenced to manufacture a new line of goods, under the trade-mark 'Diamond H.' Our sales of these goods have steadily increased, as they have become better known to the trade, so that the month of August, just passed, which should be a dull month, was from 25 to 30 per cent. larger than any previous month in our existence. We usually consider August business a fair indication of the fall business, as activity during that month means a largely increased business during the months following. If our own business follows the general rule, we shall have no cause for complaint on account of lack of business."

A. H. Kreitler, manager of the Kentucky Electrical company of Owensboro, Ky.: "So far as we are concerned business prospects are exceptionally bright, both in incandescent lamps, motors and dynamos. We are having numerous daily inquiries from all sections of the United States, and have felt justified in increasing our machinery capacity to about three times that of last year. This, more than anything else, will show you how we feel relative to the coming season's trade."

A. O. Kuehmsted, president of the Gregory Electric company of Chicago: "Business is immense and the outlook splendid. We are far ahead in our sales this year over the corresponding period of last year, which had been considered by all the banner year, and as our trade is not confined to one particular section of the country, and as we are in close touch with all the lighting plants, we know that business is good everywhere. We do not feel that the coming presidential election will be the cause of an 'off' year in business this time. On the contrary, managers of lighting plants everywhere are preparing for the biggest demand ever known."

I. J. Kusel, president of the Eureka Electric company of Chicago: "We see no reason why there should not be a tremendous fall trade, and if our summer trade is to be considered any indication of what will happen in the fall, we will hardly be able to take care of the mails, notwithstanding that we have increased the capacity of our factory several times within the last year. We feel that the condition and experience of our company is the same as that of other companies which manufacture a line of apparatus of merit, and which make it an object in their trade to please all and produce goods that will give to the telephone exchanges superior service and satisfaction."

W. W. Low, president of the Electric Appliance company of Chicago: "In my opinion coming events have, in this case, cast their shadows before. The indications for a record-breaking fall trade are so unanimous and widespread that I do not hesitate to underwrite such a prophecy."

G. G. Luthy, manager of the Royal Electric company of Peoria, Ill.: "Our business this summer has been quite satisfactory. The outlook for fall and winter trade has never been better, and we expect to surpass our gross amount of business for 1899. Collections are good, and the trade seems to be in a most healthy condition."

J. J. Nate, general superintendent of the Standard Telephone and Electric company of Madison, Wis.: "We feel justified in predicting continuance of the successful business with which we have steadily been favored for several years past. We feel this confidence from the uninterrupted receipt of orders and inquiries for future purchases. A very general use of the telephone and its rapid development in small communities have opened up a field which Independent telephone manufacturing companies did not consider seriously to any extent in the earlier part of their work. It is hardly necessary to say that nearly all of our larger towns and villages, if not supplied at the present time with telephone exchanges, are practically in the market or feeling their way."

North Electric company of Cleveland (by F. F. Sapp): "Our prospects for fall business are very bright, and we can give no better assurance of our opinion in this matter than by stating the fact that we have largely increased our capacity for turning out our products because of the promises of increased business, as well as the having of numerous large contracts on our books. We see no reason why, with staple business, the fall should not show the best season for that time of the year which we have experienced since the panic of 1893."

W. F. Richardson, secretary of the National Telephone Equipment company of Detroit: "Inasmuch as we have but recently commenced operations, we feel that we are not qualified by experience to contribute anything of value in relation to the business situation. We may say, however, that if the fall trade is to be gauged by the success we have met with since the first of August and the number of inquiries we are receiving at the present time, it is going to be exceptionally good."

A. G. Roth, of Roth Bros. & Co., Chicago: "The electrical industry is continually making wonderful strides toward advancement in its various branches. New devices are being designed and constructed for

[*Continued on page 168.*]

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CONVENTIONS AND EXPOSITIONS.

Street Railway association of the State of New York, Buffalo, N. Y., September 18th and 19th.

Inter Ocean Automobile Meet, Chicago, Ill., September 18th to 22d.

Old Time Telegraphers' association and United States Military Telegraph Corps, Minneapolis, Minn., September 20th to 22d.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

There appears to be a good prospect for the success of the Chicago automobile show next week, and there is little doubt that an exhibition of real usefulness will be given. There is much to be learned about the practical utility of the horseless vehicle under all the varying conditions met in everyday service, and gatherings such as that promoted by the Inter Ocean should, if properly managed, do much good.

Out of 303 licensed automobile operators in the city of Chicago, 225, as shown by the list published on another page, have applied for and secured permission to operate electric vehicles. This is a significant proportion and shows that, in the cities at least, the electric carriage is the most popular type. With all their drawbacks, the storage batteries and electric motors are preferred to steam and explosion engines.

Election or no election, the electrical industry is in for a rousing, aggressive fall and winter campaign. Such is the preponderance of opinion of the electrical traders of the country, who do not willfully deceive themselves as to the business outlook. Good business means a broadening development of the electrotechnical arts in every way, and it is highly gratifying that the prospect for continued progress is so promising. Some encouraging and pithy remarks on the outlook, from representative electrical men, are printed on other pages. They are worth reading.

To an already long list of names of electrical units —many of them not in use except by the hypertechnical—two more have been added by the Paris Electrical Cogress—the "gauss," for the unit of magnetic-field intensity, and the "maxwell" for the unit of magnetic flux. There was objection to the additional names, however, and Professor Mascart, the president of the congress, took pains to say that the two new units had no legal status, such as is accorded to the volt and the ohm, for instance. Perhaps the new units will come into use, but as one of them, the "maxwell," is not defined as to magnitude, such a result is doubtful. It is, however, a compliment to the American Institute of Electrical Engineers that two of the C. G. S. units were named, although of the four names proposed by the Institute but one was adopted.

The congress placed itself on record as of the opinion that electrical energy ought to be regarded as property, to be protected by law like all other property. This is the sensible position, both from the technical and the non-technical point of view, and is, we believe, generally held by the courts and legislatures of this country that have passed upon the subject. But in Germany and some other countries the judges have pronounced that electricity is such an intangible natural force, no matter how produced, that it cannot be stolen. It is to be hoped that the official opinion of such a respectable gathering as the International Electrical Congress may have some weight with the European courts.

In the terrible storm of last Saturday that brought such an appalling loss of life and so much suffering to the city of Galveston and the surrounding district in Texas, the electrical interests bore their share of misfortune. All the telephone and telegraph wires in the vicinity were down on Sunday morning, and the Mexican and South American cables were also incapacitated, so far as Galveston was concerned, owing to the almost incredible violence of the hurricane, which seems to have parted the cables at the landing place. So far as electrical communication went, the misfortune was further accentuated by the fact that all wires connecting the island on which Galveston is situated with the mainland of Texas were on bridges, which were wrecked. Both the Postal and Western Union Telegraph companies suffered great damage to their lines. The loss to the telephone companies was also heavy. The principal telephone company in Texas is the Southwestern Telegraph and Telephone company—a branch of the Erie system. This company has, or had, a handsome exchange building in Galveston, erected in 1896. Connected with it were about 1900 subscribers. There is no telephone competition in Galveston, but in Houston, a city also in the track of the storm, but sustaining comparatively slight damage, there is a thriving young Independent company, the Citizens', with something over 1,200 subscribers. The Southwestern company has about 2,000 subscribers in Houston. The electric-light company in Galveston is the Brush Electric Light and Power company, of which H. J. Runge is president. The Galveston City Railroad company does the electric-railway business of the city, and R. B. Baer is its general manager. Both of the two companies last named must have lost heavily.

All electrical men in the afflicted district will have the sincere sympahty of their co-workers throughout the country.

In the recently decided case of the Wabaska Electric company against the city of Wymore the Supreme Court of Nebraska lays down some instructive principles bearing on the legal relations of small cities and electric-light companies in that state. For instance, it is held that the averment by an electric-light company that a party with which it has a contract for lighting, as, for example, a city, is about to discontinue the use of certain lights, for which the latter had agreed to pay a certain sum each month, does not disclose any ground for equitable relief by injunction. In the first place, the court says that the mere disuse of the lights would not, of itself, be prejudicial to the company, this declaration being followed by the explanation that there was no allegation in the petition for injunction before the court that the city intended to withhold payment of the monthly installments in violation of its contract—a hint for the lawyers. But, if a breach of the agreement in this particular were contemplated, the court says that an injunction would not be granted, for there would be in such a case a plain and adequate remedy at law, presumably meaning in an action for damages.

Then it was stated in this case that the city intended to, and would, unless restrained by injunction, enact an ordinance governing the company's private contracts with its customers and establishing rates which would be wholly inadequate for the service rendered. In dealing with this feature of the case, the judges think it unnecessary to determine whether the city was authorized by its charter to grant to anyone an exclusive franchise for the erection and operation of an electric-light plant. It says that the plant had come into being, was established, and the owner thereof had the right to furnish light to its private customers on such terms as might be mutually satisfactory to the persons concerned. The Legislature has, of course, the right to fix the price at which gas or electric lights shall be supplied by one who enjoys a monopoly of the business, by reason of having an exclusive franchise, and such right may be delegated to the governing body of a public or municipal corporation. But a city of the second class (in Nebraska, one having less than 5,000 inhabitants), to which class the city in question was treated as belonging, has no authority, the court holds, to regulate the rates and charges which an electric-light company may charge its customers for lights.

Now, the adoption of the ordinance referred to, the court goes on to say, being entirely beyond the power of the city authorities, and being an act which would, according to the showing of the electric-light company, result in irreparable injury, should doubtless be enjoined, if the proper persons were before the court. But the mayor and City Council were not parties to the suit, and the court says that it does not understand that an action will ever lie against a city for an act done by one of its officers outside the scope of his authority. The mayor and council have power to enact ordinances, but that power is plainly limited by the law under which the city is organized. In attempting to legislate upon matters beyond its jurisdiction, the governing body of a city does not represent the city, and does not act as its agent nor by color of its authority. It is like any other agent who transcends his authority, and it, and not its principal, must answer for the wrongful act done or threatened. So, if the mayor and council of a city threaten to exceed their authority and adopt an ordinance which will be prejudicial to the rights of an individual or business corporation, an injunction, the court holds, may, in a proper case, issue against them, but not against the city.

INTERNATIONAL ELECTRICAL CONGRESS AT PARIS.

[Special correspondence of the Western Electrician.]

After the formal opening and organization of the Paris Electrical Congress of August 18th to 24th, as detailed in the Western Electrician last week, and a rest on Sunday, the various sections settled down to work on Monday, August 20th.

Commission on Electrical Units

Probably the most important work of the congress was that of the commission on units. This commission, or committee, consisted of Messrs. Ayrton, Great Britain; de Chatelain, Russia; Dorn, Germany; de Fodor and de Hoor Tempis, Hungary; E. Gerard, Belgium; Hospitalier, France; Lombardi, Italy, and Kennelly, United States. On Friday, August 24th, Mr. Hospitalier, chairman of the commission, submitted the following report:

In the sessions of August 21 and 22, 1900, the commission of units appointed by Section I. of the International Congress of Electricians has adopted the following recommendations:

The commission will not consider any propositions involving a modification of the decisions of preceding congresses.

The commission does not see an actual necessity for applying names to all of the electromagnetic units.

Nevertheless, in view of the employment of practical apparatus of measurement giving directly the intensity of field in C. G. S. units, the commission recommends the attachment of the name of "gauss" to this C. G. S. unit.

The commission proposes to give to the unit of magnetic flux, the magnitude of which will be defined later, the name of "maxwell."

Mr. Kennelly, in the name of the American Institute of Electrical Engineers, withdraws the propositions relative to prefixes and to the rationalization of electric and magnetic units.

This report was discussed in Section I. (scientific methods and measuring apparatus) on Friday. Professor Mascart opposed giving a name to the C G. S. unit of field. The use of practical apparatus giving such measurements directly was not sufficient to justify the step, he said; the name "gauss" was confusing, Gauss himself being the inventor of the millimeter-milligramme-second system. Messrs. van de Well and Kohlrausch favored the report. Mr. Ayrton sided with President Mascart. Messrs. Carpentier, Dorn, Addison, Mailloux, Mascart, Siemens and Thompson joined in the discussion. The report was adopted by Section I. with but two dissenting votes.

Action of the Official Delegates.

At the session of the chamber of delegates on Friday afternoon President Mascart, assisted by Messrs. Ayrton, Kohlrausch and Preece, presided. Professor Mascart thanked the foreign governments for their interest and sympathy in sending delegates to the convention, and addressed his most sincere thanks to the delegates themselves. He spoke of the work of the commission on units, and especially commended the unselfish attitude of the American delegates. The propositions of the commission could not be given any official character, he said, for the two new units do not have the legal status of the fundamental units—meter, ohm, volt.

The propositions of the commission were then adopted by the delegates present.

Mr. Mascart put to vote the following, which was adopted by a majority:

"The congress is of the opinion that electric energy ought to be regarded as a property; that this property ought to be protected, like all other, according to the jurisprudence already established in many chief states."

The adjournment of this body ended the sessions of the congress.

Proceedings in the Sectional Meetings.—Monday, August 20th.

Section I. Scientific Methods and Measuring Apparatus.—The president, Mr. Violle, being absent, was represented by Mr. Cornu, member of the Institute. Nominated for vice-presidents, Messrs. Arnold Ayrton, de Chatelain, Crova and Kennelly were unanimously elected. Messrs. Bourguignon, David and Odent were appointed secretaries. Mr. Cornu then read the list of the members of the congress who desired to take part in the work of the first section, followed by that of the communications announced. Among these were Mr. Arnoux, "Unit Cells of Cadmium;" Blondel, "Oscillographs;" Gino-Dompieri, "Decimal Division of the Hour;" Major John Millis, "Photometry of Colored Sources;" de Rey-Pailhade, "The Advantages of Adopting a New Unit Based Upon a Physical Unit of Time Equal to the One-hundred-thousandth of the Mean Solar Day."

Mr. Cornu asked for communications from the members present. A discussion followed, in which Messrs. Cornu, Crova and Hospitalier joined, as to the best method in photometry of designating the quality of the light used. The second named held that the frequency of the light vibration offered a more practical designation than did the wave length.

Section II. Sub-section A.—Production and Mechanical Utilization of Electricity.—The session was opened by Mr. Hillairet, president. He proposed to appoint the following-named foreign vice-presidents: Germany, Professor Stroecker; England, Professor S. P. Thompson; United States, C. O. Mailloux; Switzerland, Mr. Turrettini. These were elected without dissent. Messrs. Thourine, Grunberg, Grisel, Boisseau and Halphen were appointed secretaries. The president announced communications from Messrs. Bede of Brussels, Rey of Paris and Thury, Geneva.

Mr. Bede described a system of electric-railway conduit in use in Brussels, which offered certain interesting features. Following this paper the floor was given to Mr. Rey, chief engineer of Sautter, Harle & Co., for a communication on the fall of tension in polyphase alternators, as determined by the theory of two reactions. This theory, due to Blondel, allows one to determine precisely such fall of potential in inductive or non-inductive circuits. Mr. Rey next presented a note on the compounding of alternators by Mr. Blondel, who, on account of sickness, was unable to attend the sessions. The system proposed employs a direct-current exciter, whose armature is traversed by the polyphase current of the alternator itself or by a branch current obtained from a transformer in series.

Mr. Thury spoke on the application of high-voltage dynamos to the automatic regulation of the electromotive force of accumulators. This regulation is facilitated by a compound winding; the reversal of polarity is then more rapid.

Section II. Sub-section B—Electric Lighting.—The session was opened by Mr. Fontaine, president. For vice-presidents, Messrs. Meyer (France), de Fodor (Hungary), and Carl Hering (United States); for secretaries, Messrs, Gasnier, Pernollet and Soulier were named.

Mr. Laporte then read the most important portions of the report by Blondel upon the progress of electric lamps. Mr. Mailloux regretted not having been able to read this report at leisure, and regarded it as very important. He thought that there was no future for high-tension lamps, as to efficiency, durability or light intensity. In the discussion following de Fodor, Meyer and Fontaine participated.

Section III. Electro-chemistry.—Mr. Caillet took the place of President Moissan, absent. Vice-presidents Pagliani and Zenger were elected; Londrin, secretary. No papers were read at this session.

Section IV. Telegraphy and Telephony.—Mr. Wünschendorff, president; Messrs. Roosen, Gavey, Pinter and Strecker, vice-presidents. The order of the day called for the following communications: "Telephone Systems with Common Battery," by M. André; "Question of the Directibility of Telegraphic Apparatus Without Wires," by Dr. R. Blochmann, C. E. The author arrived at a negative conclusion. Captain Ferrié questioned him regarding certain phenomena of wireless telegraphy.

An invitation to visit the central bureau of telegraphs and telephones was read, and the meeting adjourned.

Section V. Electro-physiology.—Mr. D'Arsonval, the president of this section, was ill. Mr. Bergonie occupied the chair. The communications read were: "The Sterilization of Tissues in Tuberculosis," "Colored Rays of Light in Tuberculosis," both by Mr. Bleyer, and "The Analogy Between Lines of Magnetic and Electromagnetic Force, and the Arrangement of Cells in Plants," by Mr. Stanoievitch.

Tuesday, August 21st.

Section I. Mr. Hildburg read a description of apparatus for rectifying alternating currents. This communication was in English. Mr. Arnoux spoke in recommendation of the cadmium cell of Czapski as an electromotive-force unit. Mr. Weyde read a memoir on the mechanical application of the ideas of Maxwell and the theory of vortices.

Section II. Sub-section A.—Professor S. P. Thompson offered a communication on electromagnetic mechanisms. Mr. Guénée announced that in class 27 of the exposition were exhibited such systems where the law of Thompson was rigorously applied.

Mr. Leblanc presented a paper on the construction of dynamo-electric machines, and Mr. E. Gerard, engineer of Belgian railways, read one concerning the traction resistance of self-propelled vehicles. Mr. Blondin presented the traction system, with surface contacts invented by Dolter, now in actual use on a line 750 meters in length at Porte Maillot.

Section II. Sub-section B.—Mr. de Fodor read a paper entitled, "Proposition of a New Method of Tariff for Electric Current." Messrs. Lauriol, Fontaine Meyer and Claude joined in its discussion. Mr. Mornat gave a communication on "Electricity and the Motive Force in the Theater."

Section III.—Mr. Blondin criticized the names of units proposed to the congress of applied chemistry by Dr. le Blanc. Mr. Hollard offered a new series of terms for these units.

Mr. Keller then read a paper on "Electric Furnaces," and Mr. Hollard offered a paper on electrolytic analysis, in which he brought out a new method for the commercial analysis of copper.

Section IV.—Four communications on wireless telegraphy were given by Messrs. Popoff, Vilot, Tissot and Gavey, followed by one from Mr. Chaye-Pacha, on use of submarine microphone receivers for safety of the fishermen of Newfoundland.

Wednesday, August 22d.

Section I.—A paper was read by Mr. Blondin, acting for Mr. Blondel, on new oscillographs invented by him and built by Mr. Dobkevitch, capable of recording 45,000 vibrations a second. Messrs. Duddel, Carpentier and Addenbrook spoke on the subject.

Section II.—Sub-section A.—The discussion of Gerard's paper was continued, and the subject of traction by superficial contacts given over to a special sub-section, with Mr. Turrettini as supervisor.

Mr. Semenza spoke concerning tests made upon a large installation of high tension, that of Paderno-Milan, Mr. Boucherot on the compounding of alternators, and Mr. Thury on transmission at high tension by means of direct-current machines in series.

Mr. Perot spoke concerning the coupling of alternators, from the point of view of harmonics and the effect of synchronous motors upon such coupling. This was a most interesting paper.

Section II.—Sub-section B.—The order of the day called for the communication from Mr. Weissmann upon the use of lamps of large filament and low tension. Mr. Bochet spoke, discussing the report of Mr. Blondel, on the employment of arc lamps, and Messrs. Ayrton, Bainville, Mailloux, S. P. Thompson and Meyer participated.

Section III.—Mr. Zenger offered a paper upon the utilization of sea-water in the production of electric energy, by means of a new cell, the principle of which had been indicated, as President Sebert recalled, by Colonel Renard. Mr. Vignon discussed the communication.

Section IV.—The paper by Mr. Blondel and Captain Ferrié, upon the actual state of wireless telegraphy, was presented by the latter and discussed by Captain Tissot, Messrs. Pierard and Ducretet.

Mr. Pinter's communication on the rapid-writing telegraph of Pollak-Virag was followed by one from Mr. Rochefort on unipolar transformers.

Mr. Boulanger proposed that the congress render some public homage to Mr. Branly, and the president proposed that an extract of the minutes of the session, suggesting as the name of the coherer the "Branly tube," should be addressed to Mr. Branly. The proposition was adopted at once.

Thursday, August 23d.

Section I.—Mr. Violle first spoke upon photometry, followed by Mr. Kempf-Hartmann, in a note concerning an apparatus for measurement of frequencies of alternating currents.

Mr. Blondin presented, for Mr. Blondel, a communication on diphase and triphase alternators.

Section II.—Sub-section A.—Mr. Routin spoke on compound alternators and static transformers, and Mr. L. Gerard on the haulage of boats by electric towing machines.

Section II.—Sub-section B.—Mrs. Ayrton read a paper on the luminous intensity of the direct-current arc. Messrs. Fontaine, Bochet, Arnoux and S. P. Thompson all spoke in praise of this admirable work. Mr. Laporte communicated a note from Messrs. Blondel and Gigonzo, on the alternating-current arc. Messrs. Duddell, Arnoux, Bochet and Pellissier added remarks upon these two papers.

Mr. Dolter presented a model of a roadway, with magnetic contact, of his invention, and pointed out its chief advantages. He was eagerly questioned by Messrs. Vedovelli and Bonton. Mr. Diatto in turn described the features of his own system.

Section IV.—Mr. Kennelly presented a communication from Captain Squier and Professor Crehore on their telegraphic transmitter, employing sinusoidal waves, with Wheatstone receiver, and recalled the experiments made in England and on the Canso cable. Mr. Gavey asked why the system had not been adopted, and expressed doubt whether this system would operate, if subjected to induction from neighboring lines.

Captain Ferrié spoke upon his decohering coherer and the theory. Mr. Semonov related some experiments upon the movements of filings in coherers. Captains Ferrié and Tissot disagreed with his views.

Mr. Bodde presented a paper on "Wireless Telegraphy for Preventing Collisions at Sea," and described a method by which the direction of an approaching ship might be determined. Messrs. Chaye-Pacha and Blochmann asked further details.

Additional Delegates.—In addition to the American representatives at the congress already mentioned may be named Francis E. Drake, official delegate; B. J. Arnold and F. B. Crocker, American Institute of Electrical Engineers; A. E. Kennelly, Franklin Institute; C. O. Mailloux, New York Electrical society.

Friday, August 24th.

Section I.—Mr. Arnoux presented a new model of a thermic galvanometer.

At the afternoon session Mr. Perskyi spoke on "Television by Means of Electricity," with apparatus employing selenium cells.

Section II.—Sub-section A.—Mr. Janet spoke on

converters. Mr. Boucherot resumed his report upon condensers, and Mr. Lombardi replied to certain of his arguments. Mr. Rey read a paper from Blondel on the graphic theory and regulation of rotary converters. Mr. Weyler spoke concerning the calculation of the winding of electros, and Professor Thompson added that the approximate formulas of Steinmetz are very good for the same problem.

Mr. Boucherot was called upon regarding the calculation of circuits.

Section II.—Sub-section B.—Messrs. Lorcay, Laporte and Stanoievitch spoke on incandescent lighting. Mr. Hoho described the Lagrange-Hoho system, and Mr. Blondin, the Parvillée molded-metallic resistances for cooking apparatus.

Mr. Pollak presented certain general considerations on traction by superficial contact, and presented a model of his distribution box. Messrs. Diatto, Bouton, Dolter and S. P. Thompson took part in the discussion.

ENTERTAINMENT FEATURES.

During the period that the International Electrical Congress was in session only the forenoons were given up to the reading of papers and discussions, with the exception of Friday. The afternoons were devoted to side trips, which were previously planned by the officers of the congress. Twelve different trips were offered, besides an evening reception given by Prince Roland Bonaparte, and a special evening for an electrical display in the Palais d'Illusion, in the Electricity building. The Eiffel Tower was also open free to all members on Wednesday and Thursday. Unfortunately, these two days were not clear, so as to give the best view of Paris and its surroundings.

The most elaborate excursion offered, and the one in which all members participated, was the trip to Chantilly, on Tuesday. This was ladies' day, and a great many enjoyed the outing. Chantilly is 25½ miles from Paris and is one of the attractive suburbs of the capital city. The Musee Conde is situated here, with its valuable collection of paintings, jewels and sculptures. Two trains of about 20 first-class coaches each left Paris with the visitors at 1 p. m. The ride, of about 35 minutes, was through a very fertile and interesting country. On arriving at the station at Chantilly, buses were waiting to take the people to the chateau, a drive through the forest of about 15 minutes' duration. Tuesday is not a day for a public inspection of the chateau and gardens, so everything was at the disposal of the congress only. At five o'clock an elaborate lunch was served. At seven o'clock the party reached Paris, and everyone was in high praise of the manner in which all details of the trip had been so carefully arranged by the committee of organization.

J. M. H. .

Hub-motor Vehicle Plans.

The Hub Motor Transit company of Chicago, which was organized a few months ago for the purpose of establishing a system of omnibuses on the streets of Chicago, reports satisfactory progress on the construction of its vehicles. It is building 50 imperials, as they are called, which will seat 40 passengers each. Fifteen of these omnibuses are to be operated on the North Side, 15 on the West Side and 20 on the South Side. The most desirable routes to the heart of the city will be selected, passing around loops dictated by the convenience of the public and not by necessity.

The American Car company of St. Louis has the contract for building the car bodies of the imperials, and it is expected that the first vehicle will be completed in four or five weeks. The omnibuses will be driven by hub motors and the wheels for the first vehicle are being constructed at a machine shop in Chicago. It is probable that the company will soon close negotiations with a large eastern manufacturing concern to manufacture the wheels under the hub-motor patents. Arrangements are also being made to place the exclusive rights to the patents in England. The patents and manufacturing rights for the hub motors are owned by the Hub Motor company of Chicago.

The Hub Motor Transit company, which is capitalized at $1,000,000, under the laws of New Jersey, is solely an operating company and has the exclusive right to the use of the hub-motor patents on public omnibuses in Cook County, Ill. The following-named gentlemen are officers of the Hub Motor Transit company: President, Elmer E. Francy; vice-president, Charles Berg; secretary and treasurer, William H. Eastland; general manager, William A. Lake; general counsel, Harry L. Irwin; chief engineer, Frederick J. Newman; construction engineer, Joseph Ledwinka.

New York Automobile Expositions.

Preparations for the two automobile shows to be held in New York city in November are steadily progressing, and while each manager works independently of the other, the exhibitors are said to be disposed to consider both the expositions together. The show to be held at Madison Square Garden will be open from November 3d to 10th. Following this will be a longer exposition to be given at the Grand Central Palace from November 14th to 24th. More space for exhibitors will be afforded at the latter show, and a point in favor of it is that it will be held simultaneously with the horse show which draws annually to New York more than 50,000 visitors from out of town. Marcus Nathan is manager of the Central Palace show.

BOOK TABLE.

THE ELECTRIC AUTOMOBILE: ITS CONSTRUCTION, CARE AND OPERATION. By C. E. Woods, E. E., M. E. Chicago: Herbert S. Stone & Co. 1900. Pp., viii., 177, with 22 plates. Price, $1.25.

The author has brought forth a book relating to the operation, use and possibilities of the electric automobile that is not in any sense a technical or engineering work, but which can be easily understood by persons who are neither engineers nor mechanics. "The effort has not been," says the writer in his preface, "to produce a scientific treatise on the subject, nor even an elaborate composition, but to set forth in plain and unembellished English the facts and conditions surrounding the question in hand so that those interested in the subject might learn the elementary conditions and thereby purchase an electric automobile with some discrimination and give it intelligent care and careful operation." That the author has accomplished his purpose, in the main, is shown by a glance through the book. Mr. Woods has carefully avoided scientific terms wherever possible and has developed the elementary side of the different subjects treated. The book should prove interesting to those unaccustomed to the care and operation of an electric vehicle and to those unskilled in its construction.

In the first chapter are given some general conditions surrounding the introduction and use of automobiles, the opening pages of the chapter being historical in nature. Several comparisons between horse and electric vehicles are made as to cost, maintenance, etc., and the rest of the chapter treats of general topics in regard to the use, care and construction of the vehicle and answers several questions as to the future of electric vehicles.

Chapter II. deals with carriage construction, design and speed in connection with automobiles. The wheels, tires, bearings and frame are subjects treated and considerable space is given to the regulation and limits of speed.

The construction, use and operation of secondary or storage batteries in automobiles is taken up in the next chapter, and this topic is handled in a clear manner, but chiefly from the author's own manufacturing experience. In the fourth chapter electric motors are treated, and an elementary discussion is given of the principles of motor construction and use and the operation of controllers. Gearing, from the motors to the wheels, is also discussed.

Several pertinent suggestions and instructions on the testing and inspection of electric automobiles are next taken up. The question of battery charging and care is given the consideration it merits. Chapter VI. dwells upon street operation and care of electric vehicles in general and gives several aids valuable to the novice in learning to operate a vehicle.

The last chapter is headed "Automobile Clubs, Meets and Races," but is given up almost entirely to the constitution of the Automobile Club of America and to the racing rules of the Automobile Club of France, both of which are printed in full. An appendix is descriptive of several types of modern vehicles as manufactured by the Woods Motor Vehicle company, and illustrated by plates in the book. Other plates illustrate motors, batteries, a controller, gearing, controller connections, etc.

AMERICAN AUTOMOBILE ANNUAL FOR 1900. A handbook for all interested in horseless vehicles. Edited by Alfred B. Chambers, Ph. D. Chicago: Laird & Lee. Pp., 275, with 104 diagrams and illustrations. Price, $1.50.

This useful handbook will undoubtedly prove helpful to all interested in automobiles. Much of the material that has been compiled by the editor is historical in nature, but the work is brought up to date by discussions and descriptions of new and improved methods of motor-vehicle construction and operation. The work is divided into six parts, the first of which treats of the internal-combustion motor system. The chapters in this part discuss the invention and principles of internal-combustion motors, carbureters, gasoline-motor vehicles, petroleum motors and vehicles, etc.

Steam-power vehicles are next taken up, and then the electric storage-battery vehicles are discussed. The topics treated under the latter head are: The storage battery as a power source, construction features of typical electric vehicles, variations in electric-vehicle construction, maintenance and recharging of storage batteries, and notable performances of electric vehicles.

Part IV. gives other forms of motor power, such as compressed air, liquid air, carbonic-acid gas and combination motors. In the next part steering, wheels, tires, differential gearing, bearings, etc., are treated. Copies of the Chicago and New York city automobile ordinances are given, as well as several automobile "dont's," and the book is completed by a blank form of automobile log for a run. An automobilist's calendar for 1900 is also contained in the handbook. The volume is bound with a flexible cover and is of the ordinary handbook size.

At the recent annual meeting of the Pottstown, Boyertown and Reading Railway company of Reading, Pa., E. C. Watson of Philadelphia was elected president. The company has a charter to construct an electric railway from Reading to Boyertown, 18 miles, and thence to Pottstown, eight miles.

Excellent Prospect for Fall Business.

[*Continued from page 165.*]

the application of electric current in nearly all lines of manufacture. They are found to be advantageous. This is a good reason why the trade is so well sustained, and as there is still an unlimited field for further advancement, there is every indication that the electrical trade will hold good for many years, barring serious panics, wars, etc. In our special line we are very well pleased with the volume of business done during the first half of the year 1900. Our shops are overcrowded with work now, and we have every reason to believe that the prospects for a rushing business in our line for the latter half of the year are encouraging, as the outlook is brilliant. We consider the trade advancing everywhere. Locally, our business could not have been better, while in our trade with foreign countries we have made wonderful strides, with a good outlook for the future."

P. H. W. Smith, assistant general manager of the Standard Underground Cable company of Pittsburg: "Business with us during the past summer months has been sustained to an unusual degree, and with a largely increased output we find ourselves taxed to the utmost. The prospect at the present time for a large fall business for 1900 seems very good."

Sprague Electric company of New York (by Harold McGill Davis): "The Sprague Electric company has been unusually busy this season. The sales in the interior-conduit department have been greater than ever. The company has been obliged to increase its plant in order to keep up with the demand for this line of products. There has been great activity in all of the departments, and the outlook for future orders is excellent. Manufacturing plants throughout the country, and, in fact, all over the world, are beginning to recognize more fully the advantages of electrically driven machines. Anticipating the reëlection of Mr. McKinley and at least four years more of prosperity, it is quite natural to expect many factories to adopt electric power. Then, too, the new industries that will be started in the so-called 'American colonies' will require the most modern methods, so that altogether there will be a great demand for electric motors."

B. E. Sunny of Chicago, western manager for the General Electric company: "In the middle West the demand for electrical apparatus is even better than a year ago, when the business done was phenomenal, while in the East it seems to be about the same as last year. New enterprises are not showing activity, pending financial arrangements, which are difficult to make until the election shall have passed off satisfactorily. The greatest activity is in the reconstruction of existing railway and lighting power houses and systems. The necessity for this class of work has been made urgent by the increased business done by railways and lighting companies in all parts of the country, and the work is going along regardless of the forthcoming election, the Chinese question, etc. The indications seem to point to a falling off in business for September and October and a brisk revival on the re-election of President McKinley. In the latter event, which seems to be generally conceded, there will be special activity in the promotion and building of interurban railways. Indeed, in the 12 months following President McKinley's reëlection I think that there will be more interurban railways built than have been built to date."

Triumph Electric company of Cincinnati (by W. H. Jacob): "The indications are that there will be a great deal of business this fall, even more than there was last year. We judge this, not only from the amount of business that we have at present, which is over 50 per cent. in excess of last year's business, but from the number of inquiries we are receiving daily, and the prospective sales that we have in view."

C. H. Wilcox, president of the New York Insulated Wire company: "While I look for a good business during the coming year, I am inclined to believe that the top of the business boom has been reached, and that it will be many years before we see such prosperous years as the last three. I do not speak of the electrical trade alone, but of the trade of the entire country. I am also of the opinion that a change of administration would be very disastrous and fatal to the business world."

Old Telegraphers' Convention at St. Paul and Minneapolis.

The twentieth annual reunion of the Old Time Telegraphers' association and the United States Military Telegraph Corps will be held at St. Paul and Minneapolis, September 18th, 19th and 20th. The headquarters in St. Paul will be at the Ryan Hotel and in Minneapolis at the West Hotel. Business meetings of the two associations will take place in St. Paul on September 18th and September 19th will be known as "Minneapolis Day." Local entertainment committees have ben formed, and a number of drives, excursions, etc., have been planned for the entertainment of the delegates. An informal reception and ball will be held at Masonic Hall, Minneapolis, on Wednesday evening, and the convention will close with a banquet to members of the two associations on the evening of "St. Paul Day," September 20th. A large and very successful meeting is looked for.

Licensed Automobile Operators in Chicago.

The first examination of applicants for licenses to operate automobiles on the streets of Chicago was held in the city hall, February 17, 1900. Since that time examinations have been held at stated times and a total of 303 certificates has been granted, 225 of these being for electric-vehicle operation. A large proportion of the applicants were licensed as public-vehicle operators for the two public operating companies located in the city. The majority of the private operators own their own vehicles. The following list gives the names of those holding certificates, for what purpose or with what company they operate and the motive power of the vehicles. Mr. Arthur J. Eddy holds license No. 1, and the rest of the list is given in chronological order, up to and including the certificates granted on September 7th. The examining board consists of City Electrician Ellicott, Health Commissioner Reynolds and City Engineer Ericson.

NAME.	USE.	POWER.
Arthur J. Eddy	Private	E., G. and S.
F. R. Jenkins	I. E. V. T. Co.	E.
J. E. Scully	Private	E., G. and S.
William Weare	Private	G.
Charles T. Jeffery	Private	G.
Harold A. Bestorp	The Hub	E.
W. L. Post	I. E. V. T. Co.	E.
Edward Spengler	I. E. V. T. Co.	E.
John Spengler	I. E. V. T. Co.	E.
Fred J. Garvison	I. E. V. T. Co.	E.
Oliver M. De Lamity	I. E. V. T. Co.	E.
Fred Haines	I. E. V. T. Co.	E.
Charles Miller	I. E. V. T. Co.	E.
Oscar J. Friedman	Private	G.
William D. Ray	Public and private	E.
Robert N. Dickman	Private	G.
A. S. Blessing	I. E. V. T. Co.	E.
D. M. Greene	W. M. V. Co.	E.
C. B. Slade	Private	G.
M. E. Fowler	I. E. V. T. Co.	E.
David Cottrell	Private	G.
J. W. Hendrick	U. S. Express Co.	E.
W. Y. Miller	Private	E.
Henry B. Babson	Private	E., S. and G.
S. Kandel	I. E. V. T. Co.	E.
G. L. Marshall	I. E. V. T. Co.	E.
Thomas Mackin	I. E. V. T. Co.	E.
Charles H. Clink	I. E. V. T. Co.	E.
Frank L. Donaldson	W. M. V. Co.	E.
W. L. Place	I. E. V. T. Co.	E.
H. Valiquest	I. E. V. T. Co.	E.
F. H. Luther	I. E. V. T. Co.	E.
H. C. Ball	I. E. V. T. Co.	E.
Ford Yates	W. M. V. Co.	E.
F. Jolicoeur	I. E. V. T. Co.	E.
Bruce Clark	Priv. and W. M. V. Co.	E.
Robert T. Wagner	W. M. V. Co.	E.
G. A. Nelson	I. E. V. T. Co.	E.
Oscar Halberh	W. M. V. Co.	E.
Charles W. Fisher	I. E. V. T. Co.	E.
George Templeman	I. E. V. T. Co.	E.
Arthur Morrison	I. E. V. T. Co.	E.
G. W. Walterbaugh	Private	G.
John P. Quinn	W. M. V. Co.	E.
Thomas Gnuning	W. M. V. Co.	E.
C. A. Stutsman	W. M. V. Co.	E.
P. Coughlin	I. E. V. T. Co.	E.
Arthur W. Lloyd	Montgomery Ward & Co.	E.
S. E. Stickney	I. E. V. T. Co.	E.
A. E. Duttelzweig	W. M. V. Co.	E.
Thomas Schweig	I. E. V. T. Co.	E.
A. M. Hildebrandt	McMullen Mfg. Co.	G.
E. H. Roderick	I. E. V. T. Co.	E.
J. A. Windsor	W. M. V. Co.	E.
R. B. Leffingwell	Priv. and W. M. V. Co.	E.
Julia E. Bracken	Private	E.
Harvey Raymond	Private	E.
George W. Pynchon	Private	E.
L. F. Wright	W. M. V. Co.	E.
I. C. Lindsay	W. M. V. Co.	E.
Richard Reynolds	I. E. V. T. Co.	E.
William J. Peer	I. E. V. T. Co.	E.
W. M. Henry	I. E. V. T. Co.	E.
James Forrester	I. E. V. T. Co.	E.
John Farrell	W. M. V. Co.	E.
John H. Shanley	Priv. and W. M. V. Co.	E.
W. E. Mack	Exhibition	E. and S.
J. H. Gates	Exhibition	E. and S.
Fred A. Gardner	Private	S.
Paul Kraemer	Private	G.
Charles Dickinson	Private	S., G. and E.
F. P. Illsley	Exhibition	S. and E.
E. F. McQuaid	I. E. V. T. Co.	E.
E. L. Bentley	I. E. V. T. Co.	E.
A. L. Sanderson	I. E. V. T. Co.	E.
Robert Shaw	Private	E. and G.
W. Vernon Booth	Private	E.
F. C. Bronson	Private	G.
Lewis H. Falley	Private	E., G. and S.
M. M. Orten	Private	G.
W. R. Donaldson	Private	G.
G. W. Hayden	Private	E., G. and S.
C. W. Stokes	Priv. and C. M. V. Co.	G.
R. J. Conway	C. M. V. Co.	G.
W. L. Githens	Priv. and I. E. V. T. Co.	E.
A. W. Pauley	Priv. and W. M. V. Co.	E.
W. O. Worth	C. M. V. Co.	G.
J. D. Worth	Exhibition	G.
William P. Dale	Priv. and Chi. E. V. Co.	G.
Adolph Ulrich	I. E. V. T. Co.	E.
George Sparling	I. E. V. T. Co.	E.
George Henderson	I. E. V. T. Co.	E.
Frank Korff	I. E. V. T. Co.	E.
Edward Armhold	I. E. V. T. Co.	E.
Emmett O'Connell	I. E. V. T. Co.	E.
Charles A. Lindstrom	Private, manufacturer	E.
John O'Neill	I. E. V. T. Co.	E.
Byron Goggin	I. E. V. T. Co.	E.
M. A. Policaster	I. E. V. T. Co.	E.
H. M. Brinckerhoff	Private	S.
H. B. Boies	I. E. V. T. Co.	E.
J. H. Fahrney	Private	S. and G.
King Upton	Exhibition	E.
W. D. Long	I. E. V. T. Co.	E.
T. W. Davidson	I. E. V. T. Co.	E.
John Frier	Private	E.
Irving R. Hall	Private	G.
Alfred T. Leopold	Private	E.
John Wright	I. E. V. T. Co.	E.
H. H. Porter	Private	S.
Charles Rupert	Business	E.
Fred Franklin	W. M. V. Co.	E.
Frank Clark	W. M. V. Co.	E.
A. F. Kerns	W. M. V. Co.	E.
William E. Pleasant	Priv. and W. M. V. Co.	E.
Charles W. Gillett	Private	E.
Charles E. Bartley	Private	S. and E.
C. K. G. Billings	Priv. and I. E. V. T. Co.	E.
William C. Pullman	Priv. and W. M. V. Co.	E.
W. J. Buckley	Priv. and Con. M. V. Co.	E.
W. F. Hormann	Private	E.
George H. Lockbaum	Siegel, Cooper & Co.	E.
L. C. Fuller	Private	S.
Charles Crager	I. E. V. T. Co.	E.
D. J. McDonald	I. E. V. T. Co.	E.
E. H. Hart	I. E. V. T. Co.	E.
James Blinker	I. E. V. T. Co.	E.
Harry Jeusen	I. E. V. T. Co.	E.
G. H. Atkins	W. M. V. Co.	E.
Clinton E. Woods	W. M. V. Co.	E.
Charles Coulan	Priv. and W. M. V. Co.	E.
Grace Wassall	Private	E.
Mrs. Bruce Clark	Private	E.
G. A. Schank	I. E. V. T. Co.	E.
John F. Stahl	I. E. V. T. Co.	E.
C. W. O'Conner	I. E. V. T. Co.	E.
J. G. Francis	I. E. V. T. Co.	E.
John A. Patterson	I. E. V. T. Co.	E.
C. J. French	I. E. V. T. Co.	E.
G. H. Rickerman	I. E. V. T. Co.	E.
Edward Johnson	I. E. V. T. Co.	E.
John Smith	I. E. V. T. Co.	E.
George H. Stout	Exhibition, manufacturer	E.
Owen Murphy	I. E. V. T. Co.	E.
Walter L. Upson	Public	E.
Joseph Ledwiuka	Private	E.
Walter A. Crowdus	Exhibition	E.
Miss C. Neely	Private	E.
W. A. Burnham	Private	E.
Marshall F. Holmes	Public	S.
C. H. Matthiessen	Private	E.
W. E. Brown	Private	E.
John Anderson	Private	E.
F. W. Loreless	W. M. V. Co.	E.
W. R. Donaldson	W. M. V. Co.	E.
B. E. Goodrich	W. M. V. Co.	E.
John H. Low	Private	E.
Charles Hoffman	Public	E.
E. D. Brock	Public	E.
George E. Foster	Private	E.
T. B. Jeffrey	Private	E. and G.
Otto Unzicker	Private	E., G. and S.
John W. Bates	Private	G. and S.
F. M. Brinkerhoff	Private	S.
J. B. Burdett	Private	S.
A. B. Porter	Private	S.
R. C. Jeturke	Private	E.
Burton Smith	Private	E.
Mrs. F. W. Newman	Private	E.
F. W. Newman	Private	E.
Charles T. Yerkes	Private	E. and S.
Benjamin H. Marshall	Priv. and I. E. V. T. Co.	E.
John J. Strohm	I. E. V. T. Co.	E.
J. W. Scott	Private	E., S. and G.
B. C. Hicks	Private	E. and G.
A. R. Stuner	Private	E.
G. L. Harvey	Private	G.
M. E. Pine	Private	S.
Frank Northhelper	Private	E.
L. O. Van Riper	Private	S.
Frederick Irving Lake	Private	E.
H. H. Newton	Private	E.
Charles P. Champlin	Private	E.
A. L. Utz	Private	E.
F. W. Brown	Private	E.
J. B. Conrad	Private	E.
S. C. Coleman	Private	E.
F. C. Donald	Private	S.
F. E. Rich	Private	E.
T. C. Hewitt	Private	E.
Charles H. Fergusou	Private	S.
F. A. Hadley	Private	E.
T. L. Higgins	Private	E.
W. J. Wuser	Private	E.
J. H. Reid	Private	G. and E.
H. Wrightman	Private	G.
Christ Brookins	I. E. V. T. Co.	E.
Robert I. Howes	Private	E.
F. S. Canda	Private	G.
Norman Williams, Jr.	Private	E.
W. O. Kutsche	Priv. and W. M. V. Co.	E.
L. D. Sheppard	Private	S.
Henry B. Tefft	Private	E.
Carrey Canda	Priv. and W. M. V. Co.	G.
Eugene Bivert	Private	E. and S.
J. T. Palmer	Private	S.
Britton Laue	W. M. V. Co.	E.
J. K. Robinson, Jr.	Private	E. and G.
William S. McMillen	Private	E.
R. B. Fort	Private	S. and E.
J. D. Hubbard	Private	G. and E.
Marion Richey	Private	E.
Thomas Halliday	Private	G.
R. T. Crane	Private	E.
B. J. Arnold	Private	E., S. and G.
W. S. Goll	Private	E., S. and G.
R. P. Searle	Private	S. and G.
A. L. Kuehmsted	Private	E.
F. C. Green	Private	S.
E. F. Brown	Private	S.
George E. Miller	Private	S.
Ross Judson	Private	S.
J. Schevimm	Private	G.
J. O. Durand	W. M. V. Co.	E.
W. E. Railsback	W. M. V. Co.	E.
Frank Ewold	W. M. V. Co.	E.
A. W. King	Private	G. and S.
James A. Pugh	Private	G.
Morris Vehon	Private	E.
William R. O'Dell	Private	E.
Adolph B. Babcock	Private	E.
B. M. Young	Private	E.
Walden W. Shaw	Private	G.
Otto V. Bachelle	Private	G.
W. P. Robinson	Private	E.
W. W. Robinson	Private	G.
Hugh E. Miley	Private	G.
John L. Lewis	Private	E.
Orville E. Babcock	Private	E.
W. R. Breneman	Public	E.
Arthur Chester	Public	E.
W. J. Gregory	Private	E.
Robert D. Camp	Private	S.
R. G. Burdick	Private	S.
Si Mayer	Private	G.
W. D. Sargent	Private	E. and G.
Prince Nicholas Eugalitcheff	Private	E.
R. A. Waller	Private	E.
J. F. Gunther	Private	G.
John McGrath	Public	E.
Martin F. Hauson	Private	E. and G.
G. E. Sparks	I. E. V. T. Co.	E. and G.
Frank V. Sackett	Private	E.
Walter A. Boal	Private	S.
W. D. Glenn	Private	E.
Paul Rainey	Private	G.
Ogden T. McClurg	Private	S.
H. J. Baldwin	Private	G.
Asa J. Milman	Business	S., E. and G.
Peter Paulsen	Private	G.
B. F. Harris	Private	S.
Isaac Miller Hamilton	Private	E.
Hubert C. Downs	Private	G.
George W. Webster	Private	E.
E. J. Day	Private	G.
John Gibbs Lovell	Private	S.
Miss Francis K. Sargeant	Private	E.
Miss Mary Ryan	Private	E.
Charles C. West	Private	G.
Hugh J. Ellis	Private	E., S. and G.
William Montague	Private	E.
Frank S. Washburne	Private	G.
Holton Serum	Business	E.
George W. Nelson	Business	E.
Peter Nelson	Private	E.
F. W. Gresham	Private	E.
C. A. Allen	Private	E.
F. R. Shepard	Private	E.
Jacob Spengler	I. E. V. T. Co.	E.
Allen Blanchard	Private	S. and G.
Sam C. Beck	Private	S.
George H. Ellis	Private	G.
George G. Spencer	Private	E.
A. H. Brumbeck	Business	G.
E. H. Farquhar	Private	E.
M. M. Mahoney	Business	G.
H. C. Porter	Bus. and Priv.	E., S. and G.
A. O. Kuehmsted	Private	E.
Charles W. Duer	Business	E.
J. M. Morehead	Private	E.
H. A. Lange	Business	E.
Frank Spaulding	Public	E.
Leroy Loveless	Public	E.
William Fielding	Public	E.
D. Weaver	Private	G.
W. R. Cole	Private	G.
Charles Gustafson	Private	S. and G.
Miss Emlen S. Blye	Instructor	G.
Charles N. Peterson	Business	E.
Henry K. Holsman	Private	G.
Charles H. Stonehill	Private	E.
Charles E. Hyman	Private	E.
Cornelius Malo	Business	E.

Note.—The abbreviations used in the above list are as follows: I. E. V. T. Co., Illinois Electric Vehicle Transportation company; W. M. V. Co., Woods Motor Vehicle company; C. M. V. Co., Chicago Motor Vehicle company; E., electricity; S., steam; G., gas or gasoline.

Suggestions for Exporters.

Washington, D. C., September 8.—Attention has been frequently called to the dangerous haste with which American manufacturers have granted exclusive agencies for continental Europe and Great Britain, when they were personally sought by well-accredited foreigners, who represented undoubted financial responsibility, frequently ready to pay from 70 to 90 per cent. on consignments. Our American manufacturers have been urged, more than once, to take time in which to investigate and satisfy themselves that the motive behind such a proposition was not an intention to control and hamper a possible future competitor, and to buy American styles in merely nominal lots, while strong efforts would be made to sell foreign adaptations of the articles. It is positively known that a great deal of such trickery is practiced on Americans.

Consuls repeatedly warn, until they feel that their warnings become tiresome, and they see that the initial efforts of American manufacturers are beset with so many difficulties, no matter what plans are formed or directions taken, that they despair of offering suggestions. But, because of the excellence of our manufactures, American export trade is growing rapidly, despite every obstacle that might be named, not the least of which is bad trade methods, so it is presumed that all will come right in the end. There has, however, been much dearly bought experience, and it is hoped that the timely consular warnings have saved many Americans from the pitfalls experienced by others in different lines.

These failures in export efforts are often traceable to too great impatience on the part of the American manufacturer; also to unwillingness to accept new trade conditions and to an evident reluctance to make special styles. Salesmen are not given time sufficient in which to build up new business. The slowness of foreigners to take up new things and ideas is not believed when it is reported by the salesmen, whose whole interest, indeed, is the home interest. Salesmen's advice is unheeded, and the fact that it took time to build up the original home business in the face of smaller obstacles is entirely forgotten. Building up a foreign business is as much an investment, requiring the expenditure of both time and money, as is the addition of a new wing to the home factory. A. F. T.

Depreciation in Detroit.

Many of our readers, says Public Policy, will readily recall how jauntily the Public Lighting Commission of Detroit disposed of the question of depreciation in its first annual report. We now learn from a report of the proceedings of the lighting commission, published in the Detroit Journal, that the facts of depreciation are causing this question to become a practical condition that must be dealt with. The report says:

The public-lighting plant has been allowed wofully to deteriorate.

The entire power plant will have to be overhauled.

The lamps have not been renovated for two years and are causing great trouble.

The roofs of the power house are leaky and defective.

The line poles are rotting away.

The dock is in very bad condition.

There is no reserve power in the plant and more power must be added.

The machinery and lines have not been properly maintained and will have to be overhauled and repaired.

The dock back of the works is rotting away.

To this statement the assurance is added that "no stone will be left unturned to put the plant into first-class condition."

This proves what we have always said. Depreciation is as much a part of cost as coal for fuel. Statements showing low cost per lamp per year that do not properly provide for depreciation are false.

The Ravenna (Ohio) council has granted a franchise to the Portage Lakes Traction company to construct an electric railway in Ravenna.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Work and Prospects in the Philippines.

PART II.

Good Work of Signal Corps.

Although the inferior Spanish line is practically the only line for the public and is confined in its operations to the field in the vicinity of Manila, there are a great many lines working in all parts of the islands which have been put up by the Signal Corps of the United States Army. A notable feature about these lines is the clearness of the voice transmitted, even for long distances. The many lines which extend from main garrisons to sub-stations, usually from five to 25 miles in length, are operated with such clearness as to draw forth praise from the persons using them. There is a line in service along the garrisoned coast line of Panay, recently visited by your correspondent, where the sound of one's voice is heard at the instruments almost as clearly as if the person were in the same room. In some places it has been arranged to relay the messages over long-distance lines which run over the mountain ranges and through the depths of the jungle,

Guard for Telephone Linemen.

Linemen with Supplies Crossing a River.

TELEPHONE WORK IN THE PHILIPPINES.

but in most cases where these intersecting stations have been arranged it has been found that the messages are transmitted with sufficient clearness the whole distance, thus doing away with the relay stations.

Use of the Telephone Lines.

The government is not at all stingy with its telegraph or telephone wires, and although both are intended exclusively for the use of the military officials, the natives are permitted to send messages for a small fee over the telegraph line and use the telephone free, if they do not interfere with the regular business of the office. This is a good plan, for it is gradually educating the natives into the benefits of using a telephone line, and when civilians put in a public system they will find that the business men and others of the locality are in readiness to take advantage of the rapid means of communication.

Telephones Would Be Taken Readily.

A reason why telephones would be put in readily by many of the commercial houses of the leading cities is that it is the custom in this country for the merchants in the cities to have branch stores distributed throughout the smaller towns and barios of the island. Often one city merchant will own or control 25 to 50 small stores in the outlying sections. There are rich Chinamen here who control many stores in the mountains in this way, they themselves remaining at the central city, from which point they have heretofore communicated with their agents by means of runner or pony rider. All of these merchants would take advantage of the telephone and put in instruments. This would save them much time and give them the opportunity to communicate with their agents in the country and transmit instructions to take advantage of the different conditions of the market. All of these representative storekeepers and agents are well off, and I have usually found them willing to adopt new American ideas. Anything American seems to be useful to them, and they place their money liberally. For instance, some of the merchants are engaging the services of discharged American soldiers, who were formerly electricians. These electricians are having all the work they can handle in erecting home-made electrical devices for operating electric signs, lighting of stores on a small scale and running fans, etc. The merchants do not lack the money with which to have these modern devices introduced, and if an opportunity were offered them to have telephone instruments in their stores, they would take advantage of the chance very promptly.

Lines Would Pay Well.

There is no doubting the fact that any sort of a telephone line in the Philippines would pay. The old Spanish line in Manila, with its worn-out, unclean and broken-down equipments, pays a very large profit to the company, and would pay much larger if the scope of the system were increased. The returns are limited by the small capacity of the system. There are lines required in all of the islands of the group in which there are mercantile houses in operation, manufactures going on, or transactions in progress related to the mines, the dye woods or the rice and tobacco crops of the country. The plantation owners are very anxious to have lines put in through their sections, for if means for communication were available, the business, which has been gradually increasing since American occupation, would be doubly benefited. The vast hemp industries, as well as the sugar-mill manufactures, are handicapped through lack of proper modes for communicating with the coast line or with the distributing centers. Then there is the fabric industry of the archipelago, which has grown to immense proportions recently, there being several hundred thousand of the old-fashioned hand looms in operation making the fine silken fabrics for which the weavers of these islands are noted. There is no way to move these vast textile products at the most convenient time for the profitable disposal of the same, owing to there being no telephone lines to the cloth-weaving districts. If lines were established so as to have communication with the coast, it would be possible for the agents of the weavers to handle the goods to better advantage, as they could ship them to the seaports at a time when the prices are most favorable.

Organization of a Company.

The formation of a stock company for the introduction of telephone lines in Luzon, Panay, Negros and other of the most important islands would not be a difficult problem at the present time. There is an abundance of money here in the possession of the wealthy sugar-mill owners, dye-woods dealers, plantation owners and others. Just as soon as it could be shown that definite plans had been formulated for the organization of a company the stock would sell readily, and for cash. The instruments would be liberally subscribed for, because there are so many business firms waiting for the opportunity to place telephones in their establishments. Of course, all of the parts of the system needed in the placing of the instruments and the erection of the line would have to be sent in from America or other place. There is opportunity to purchase tools with which to work in Manila, Iloilo and other of the chief cities of the islands, but no one has yet undertaken to put in a supply of telephones, switchboards and telephone appliances. The time may come when devices related to telephones will be manufactured in these islands, but for the present these articles must be secured from the home manufacturers.

Putting in the Line.

I have noticed that many manufacturers of commercial articles, and others concerned in the industrial enterprises, have hesitated about coming here to start business, owing to the supposed lack of the right kind of employes. Take the telephone business, for example. If a company were to start to put up a line to-day, there would be a great many applications for positions as linemen from men who have served their time in the Signal Corps of the United States army, and who can get higher wages working for a private concern. Then there are many soldiers in the regiments here who are about to be discharged, who by trade are linemen, or have been connected in some capacity with telephone institutions. These men are competent, and can be had at reasonable wages. Gangs of these men would go ahead and secure natives for doing the digging of holes, cutting of poles, etc. There would be no trouble in getting the line of wire established.

As For a Guard.

The most of the cities and towns are peaceful now, but in the hills and jungle there are certain roving bands of ladrones and guerillas that make a business of killing, looting and burning, and to avoid these the present forces of Signal Corps men have a soldier guard with them, of from four to 10 men. A similar guard would be provided for private enterprise, for it is the wish of the military commanders in these islands to have improvements made, and whenever necessary the proper guards will be provided to protect persons and properties from the raids of the freebooters of the mountains. Therefore, the telephone company need have no fear concerning the protection of its men engaged in the field stringing wires and placing instruments wherever needed. The writer has been out several times with Signal Corps detachments, and although the enemy has often come within range, they have never molested the men.

G. W. T.

Notes from Ohio.

Senator Foraker was in Columbus Friday of last week and appeared before the state Board of Appraisers and Assessors in the interests of the Cincinnati Telephone company to argue for a reduction of the tax rate placed upon it. The telephone companies of the state in general seem to feel that the tax rate is too high and they are making an effort to have it reduced. The senator presented a number of reasons why these companies should not be placed under a burden at this time while in the formative period, and asked the board to take into consideration all the conditions surrounding the matter and make a reduction commensurate with the situation.

The Portsmouth Telephone company has proposed to furnish the public schools of Portsmouth with nine telephones at the rate of $120 a year. Strange to say, the offer met with some opposition and was laid over at the last meeting of the board of education. Just what that body expects to get for its money is not entirely clear to an outsider.

The Citizens' Telephone company of Columbus and the Central Union both had instruments in the offices of the state fair grounds this year. The Independent company also had telephones outside where they could be used by the public and had long-distance connections, so that persons wishing to speak with others outside of the city could do so.

Henry Bartholemew, wire chief of the Baltimore and Ohio Railroad office at Newark, has been granted a patent on a new system of multiplex telegraphy, for which claims of superior merit are made. Two dispatches may be sent over the wire at the same time, without interference and greater flexibility and wider range than those of any other system are claimed.

Evan Shelly, manager of the Lafayette (Ind.) Telephone company, has invented a pocket telephone for the use of police officers and others. It consists of a small transmitter and receiver so arranged that a small plug may be inserted in a telephone circuit and connection with the central office can be secured immediately. The whole instrument weighs only about 17 ounces and it can be carried in the pocket conveniently. Tests at long distance have been made, and it was found that the instrument operated successfully.

A complete system of telephones is being installed at the Gibson House, Cincinnati, which is now being rebuilt and refurnished. The system consists of 150 stations, or one for each room, with a switch room in the office which will be presided over by an operator. Twelve persons can talk over the system at the same time without crossing, and the guests may talk with each other as well as with the office. This is something new in hotel telephones in Cincinnati, and in most other Ohio cities, for that matter.

The Citizens' Telephone and Message company of Fostoria, Ohio, has filed notice with the secretary of state of an increase of capital stock from $25,000 to $50,000. The president of the company is W. C. Beckwith and the secretary is H. A. Tremaine.

The Mineral City Home Telephone company of Mineral City, Tuscarawas County, has been incorporated by George J. Markley, T. E. Wilson, E. Vankirk, John L. Kennedy and C. D. Juvinal to construct and operate lines in Mineral City and throughout the county. The capital stock is placed at $12,000.

K. F. Briggs, manager of the Home Telephone company at Tiffin, has purchased the Daily and Weekly News of that place. Mr. Briggs is an old newspaper man and has been postmaster in his city.

William Christy and J. R. Nutt of Akron have been advised that their new telephone company at Elgin, Ill., has been granted a franchise to construct and operate a plant.

The North Ridgeville Telephone company of North Ridgeville, Lorain County, has been incorporated, with a capital stock of $2,000. The incorporators are H. F. Culver, E. F. Allen, C. T. Winckles and W. W. Boynton.

Howard Swartz has been made manager of the Star Telephone company at Ashland.

The Stark County Telephone company of Canton has been incorporated, with a capital stock of $100,000.

O. M. C.

The Tesla Patent Decision.

Further details of the decision of Judge Townsend of the United States Circuit Court for the District of Connecticut, upholding the Tesla rotary-magnetic field patents in the case of the Westinghouse Electric and Manufacturing company against the New England Granite company, are of interest.

Judge Townsend, in sustaining Tesla's claims, directed attention to the sweeping changes brought about in the electrical arts by Tesla's inventions, and paid a strong tribute to the inventor's genius. In reviewing the history of electrical power transmission, the court referred to the earlier state of electrical science when direct current was alone used for the transmission of power, and pointed out the limitations which characterized this method. He then showed that efforts had been made to transmit power by the simple alternating current and that this system had proved inadequate, especially for variable loads. He then went on to state that at this stage of electric science, marked by the limitations of direct-current systems on the one hand and the impracticability of alternating-current systems on the other, Tesla's brilliant conception of the rotating field placed the transmission of power over considerable distances for the first time on a practical basis.

The court then took up in detail Tesla's three fundamental patents (Nos. 381,968, 382,280 and 382,279), covering respectively an electromagnetic motor, the transmission of power therefor, and specific designs of induction apparatus, and reviewed the respective position of the litigants. The defendant alleged that magnetic progression or rotation was not a new principle, but had been known in essence since Argo caused a copper disk to rotate by the rotation of an adjacent horseshoe magnet, subsequent to which Bailey had produced rotation in a similar disk by "an intermittent rotation of the field affected [effected?] by means of electromagnets."

Upon this point the court made an exhaustive analysis of the state of the art at that time, showing that Bailey had not used alternating currents to operate this motor, which was admitted by the defendant to be only a laboratory experiment.

The Westinghouse experts compared the operation of Bailey's intermittent field to the action of "propelling a boat with oars hung on pins so as to be incapable of feathering, and which are held rigidly in the water for a considerable time after each stroke before they are advanced for the next. It is evident that this method of propulsion would involve a large waste of power, since the oars would act alternately to propel and to stop the boat, and the method would be practically useless. Using the same analogy, the action of Tesla's continuously rotating field would be like that of the ordinary screw propeller, in which all the power is applied in a continuous push forward."

With reference to the Siemens and Gramme multiple-circuit machines and other early apparatus, the court cited the contentions of the defendant that these machines embodied in themselves the elements necessary to their operation as motors, and that with "suitable modifications," they would have shown the essential qualities of the Tesla apparatus. On this point the court held that whatever elements of this character these earlier machines may have possessed, such elements were at no time developed, and that their development would have required such a series of experiments, such a departure from then existing theories, and such development and application of devices in unexpected and non-analogous ways, as would in themselves have constituted invention. The court further said, "Siemens himself as late as 1884, and Alteneck, the other inventor of said Siemens' patent, admitted in 1881 that they did not know that alternating currents could be used as (in) motors," this statement being substantiated by sufficient evidence.

In 1887 C. B. Bradley made application for a patent on a dynamo-electric machine, which, the defendant contends, was a two-phase machine; but the court declared that the single specific object of Bradley in this construction was to "obviate difficulties and limitations" in prior constructions, and that he did not indicate any combination of the alternate currents for a single motor or show that he had any conception of their use, if at all, otherwise than separately in single-phase motors.

The court further held that Bradley's claims were limited in scope, were ambiguous and indefinite, and failed in showing any conception, on the inventor's part, of the Tesla idea of the production in a motor of a progressively shifting magnetic field by means of two or more independent alternating currents, differing in phase, and circuits which preserve the independent character and phase relation of such currets and added: "Even if the idea had been first conceived by Bradley, it was not sufficiently described to disclose the principle or method of operation. * * * Tesla was the first to reduce this principle to practice. Bradley does not anticipate or limit."

The defendant's chief reliance was upon the Marcel Deprez publications of 1880-84. In these Deprez had shown a device called a "comparer," in which a stationary ring of iron, carrying two independent windings, was employed. Into these two circuits currents of different strength were simultaneously thrown, the resultant polarity of the ring depending upon the ratio between the two current strengths. As a practical application of this device, Deprez describes the construction of a new form of compass, the needle of which was to respond to the varying current strengths induced in the two windings by changes in their position relative to the earth's magnetic axis. Deprez did not conceive even now of the Tesla idea of utilizing regular, progressive alternations of current, as is conclusively shown by his own statement, made in 1884, that "alternating currents are of no use in the transmission of power; they are suitable only for lighting purposes."

The court stated that, on the other hand, Tesla's underlying thought was "the use of the rapidly successive opposing alternation of the alternating current, regularly and constantly recurring in such differing phases as would not only prevent the alternations from stopping the armature, but would become a source of power. It was essential to the practical development of this idea that the alternations should rise and fall and succeed each other progressively and constantly and should be arranged, as counsel for complainant puts it, 'like the crank on a locomotive in which there is no dead center, but one crank is always pushing forward.'"

Such, then, was the status of the art in 1887, when Tesla filed his applications for patents. Prior to his invention alternating-current motors were not in use, although there had been an urgent demand for some practical means of utilizing alternating currents for power transmission. This demand had been emphasized by the rapid development of the electrical art in other directions, but the leading electricians of the day concurred with Deprez in his declaration that alternating currents could not be used for the transmission of power.

It was at this juncture that Tesla patented his invention, introducing a new method, a new means and a new terminology into the art. The prompt recognition of Tesla among electricians, as the original inventor of a new system and of means for its practical application is abundantly supported by the literature of that day. Tesla did not originate the parallelogram of forces or discover the rotary field, but he was the first to do practically what Bailey had said could be done by an impracticable, if not impossible, apparatus, and what others had vaguely said could be done without indicating the means.

Judge Townsend declared that Tesla, having stated the discovery by himself of a method whereby alternating current could be utilized for power, and having shown the actual machine and method, was as much entitled to a patent for this discovery as were the discoverers of the application of electricity to the telegraph and the telephone, and he added: "A careful study of the evidence has led to the conclusion that Tesla made a new and brilliant discovery. But even if this be incorrect, it is proved that by a new combination and arrangement of known elements, he produced a new and beneficial result never attained before."

The defendant tried to establish a point by showing that in the construction defended none of the transmitting circuits of the system consisted of two conductors specially devoted to any one of the differing phase currents, whereas the patents show two line conductors especially devoted to a single one of the differing phase currents. The court, in commenting upon this point, called attention to the question as to the construction to be placed upon the word "independent" in the Tesla patents, the complainant contending that Tesla's broad invention was the production in a motor of a progressively shifting magnetic field by means of independent alternating currents differing in phase and circuits which preserve the independent character and phase relation of the currents, while the defendant alleged that the words used in Tesla's patent ("induced circuits connected independently to corresponding circuits in the motor") referred to the physical relations which exist, and not to any result produced. But in Tesla's original specification he says: "By 'independent' I do not mean to imply that the circuits are necessarily isolated from one another, for in some instances there might be electrical connections between them to regulate or modify the action of the motor without necessarily producing a new or different action." This clause of Tesla's specification fully answers the last contention of the defendant, who is shown not to have invented any new idea but to have adopted an old contrivance which performs the same result in substantially the same way by a formal and unsubstantial change in means.

In conclusion, Judge Townsend referred eloquently to the genius of Tesla in seizing and adapting to purposes of utility what others had long looked upon as contradictory forces and impassable barriers. He said: "The searchlights shed by defendant's exhibits upon the history of this art only serve to illumine the inventive conception of Tesla. The Arago rotation taught the schoolboy 50 years ago to make a plaything which embodied the principle that a rotating field could be used to rotate an armature. Bailey dreamed of the application of the Arago theory by means of a confessedly impossible construction. Deprez worked out a problem which involved the development of the general theory in providing an indicator for a ship's compass. Siemens failed to disclose the 'suitable modifications' whereby his electric-light machine might be transferred [transformed] into a motor, and Bradley is almost equally vague. Eminent electricians united in the view that by reason of reversals of direction and rapidity of alternations, an alternating-current motor was impracticable, and the future belonged to the commutated continuous current.

"It remained to the genius of Tesla to capture the unruly, unrestrained and hitherto opposing elements in the field of nature and art and to harness them to draw the machines of man. It was he who first showed how to transform the toy of Arago into an engine of power, the 'laboratory experiment' of Bailey into a practically successful motor, the indicator into a driver. He first conceived the idea that the very impediments of reversal in direction, the contradictions of alternations, might be transformed into power-producing rotations, a whirling field of force. * * * A decree may be entered for an injunction and accounting as to all the claims in suit."

Electricity in the German Navy.

In a recent issue of the Elektrotechnische Zeitung there appeared an article on the use of electricity in the Germany navy, from which the following abstract is taken:

Up to the year 1895 the use of electricity on board German war vessels was limited to the lighting of the various rooms of the ship, and the running of the searchlights. It was only at the end of the year 1895 that electricity was used on a larger scale as motive power on board the coast-defense cruiser Ægir. The main plant on that vessel consisted of nine dynamos of 120 volts' potential; three of these dynamos, of 48 kilowatts each, were driven by steam engines, and the remaining six, of 33 kilowatts each, by three steam turbines, one turbine driving two dynamos. Besides lighting the interior of the vessel, working the telegraphic navigation apparatus, the signal lanterns, the searchlights, etc., the electric energy on board the Ægir is also used as motive power for ventilating purposes in the engine and other rooms of the ship, for the handling of the ammunition, for turning the big guns, for working the cranes, windlasses and capstans and, for a short time, it was also used for dropping and lifting the anchors. It was, however, soon found out that for the special work of operating the anchor spills, steam was better adapted. Since that time electricity has been introduced on board most of the German warships. The large war vessels of the so-called "Kaiser" type now building at Stettin, Elbing and Hamburg, are all to have electric plants of four machines of 60 kilowatts each. The lighting of the interior of these vessels alone requires from 35,000 to 40,000 watts, and the searchlights from 45,000 to 50,000 watts. The remaining energy will be used as motive power for ventilating purposes, for handling the ammunition, for the turning of the 15-centimeter protected towers, for working the coal-conveying machinery, refrigerating plants, etc. These ships will also be provided with accumulator batteries for the apparatus, by means of which the commands will be given. One of the greatest electric plants so far installed on board a German war vessel is that on the protected cruiser Prince Bismarck, now in Chinese waters. It consists of five 110-volt machines of 65 kilowatts each.

In connection with the above remarks, the attention of American electrical engineers may be called to the fact that, according to the new German naval bill, the German government will spend for the next 19 years, every year, the amount of nearly 225,000,000 marks ($53,550,000) for new vessels, and there will undoubtedly be more than one opportunity for American manufacturers to get some of the big orders which will be placed from time to time. American refrigerating machinery especially enjoys the highest favor among German engineers, and it has often been mentioned in leading German technical papers that the refrigerating plants on board our men-of-war are "model installations."

Infringement on Electric-car Patents Claimed.

There has been filed in the Federal Court at Milwaukee a complaint in a suit brought by Benson Bidwell and Clara Bidwell of Chicago and Charles F. Bidwell of Toledo, Ohio, against the Milwaukee Electric Railway and Light company. The plaintiffs allege that the defendant has infringed on certain patent rights owned by them, and ask that a perpetual injunction be granted restraining the defendant from any further construction or use of the patent right. The plaintiffs allege that they are the owners of the patent whereby electric cars are lighted with the same electric current taken from the line conductor that is required to operate the electric motor on the cars, and that the street-railway company is using this patent without any license or authority from the plaintiffs. It is further alleged that the system of electric railroad operation was originally invented by Benson Bidwell. Some time ago a suit of this kind was commenced in Toledo, but it is stated that the defendant in that case settled for $10,000. Similar suits, it is reported, have been instituted in several other cities—San Francisco, Minneapolis, St. Paul, Indianapolis, Detroit, Grand Rapids and Logansport—and as rapidly as these are disposed of the Bidwells will take up other cities, Chicago among the number.

The county commissioners at Decatur, Ind., have granted a franchise to J. B. McIlhenny of Cincinnati to construct an electric railway from Decatur to Fort Wayne.

Fuller Double-acting Engine.

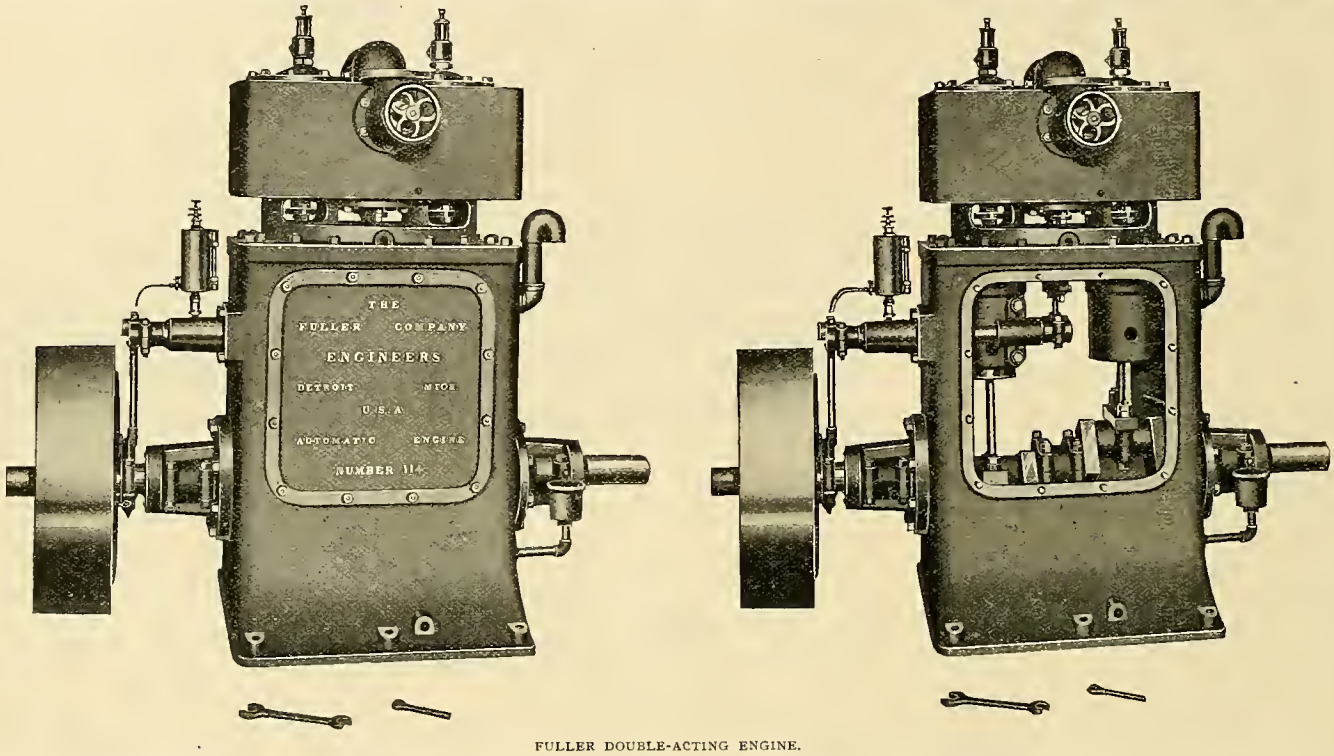
The demand for a satisfactory engine that will run noiselessly at the high speed required for dynamos, fans, blowers, centrifugal pumps, etc., has enlisted the abilities of the ablest engineers in all countries, most of whom have worked on the line of improving the ordinary double-acting engine, and while great advancement has been made on those lines, there is still much to be desired. The natural difficulties of the ordinary double-acting engine for high speed have led to the introduction of the single-acting type for that service, and while this type has eliminated some of the difficulties, it has natural disadvantages of its own that make it undesirable, and it has therefore failed to supplant the ordinary double-acting type.

The Fuller company of Detroit, having had large and unpleasant experiences with both the double and single-acting types, has designed a double-acting engine, which is said to combine the advantages of both, without their disadvantages. This engine is set vertical and has the usual cylinder, piston rod, crosshead, guides, connection rod and double cranks of the double-acting engine, but the operation of the steam on the piston is entirely different, the so-called Cornish cycle being used, and it is claimed to be the only engine of the type made in America for high speed.

The high-pressure steam is admitted to the top of the cylinder only. After having done its work there, it is transferred below the piston by the valve establishing equilibrium between both ends of the cylinder and closing at the proper point on the up stroke of the piston, to prevent any tendency of connections leaving the crank pin. On the down stroke the steam is exhausted to the atmosphere, or to a condenser, where the vacuum forming under the piston removes the back pressure. Thus, the piston at all times, whether working condensing or non-condensing, exerts a downward pressure on the crank pin, which enables the engine to run noiselessly at high speed.

The stuffing box of the piston rod is in the open space between the cylinder and crank case, and, being on the low-pressure side of the cylinder, can be quite slack and free from friction. The engine is of the enclosed type, with splash lubrication, which offers so many advantages where run at high speed. The Rites single-weight governor, which will regulate within two per cent., is fitted on the engine.

The engine is built of the best material and workmanship, with single or double cylinders, compounded, if desired, and is adapted to any service where a noiseless high-speed engine is required. These engines have large doors in the crank case, both front and back, and when these are removed all parts are as accessible as the parts of any ordinary open engine. These noiseless engines are especially suitable for hard work in dirty and dusty places, where ordinary engines would suffer in their moving parts from such dirt and dust. Owing to the absence of knock, the bearings and brasses wear a much longer time, never requiring "taking-up" or adjusting, the engines working noiselessly until the brasses are worn through, when they can then be removed and replaced at as low a cost as those of any double-acting engine.



FULLER DOUBLE-ACTING ENGINE.

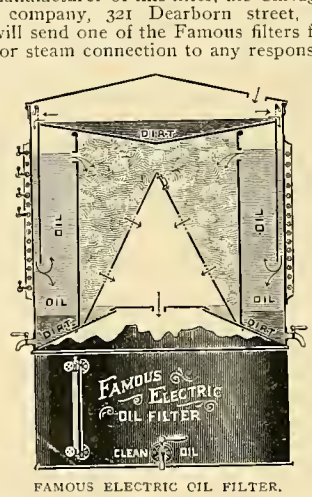
The Monte Christo Railway company of Everett, Wash., has been incorporated, with a capital stock of $200,000, by J. B. Crooker, W. V. Butler, F. H. Brownell and S. N. Baird.

Famous Electric Oil Filter.

In order to filter successfully certain grades of oil it is necessary to employ a low initial heat in order to thin the oil so that the minute impurities may be easily precipitated and removed. In the Famous oil filter shown in the accompanying illustration steam has been successfully used to furnish this heat for a number of years, but it is only recently that electricity has been applied to this work. In this filter dirty waste oil is poured into a removable strainer which retains all of the coarser impurities. The oil passes through a large area of fine straining surface (around the removable strainer), then down toward the bottom of the purifying chamber.

The body of the filter with which the oil comes in contact is heated by passing an electric current through a solenoid jacket covered with asbestos, which surrounds the filter. The proper purifying temperature is safely and gradually communicated to the oil. The current flow and the proper temperature are easily controlled by connecting one terminal to the bottom post and the other terminal to the second, third or fourth upper post, as may be necessary to increase or decrease the amount of current in the solenoid jacket according to the quality of oil to be purified. This is believed to be the only successful electric filter ever made.

The manufacturer of this filter, the Chicago Boiler Cleaner company, 321 Dearborn street, Chicago, says it will send one of the Famous filters for either electric or steam connection to any responsible firm



FAMOUS ELECTRIC OIL FILTER.

with the understanding that if the filter does not meet its requirements, it may be returned. The company will also furnish free of charge to any interested engineer a copy of a booklet on modern engineering practice, as applied to oil filtration and lubrication. This booklet is said to contain much valuable and interesting information, covering not only a description of the Famous filter, but giving suggestions as to proper methods of lubrication, filtration, etc.

City Electrician Sayer of Denver has made an order that no men be employed on stage and scenery wiring in the theaters without passing an examination before him. The stage wiring in one of the Denver theaters has been condemned.

Some Street-railway Questions.

Readers of the Western Electrician will be interested in the series of questions prepared by the street-railway commission of Chicago and submitted to the citizens to test public sentiment on the street-railway problems that are pressing for settlement. The commission asks that answers, whether to all or a portion of the questions, be sent to its secretary, room 100, City Hall.

Following is the list of questions:

I. Unification of management.

(a) Do the public interests require that all the street-railway lines of Chicago should be brought under a single management, either through consolidation or through operating agreements?

(b) Should it be the policy of the city to treat the street-railway business as a monopoly? In other words, would you favor giving to a single corporation virtual assurance of a monopoly of the right to operate street cars in Chicago, provided that corporation on its part would undertake to furnish adequate service to the entire city on the basis of a unified system, the city government reserving authority to require, among other things, the building by such corporation of new lines as needed?

II. Duration of grants—public control.

(a) What should be the duration of street-railway franchise grants?

(b) Need renewals or extensions of grants run for as long periods as new or original grants?

(c) How is the city to insure that first-class service shall be constantly maintained throughout the term for which the franchise is granted and that plant and equipment shall be kept strictly up to date in all respects?

(d) Would you advise inserting in franchise grants hereafter made a provision giving the city the right at any time, upon stipulated notice, say of one or two years, to take over the property at an appraised valuation?

III. Quality of service.

(a) How does the service furnished by the street-railway companies of Chicago compare with that of other cities of which you have personal knowledge?

(b) What improvements in service for Chicago would you suggest as desirable and practicable?

(c) Please tell of any portions of the city that you know to be especially in need of additional transportation facilities or of improved service.

(d) Would you favor continuous car routes passing through the heart of the city in preference to the present system of downtown terminals, whether of the switchback or of the loop variety?

IV. Rate of fare and compensation.

(a) Ought it to be made possible for a passenger to ride from any point in the city to any other point for a single fare?

(b) What would you think of a graded-fare system or a zone system of fares for Chicago?

(c) Do you favor reduced fares during the morning and evening hours when working people are going to and returning from their work? Should there be reduced fares for school children?

(d) As between low fares and compensation in the form of payments into the public treasury, which do you prefer?

(e) What suggestions have you to offer with regard to compensation and method of determining fair compensation? What form should the compensation take?

V. Co-ordination of service.

The three principal means of local transit are the steam roads, the elevated roads and the surface roads or street railways. The steam roads—since the elevation of their tracks—and the elevated roads that operate express trains are prepared to furnish the most rapid transit. To these roads, by virtue of their speed, it would seem, naturally belongs the long-haul business, the street railways being better suited to the convenience of passengers desiring to ride moderate distances. Such being the case, should the city undertake, as a matter of public policy, to promote co-ordination between the surface lines and the steam and elevated roads? Particularly:

(a) Should the city require surface routes to be arranged on the basis of such co-ordination, where this arrangement would work to the benefit of the traveling public?

(b) Should special low fares be required for certain short rides over routes serving as feeders to steam and elevated roads?

VI. Municipal ownership.

(a) Do you favor city ownership of tracks without city ownership of power plants or rolling stock and with-

out city operation, the tracks to be leased by the city to an operating company?

(b) Do you favor the policy of municipal operation of the street railways of Chicago, either in the near future or ultimately?

(c) If in favor of city ownership of the tracks or of ownership and operation of the system, what plan for acquiring the property would you suggest?

VII. Publicity.

What plan would you suggest for securing proper publicity of the affairs of street-railway companies? Can you cite instances where provisions designed to secure publicity have worked satisfactorily?

VII. Labor policy.

(a) What provisions or methods of procedure, if any, would you suggest for securing to street-railway employes fair treatment and of insuring to the public immunity from interruptions to service due to labor controversies?

(b) Should the city, in street-railway franchises, prescribe either a minimum wage or a maximum working day, or both, for employes? If so, what should be the minimum wage and what the length of the minimum working day?

(c) As a means of avoiding interruption of service through labor disputes, would you think it advisable for the city to require the company, in accepting a grant, to agree to submit such disputes to arbitration? Have you any definite plan in this line to suggest?

IX. Subways or underground roads.

Do you favor a system of subways or underground roads in the downtown district for the accommodation of street cars, thus making possible the removal of all cars from the surface of the streets within that district? Will you state what seem to you to be the important considerations affecting this question?

X. Motive power.

(a) What suggestions have you to offer with regard to motive power for Chicago street railways?

(b) Should Chicago insist upon some such motive power as the underground trolley or compressed air in the central portions of the city, or in areas where the overhead trolley has not been permitted hitherto?

XI. Refereedum.

To what extent do you favor the application of the refereedum principle to franchise grants?

XII. Financial aspects.

(a) In the event of acquisition by the city of street-railway property from private corporations, what should be the basis of compensation? Should it be:

(1) The market value of outstanding stocks and bonds?

(2) The return to stockholders of money actually invested in the business?

(3) The cost of duplication, less depreciation, or some other basis not herein indicated?

(4) Should the "watering" of securities by street-railway companies be forbidden by law?

(5) Should companies be forbidden to issue bonds or otherwise to encumber their property for periods in excess of the time for which their franchises run?

(6) Would you favor the adoption here of the Massachusetts plan of requiring all stock and bond issues of street-railway companies to be approved by designated public authorities?

XIII. Frontage law.

What change, if any, would you recommend in the frontage consent law?

Eastern Cable Arrangements.

The Postal Telegraph-cable company has made a half-rate for cable messages sent in behalf of the officers and men of the United States army serving in China and their families and friends at home. This rate is for social messages in plain language, when these messages are sent and received through the adjutant-general of the army. The full rate to all China points where the American army is serving is $1.63 a word, including address and signature. The rate applying under the offer of the Postal Telegraph-cable company is, therefore, 81½ cents a word.

The Eastern Cable company of London, in reply to an inquiry from Adjutant-general Corbin, has notified the War Department that, owing to the trouble in sending dispatches across the land line between Shanghai and Chefoo, it has decided to lay a cable between those points.

Mr. Edison Denounces a Fake.

In reference to a report to the effect that Thomas A. Edison had invented a new system for the generation of electricity direct from coal without the intervention of engine, boiler or dynamo, with a prediction that it would revolutionize the world in electrical matters, the inventor is reported to have used this vigorous language: "It is a lie and a fake. There is not a word of truth in it from beginning to end."

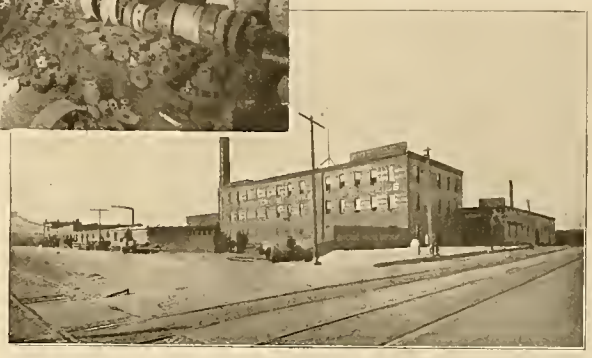
The Buffalo, Niagara Falls and Rochester Railway company has made application for permission to construct and operate an electric railway through the town of Wheatfield, N. Y.

A Great House-wrecking Plant.

Situated on the South Branch of the Chicago River, about one mile north of the Union Stock Yards, is the plant of the Chicago House Wrecking company. The company was incorporated in 1891, with a capital stock of $10,000, increased in 1899 to $150,000. To-day the company has a paid-up capital and surplus of $250,000. This notable growth has been due to the efforts of the following-named officers of the company: President, A. Harris; treasurer, F. Harris; secretary, S. H. Harris. These young men have to their credit a series of remarkable achievements.

The first contract of any note undertaken by the company was the purchase of the World's Fair at Chicago, which was built at a cost of $35,000,000.

Machinery Hall.



A GREAT HOUSE-WRECKING PLANT.

As the end of the World's Fair drew near the question that puzzled the exposition authorities was what to do with the buildings and how to clear the grounds. The Chicago House Wrecking company, at this juncture, offered to remove the structures and debris entirely from the grounds of the South Park commissioners within eight months, and offered a sum of $80,000 for this privilege. No other competitor caring to undertake a task of such magnitude, the contract was closed with the wrecking concern. It seemed like an almost impossible undertaking, and yet the contract was carried out to the very letter, and all that vast quantity of material fell into the hands of the company. What to do with the great supply of electrical apparatus, lumber, sash, doors, structural iron, pipe, roofing and the other items, was the problem that confronted the buyers. A catalogue, containing in detail the contents of the exposition, was finally compiled and mailed broadcast throughout the country. It was a unique and original idea, something never before heard of—a catalogue of second-hand machinery and building material. The reception accorded it exceeded the highest ambitions and ideas of its originators.

From this beginning the mail-order feature of the Chicago House Wrecking company expanded and increased at a rapid rate, until to-day it requires a force of 40 stenographers to answer the large amount of correspondence and inquiries that fairly pour in upon them. In the accompanying group illustration are shown two views of the clerical department and general offices.

Other contracts followed the World's Fair, notable among them being the Chicago postoffice and sub-treasury building (the original cost of which was over $7,000,000, and which was purchased by the company for $15,519), the Mackay Spectatorium at Chicago and a million-dollar hotel at Cumberland Gap.

In 1898 the great Omaha Exposition was opened. No money was spared in the construction of the buildings. The very best of material was used throughout, and the cost was in the neighborhood of $2,750,000. The electric-lighting effects were especially noteworthy and beautiful. The entire outfit was sold to the Chicago House Wrecking company for $50,000. By this purchase the wrecking concern obtained absolute possession of the complete exposition, including even the water and the fish in the lagoons; trees, shrubs and flowers; machinery, copper wire and innumerable other materials. The company was given five months' time in which to efface completely the exposition from the face of the earth, and the contract was completed one month in advance of the time set.

The buildings, warehouses and office of the company are situated at West Thirty-fifth and Iron streets, Chicago. They occupy a space of over 15 acres. The offices occupy two floors, each 150 by 125 feet. Employment is given to over 300 people. Visitors are always welcome.

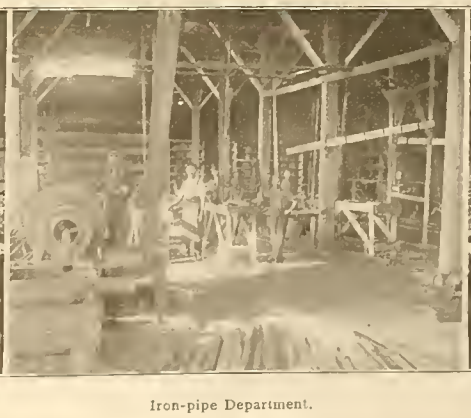
Entering the grounds of the company, one is surprised by the quantity and variety of material on every hand. Machinery Hall is shown in the picture at the left. It occupies a space 200 by 360 feet, and is completely filled with a vast quantity of electrical supplies, generators, steam, gas and gasoline engines, wood-working machinery, packing-house machinery, brick-making machinery, saw, milling and ice machinery. A large area is devoted to the repair shops of the company. The facilities for rebuilding all kinds of dynamos and machinery are unsurpassed by anything in the country. The company employs a large force of competent mechanics and is entitled to much credit for the manner in which it executes its work.

Independent of its machine shop, the company devotes a large area to a boiler department. It has just made a notable purchase in this line, namely, the complete boiler plant of Armour & Co., who have changed their motive power from steam to electricity. Inside the main building a complete floor is devoted to electrical supplies, most of which have been secured from the various buildings the company has dismantled. Large quantities of copper wire are in evidence.

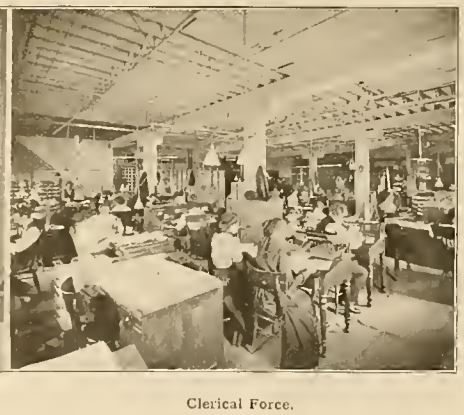
One illustration shows a corner of the space set apart for the operation of a large iron-pipe department, which appears to be one of the important features of the business. The company claims to handle more pipe than any firm in existence. It has a complete apparatus for the rehabilitation of second-hand pipe and flues. It is an interesting process and one worth seeing. In a tumbler which revolves at a rapid rate, the pipe is cleaned, and all rust and scales removed. The pipe is then taken to a machine that straightens it out and then onward into the hands of the cutter, who removes all defective portions. It is then taken into the threading department, and so on, until, when the operation is completed, the pipe appears to be fresh from the hands of the manufacturers.

In the yards of the company the amount of material in sight is really remarkable—tons of pipe, radiators and heating apparatus, fire departments on every side, carloads of rope, bathtubs, jardinieres and pedestals from bankrupt manufacturers; windows, doors and lumber from dismantled

General Offices.



Iron-pipe Department.



Clerical Force.

A GREAT HOUSE-WRECKING PLANT.

buildnigs; anvils, axes and supplies of every kind.

The buildings are devoted to stocks of merchandise secured from various sales. One large floor is used exclusively for the sale and display of leather and rubber belting and mechanical rubber goods in general. Hardware plays one of the leading features in the company's purchases. The company is constantly buying stocks of general merchandise at sheriffs', receivers' and manufacturers' sales.

For the convenience and well-being of its officers and employes the company recently fitted out a two-story building as a restaurant. This department is under the careful supervision of colored chefs and waiters.

The company's extensive mail-order business requires 12 catalogues to be issued every year, and its fall number—No. 156—giving prices and complete lists of the various materials carried, has just been published and will be forwarded upon request.

Storage Battery Working Under Water.

The municipal electric plant of Munich furnishes the remarkable case of a battery of accumulators which continued to work when submerged under water, says the Scientific American. The station is situated on an island formed by the Isar, and during the inundations of last year was partially submerged. The batteries of accumulators, which were on the ground floor, were first reached, and were soon entirely covered. One of the batteries was used on the city-lighting circuit and the other was connected in parallel with the dynamos for the traction system. As the tramway service had to be discontinued, the second battery was removed from the circuit, and it was thought that the batteries for the lighting circuit would also have to be cut out, as the flywheels of the engines were half under water, except two. Nevertheless, as it was almost indispensable to light at least the principal streets of the city, it was decided to try to operate the submerged battery. The attempt was successful, and the battery, which had been constructed to give 6,000 ampere-hours with a 600-ampere discharge, was able to furnish 4,000 ampere-hours during the night; the remainder was lost in discharges in the water. Encouraged by this success, the engineers charged the battery on the following day, and the discharge was repeated under the same circumstances. Two days after the water had lowered sufficiently to give access to the battery rooms; it was found that the density of the acid had fallen, but not to a very great extent; from 22° B. it had fallen to 20° B. only. It is thus seen that there was scarcely any diffusion. Outside of a layer of mud a quarter of an inch thick upon the top of the plates and the connecting rods, the inundation had left scarcely an appreciable trace. It was supposed at the beginning that it would be necessary to replace the acid of the batteries, which represented a considerable expense, as they contained more than 30,000 gallons; but as the acid held its strength, as shown above, a slight strengthening was all that it required.

John Chinaman Utilizes an Improved Clothes Line.

G. A. Wiese, the city electrician of Alameda, Cal., who went to China some years ago to install an electric-light system for the city of Canton, had some interesting experiences with the Chinese. Mr. Wiese thinks that he was the first man to put electricity for lighting purposes in operation in China. "In many places," said Mr. Wiese to a reporter, "the streets of Canton are too narrow for poles. We had to get permission of the authorities to cut holes in the walls of the buildings. Into these wooden cross-arms were inserted. After the cross-arms had been placed and the wires strung, I made a tour of inspection and was astonished to see that they were loaded with wearing apparel that had been hung out to dry. It was the biggest display of family washing I ever saw. A current of 1,000 volts was running through the wires at the time, but I didn't notice any Chinese corpses strewn along the wayside. When we warned the owners of the washing of their danger they only laughed, saying that the electricity would dry their clothes much quicker than the sun. I reported the matter to the Chinese officials. After that a guard of 40 soldiers accompanied me on my rounds to see that no more clothes were hung out."

The Chinese emperor presented Mr. Wiese a beautiful carved ebony cabinet as a mark of his regard for his achievements in Canton.

Electric Cars on the Thames Embankment.

The Daily Express of London says that the first electric street-railway line in London proper will probably be built, under the recommendation of the tram committee of the County Council, at a cost of £132,000 ($642,378) on the Victoria embankment of the Thames from Blackfriars bridge to new Battersea bridge, via Victoria street and Buckingham Palace road. Possibly the County Council will demand that the machinery, rails, trolley wires, cars, etc., be all of British manufacture.

President D. Young of the Jersey City, Hoboken and Patterson Street Railway company has authorized the announcement that the company would at once proceed to lay a new trolley line from the Hoboken ferry at Fourteenth street, Jersey City, N. J., to Hackensack, 14 miles distant.

CORRESPONDENCE.

London Letter.

London, August 28.—The total rearrangement of the system of lightning conductors on St. Paul's Cathedral is now virtually complete. It is interesting to learn from Mr. Killingworth Hedges, M. I. E. E., the electrician under whose superintendence the work has been carried out, that the old idea that the erection of a lightning rod on the highest point of a structure protected an area all round it is quite illusory. The safeguarded area was supposed to be the space within a circle whose radius was equal to the height of the lightning rod. This theory is now discredited and the cathedral has been protected by a system of conductors, perpendicular and horizontal, comprising over a mile of cables, to which at various prominent points are placed about 50 aigrettes.

The salt-water submarine cable is celebrating its jubilee to-day. On the morning of August 28, 1850, the necessary concessions having been granted, Mr. John Brett, Mr. Charles Fox, Mr. Francis Edwards and Mr. Charles J. Wollaston set out from Dover in the steamer Goliath for Cape Grisnez. They had previously made fast one end of a submarine cable to the Dover pier, and when the other end had been properly fixed at Grisnez they proceeded to astonish an incredulous world by sending the first under-sea message on record. It is stated by no less an authority than Mr. Wollaston, who, by the way, has just received a civil-service pension for his share in that memorable day's work, that the first message sent was from himself to his wife. It consisted of seven words and ran, "All right at Grisnez. Home about 10." For five days communication was maintained, and then a fisherman, expecting to land the largest conger eel on record, hooked up the submarine cable and broke it. The practicability of the scheme having been demonstrated, a stouter cable covered with guttapercha and bound with iron wire, was laid on October 16, 1851, and for nearly 20 years it remained in use.

During the afternoon of Saturday the foundation stone of a new central electric-light station at Battersea, to be erected at a cost of $285,000, was laid by the chairman of the local vestry. The president of the lighting committee explained that the work of laying the mains commenced on February 5th, and out of 13 miles 11 had been completed. All the work was done by what was called direct employment; that is to say, the contractor had no abiding place there. If required, it was intended to introduce the light into private houses, and it was hoped to place it within reach of the poorer inhabitants by supplying fittings without prepayment. Commencing with a charge of 11 cents a unit, the committee was in hopes of being able to reduce it to 10 cents.

The necessary money ($750) having been subscribed, an offer has been made to provide the North Staffordshire Infirmary with electrical apparatus of the most modern description for treatment of lead poisoning. This offer has been gratefully accepted by the authorities of the institution.

An arrangement of considerable importance to the mercantile community of Liverpool has just been authorized by the postmaster-general, which might with advantage be extended to other commercial centers. For some time past the Liverpool Chamber of Commerce has been endeavoring to promote an agreement between the postmaster-general, the cable companies and the National Telephone company, whereby cable messages arriving from abroad after ordinary business hours might be transmitted direct by telephone to the residences of the addressees or answers received by the telephone company for transmission abroad by the cable companies. The postmaster-general, who has taken great interest in the matter, has written a letter to the chamber, stating that the facilities asked for will be granted.

An admirable text for a sermon on the moral effects of the underground railways may be found in the fact that the usual sittings of the City Summons Court, where cases arising out of street obstructions and quarrels of cabmen, bus drivers and carters are heard, were not held on several days last week, because there were no charges to try. Since the opening of the "Twopenny Tube" the work of this court has been dwindling. Of course, so far as improved morals are concerned, electricity as the driving power is essential, because the old, smoke-begrimed, suffocating, steam-laden underground road causes as much deterioration of temper among passengers as relief to congested streets overhead. Last week the total number of cases disposed of did not exceed 29, while formerly a day's list was often known to exceed 137. There can be no doubt as to the cause. The thousands of persons traveling on the new line must relieve the streets. The subways at the Mansion House render the stopping of vehicular traffic for pedestrians to cross less frequent and saves much congestion. Buses are not called upon to stop so often, because the travelers are using the new line, and the "odd buses," which were the greatest offenders, have sought fresh fields away from the electric competition, much to the relief of the streets, the police and public. The Twopenny Tube is likely to benefit a number of persons in a different direction. A friend writes that while suffering for some months from a very serious loss of appetite, he has now regained it through the traveling by the new Central railway. The first time he went by it he noticed he was ravenously hungry when the hour of luncheon arrived, and since then, having repeated the experiment, finds his appetite quite restored to him. This, he thinks, may be attributed to the ozone generated by the electricity. If so, then the new railway can well lay claim to even more advantages than heretofore, but it will be a very serious matter for paterfamilias with small incomes and large families to travel by the new Central railway. After traveling by it myself I always experience the same sensation of unusual hunger at luncheon. The subject, I think, will bear more investigation on the part of scientific men and the medical fraternity generally. The rumor that the company intends to run an all-night service is incorrect. "It is not feasible," the secretary explained to me, "and I will tell you why. Over 400 trains are run daily over our lines, and we therefore feel that it is a duty we owe to the public to carefully examine every foot of the permanent way at the conclusion of the day's work. This cannot possibly be done at any other time, for there is not room down below for a man to stand on one side to let a train pass. A worker in the tube would be almost blown out at the approach of the engine." He added, "I won't go so far as to say the scheme is impossible, but at present it is impracticable." The average number of passengers on the railway has already reached a total of about 120,000 daily. W. H. B.

New York Notes.

New York, September 8.—The first actual work on the digging of the downtown sections of the Rapid Transit tunnel began Tuesday morning at Tenth street and Fourth avenue. Holbrook, Cabot & Daly of Boston are the contractors on this third section of the tunnel, which begins at the middle of Great Jones street in Lafayette place and runs along Lafayette place to Astor place, thence to Fourth avenue, to Park avenue and to Thirty-third street. The work will be entirely "open cut" and it is expected that considerable rock will be encountered. The contractors will carry on the work with compressed air, and a large compressor plant costing $60,000 will soon be in operation at the north end of Union Square. The contractors are laying about one mile of five-inch steel pipe six inches below the surface and alongside the curb on the west side of Fourth avenue. When the pipe is in position and the compressed air plant is set up the work of excavation will begin at a number of points, and the compressed air conveyed in the pipe will furnish the power. Several hundred men will be engaged.

Two trains collided on the Kings County Elevated railroad at Fulton and Tillary streets, Brooklyn, yesterday afternoon at three o'clock, and the road was not cleared for traffic till nearly midnight. The accident occurred at a switch. There were passengers on both trains but no one was hurt, and the steam locomotive and motor car which headed the respective trains were not seriously damaged. The delay to traffic was caused by the locomotive being thrown across the tracks.

The state board of railroad commissioners has approved the application of the Metropolitan Street Railway company for an increase in the company's capital stock from $45,000,000 to $52,000,000. The company will employ the proceeds of the sale of new stock in changing its cable lines to underground electric conduit on Columbus avenue, Broadway and Lexington avenue and in changing its horse road on Thirty-fourth street to an electric storage-battery line.

The Reno inclined elevated or moving stairway at the Fifty-ninth street station of the Third avenue elevated road was put in operation Wednesday morning. One-half of the staircase consists of a slowly revolving rubber matting. A negro attendant stationed at the bottom instructed passengers to place one foot on the stairway and to grasp the moving railing at the side. The other half of the passageway is devoted to stationary steps for descending passengers. It is said that the elevator can carry 3,000 persons an hour. The ticket seller at the station said that there was an increase of passengers Wednesday of about 100 an hour. It is intended to establish similar elevators at the Eighteenth street and Thirty-third street stations.

In the provisional estimate of expenses for the year 1901, submitted by the Police Board to the Board of Estimate and Apportionment, the sum of $11,743,206.91 is asked, which is an increase of $415,702.49 over the sum given in 1900. The main item of the increase is for the installation of a new signal system below Fourteenth street. This has been needed for some time. When a policeman now needs help in case of attack or riot, wants an ambulance or has to make hurried communication with his superiors, he must either find a telephone or run to the station. President York thinks $300,000 will install the system desired below Fourteenth street, and an equal sum annually would soon include the entire city. M. S.

New England News.

Boston, September 7.—Kidder, Peabody & Co., the Boston bankers, have been awarded by the West End Street Railway company $2,112,000 bonds, running 15 years and bearing four per cent. interest at 104.60. This is an income basis of about 3.66 per cent.

Directors of the Street Railway and Illuminating Properties have declared a dividend of $3 a share on the common stock.

Fire on August 23d, in the building at 2, 4 and 6

Postoffice square, caused damage amounting to several thousands of dollars in the premises on the fourth and fifth floors, occupied by Stone & Webster, electrical engineers. The total loss was figured at upward of $20,000, and Stone & Webster were the principal sufferers.

It is of interest to note that the West End Street Railway system of Boston is about the only large street-railway system in the United States without a floating debt. Earnings of the road have been and are showing about the normal rate of increase.

An official of the Boston Elevated Railway company says the directors of the company will never vote to increase the dividend rate until the elevated system has proven itself a success. If contracts had been lived up to the overhead system would be in operation to-day. As it is, the main line will probably be running about January 1, 1901, and the loop on Atlantic avenue a little later. Work on the loop will be commenced very shortly..

During 1899, 15 new street-railway companies were organized in New England. Five of these were in operation at the end of the year. The incorporation of new companies still continues. During the 12 months of 1899 there were carried on the street railroads of Massachusetts 356,700,000 passengers, a gain of more than 28,000,000 over the preceding year. B.

From the Buckeye State.

Columbus, Ohio, September 8.—Notwithstanding a number of injunction suits and other drawbacks, the Columbus, London and Springfield Electric Railway company is proceeding with its loop in Columbus, and now has quite a stretch of track laid. It is believed that nothing further will be done to prevent the completion of this work, but that cannot be said with authority, as no one can tell what opposition may yet be brought to bear. It is reported that the management is negotiating for a private right-of-way on an air line from Columbus to Springfield, and in that case it may miss London entirely. The town seems to be vacillating between this company and the National Traction company, to see from which it can get the best offer, and there is a possibility that it may yet have no electric road at all.

The directors of the Cincinnati Street Railway company met a few days ago and declared the regular quarterly dividend of 1¼ per cent. The suggestion of the linemen that the company arrange a clubhouse for them at one of the wagon and tool houses was received kindly, and this will probably be arranged at an early date.

It is stated that the Dayton, Springfield and Urbana Electric Railway company will have the line from Springfield to Urbana completed within six weeks. A good portion of the grading has already been completed and the poles are now being distributed along the line.

At a meeting of the Southern Ohio Traction company, held at Hamilton a few days ago, the following-named directors were chosen: William Christy, James Christy, Jr., J. Mendelnaum, M. J. Mendelbaum, A. E. Aikins, C. Pomeroy, J. Kimberly and J. Lembhook, all of Cleveland; J. R. Nurt and J. Lembrick of Akron; Peter Schwab and Adam Rentscler of Hamilton. The directors elected the following-named officers: President, W. Christy; first vice-president, M. J. Mendelbaum; second vice-president, Peter Schwab; secretary and treasurer, F. Pomeroy; executive committee, W. Christy and M. J. Mendelbaum.

The commissioners of Warren County have granted a franchise for an electric road to Sunderland & Wolfe, capitalists of Dayton. The latter are planning to build a line between Dayton and Lebanon.

The Columbus, Buckeye Lake and Newark Traction company has filed notice with the secretary of state of an increase of capital stock from $100,000 to $1,000,000.

Two ordinances were introduced at the last meeting of the Board of Legislation of Cincinnati, both in relation to the affairs of the Cincinnati Edison Electric Light company. One provides that the company shall have power to lay conduits, feeders, tubes and pipes and all other things necessary to supply light, power and heat. The other asks for a franchise to erect poles and string wires for lighting portions of the city which have not heretofore been designated. The company maintains that this is necessary, inasmuch as the Board of Public Service has refused to grant it permits to push the work as it wishes to do. The ordinances are simply to define the authority of the company under two franchises which it is now operating.

A few days ago the Jewett Car company of Newark, Ohio, shipped three handsome cars to the South Side Elevated Railroad company of Chicago. These cars have a seating capacity for 40 passengers. The inside finish is of Honduras mahogany, with bronze metal trimmings. Each car is fitted with Peckham trucks and 75-horsepower motors.

The citizens of Norwood, a suburb of Cincinnati, have asked for incandescent gas lighting instead of electric lights, which they now have. The village has a plant of its own.

The Southern Ohio Traction company will not renew its contract with the Wells-Fargo Express company. Since the first of this month it has been carrying its own express matter. Light cars have been put on for this purpose, and the facilities of the road have been made ample for the traffic. It is thought that other roads about Dayton will follow the example of the Southern Ohio, and that ultimately the express business will become one of the important features of the electric lines.

The Little Consolidated Railway company of Cleveland will change its Payne avenue cable line to an electric line. The change will be completed within from 60 to 90 days. The track will be ballasted and made ready for the heavy electric cars. It is estimated that the improvement will entail an outlay of about $40,000.

Perry H. Rue of Franklin has brought suit against the Southern Ohio Traction company for $10,000 damages alleged to have been sustained by water mains in the village, the cause being electrolysis.

The Kenton Gas and Electric company has made a bid to light the town for $75 a lamp a year. There has been quite a fight there and another company was incorporated for the alleged purpose for building a rival plant in the town, but the old company's bid was the lowest of any made.

The Dayton and Xenia Traction company has filed notice of an increase of capital stock from $300,000 to $500,000. All of the first issue of stock has been fully paid up.

The Warner Elevator Manufacturing company of Cincinnati has been incorporated by a number of prominent gentlemen of that city to manufacture electric, hydraulic and steam elevators, motors, hoisting machinery, controllers, switches and other devices.

The Troy Electric Leasing company of Troy has been incorporated for the purpose of buying, selling and leasing electric machinery and appliances. The capital stock of the company is $25,000, and the incorporators are as follows: C. C. Hobart, Walter H. Coles, Herbert L. Johnson, Adeline S. Johnson and Ida Rhodes.

The Columbus Railway company had an immense patronage during the state fair. On Thursday night the company had more cars in service than ever before in its history. A number of handsome new cars have just been received from the Barney & Smith Car company of Dayton.

O. M. C.

Canadian Intelligence.

Ottawa, Ont., September 8.—The Brandon Electric Light company of Brandon, Man., has been given authority to increase its capital from $50,000 to $125,000.

The City Council of Kingston, Ont., will take steps to acquire the electric-light plant of the Kingston Light, Heat and Power company, or, in the alternative, to install a new electric-light plant.

The town of Morrisburg, Ont., is inviting tenders for the erection of an electric-lighting and power plant, to include three distinct sections—hydraulic development and building, waterwheels and steam works, and electric plant.

The question of municipal ownership of electric lights and street railways was a subject that received earnest consideration at the recent meeting of the Board of Trade for the Maritime Provinces of Canada. A resolution to the effect that cities and towns should guard with great care their franchises for street lighting and railways, retaining them under control for cheaper service, thus averting the high charges of private corporations, was unanimously passed.

The electric-car service from the city of Quebec to La Bonne Ste. Anne has been successfully inaugurated. The cars run at the rate of 12 miles an hour, and there will now be 46 trains a day on the new line. The electric-railway company owns all the property around the Montmorency Falls, and will shortly erect an elevator to take passengers from the railway to the head of the falls. It is also proposed to erect a powerful searchlight, which will be used to illuminate the cataract in colors at night.

The Capital Power company of Ottawa has been formed to take over and develop the Conroy electric plant at Deschenes Rapids, a few miles from Ottawa. This plant already brings in $33,000 yearly revenue, and the expense of operating it is only $9,000 per annum at present. The company's new power house at Deschenes is furnished with modern turbines, made by the Trump Manufacturing company of Springfield, Ohio. The flumes are made of concrete, and the buildings are fireproof, the whole being a good example of a modern, up-to-date power house.

While the development of waterpowers in electrical operations is one of the characteristic features of the day, the development of electrical energy on the Canadian side of Niagara Falls seems to be no further advanced that it was 10 years ago. Whatever "deals" the Ontario government has lately made with electrical companies, they appear to have had the effect of only tying up the work of development, instead of promoting it. Last year the government rescinded the monopoly of the United States company, which, theretofore, held the franchise, and made provision whereby other companies could obtain rights to develop electrical power at the Canadian falls. More than a year and a half have elapsed without any substantial progress being made, and there is little indication of development work being undertaken in the near future. On the American side, the installation of electric plant is going ahead with remarkable rapidity. The great feature of the Pan-American Exposition is the fact that the grounds and buildings will be lighted with electricity from the Falls and the machinery operated by the same agency. There is no doubt that the development of electrical energy at the Canadian Falls by the Ontario government would immensely benefit the country within a radius of 100 miles.

A. V. W.

Gleanings from Colorado.

Denver, September 7.—The Leadville Gas and Electric company has just been incorporated and will take over the business of the Leadville Light company, controlling the electric-light service of the city, and of the Illuminating Gas company, controlling the supply of gas. The capital of the company is $200,000, and those forming the new company have heretofore been identified with the two old companies. The directors are John F. Campion, C. K. Boettcher, Robert B. Sullivan and Gilbert Wilkes. The company will introduce as soon as possible a system of power distribution to supply mines in the vicinity. The most distant point to be reached is seven miles from the central station, and most of the mines are within a circle having a radius of 3½ miles. In the execution of the new plan the present electric-light station will be remodeled and enlarged so as to accommodate power-generating apparatus. The generators will probably be of the three-phase type. The present plant has a capacity of 2,300 horsepower; the new machinery will add 1,500 or 2,000 kilowatts. Work on the new plant will doubtless commence as soon as the task of transferring all properties to the new company is completed.

The Denver City Tramway company has practically completed the construction incident upon its acquirement of the property of the Denver Cable company and the equipment of the latter's cable lines for electrical operation. The work which has taken the longest time is the rebuilding of the Sixteenth street and the Lorimer street viaducts. The former was rebuilt with steel I-beams instead of wooden stringers, and new wooden stringers were substituted on the latter. On the Sixteenth street structure considerable flooring was relaid. The outlay will be about $80,000. The new transfer station and waiting room on the downtown loop is about ready for use. Work has been rapidly pushed on the downtown loop, and the rail construction is of the most substantial character. The cars will use Lawrence street, Fifteenth street, a space betwen Lawrence and Arapahoe and between Fourteenth and Fifteenth streets, and Arapahoe street. As the cars will all center on the loop, it is believed the plan will afford great convenience to the public.

Mr. Charles K. Durbin, superintendent of the Denver City Tramway company, has resigned his position and will engage in business in Denver. Mr. Durbin has been connected with the company for 12 years, 11 as superintendent. He has had great success in operating the roads under various motive powers—horse, cable and electricity. The directors adopted a set of resolutions expressing their appreciation of Mr. Durbin's services, and the company presented him a handsome gold watch, suitably engraved.

At a meeting of the State League of Municipalities at Pueblo, on August 30th, Mayor F. R. Baker of Fort Collins, Colo., read a paper on "Street Lights Under Municipal and Private Ownership." He reached the conclusion that municipal ownership was not advisable, as a general thing, especially if the private companies gave the best service by keeping their plants up to date and charged reasonable rates.

The following-named officers have been elected by the directors of the Colorado Springs Rapid Transit company since W. S. Stratton acquired control of a majority of the stock: President, W. A. Ramsay; vice-president, A. L. Lawton; secretary and treasurer, W. A. Baldwin.

The plant of the People's Light and Power company at Aspen, Colo., has been purchased by the Roaring Fork Electric Light and Power company. The purchase price is said to be about $40,000.

J. W. D.

Omaha, Neb.

Omaha, September 6.—At a joint meeting of the Elk City Improvement Club of Elk City, Neb., the Commercial Club of Omaha and the Board of County Commissioners of Douglas County, at the office of the county commissioners, the matter of the proposed electric railway to be built between Omaha and Fremont was considered. The board of commissioners unanimously indorsed the steps which the clubs have taken in the matter and offered its support. The railway will pass through a rich country and will be a great benefit to both the city of Omaha and the entire county. It is proposed that this railway shall be heavily built and equipped for carrying freight and passengers. The farmers have taken up the matter with unusual spirit, and have subscribed money, and stand ready to grant the right-of-way for the proposed road. Money is now in the hands of the Commercial Club for the purpose of making the preliminary survey, which will be made at once. Without doubt, work will commence this fall upon the grading of the roadbed. Mr. Williams of the Elk City Improvement Club and Mr. Kellogg of the Commercial Club have the matter in charge.

The City Council of Council Bluffs, Iowa, passed an ordinance, at its meeting on August 27th, granting a franchise to the Bluff City Electric Light and Gas company for the erection and operation of an

electric and gas-light, power and heating plant. The franchise granted is subject to the approval of the voters of the city, at a special election to be held on October 2d, and it is good for a term of 25 years, the plant to be in operation within 10 months. The incorporators of the company are Thomas Bowman and J. P. Greenshields, both of Council Bluffs.

M. N. B.

Northwestern Notations.

Minneapolis, September 8.—The city of Stillwater, Minn., has brought suit against the officers of the Twin City Rapid Transit company, to secure the annulment of a franchise contract and $25,000 damages, for breach of contract. The city complains that the company has failed to construct a car line to South Stillwater, as promised.

The St. Paul Gas Light company expects to be using power from the new Apple River Falls power station by September 15th. The completion of the plant has been delayed by the non-arrival of machinery. The plant will have a capacity of 5,000 horsepower and 25,000 volts. There are 10 static transformers. Four are of 275 horsepower and six of 100 horsepower each. There are also four large rotary transformers for converting alternating to direct currents.

The Johnson Electric Service company of Milwaukee has filed articles of incorporation in Minnesota, with capital stock of $250,000.

The Electric Light, Power and Heat company of Perry, Iowa, passed into the hands of the new owners on September 1st. It has been feared that the sale would fall through, owing to the inability of Mr. Grist of Cedar Rapids to secure funds arranged for. A. H. Hindert has taken the place of Mr. Grist in the new corporation, and the sale went through as planned.

Lightning struck the bridge at Waterloo, Iowa, crossed by the cars of the Waterloo and Cedar Falls Rapid Transit company, and burned off the trolley wires. It was dark and a car ran into the midst of the tangled wires, producing a startling electrical display. The motorman reversed the car, and as the trolley pole had stayed on the wire, was able to back the car out of the wires. A feed line had fallen and set fire to a tie in the bridge, despite the heavy rain which was falling. No damage was done, aside from the burned-off wires.

The Edison Electric Lighting company of Des Moines, Iowa, plans to place all its wires in the business part of town underground. The work may take five years as planned. The company is about to replace the machinery in its waterpower plant with new and improved equipment.

The Seattle Electric company has begun work at Ballard, Wash., on a branch road to connect with Fremont. The council of Ballard wants the line built, but not where the company proposes to do it. Should the company persist, the council may pass an ordinance prohibiting the company laying its tracks below a certain street.

The city of Billings, Mont., is taking bids, until October 2d, for furnishing street lighting for that city, from July 1, 1901, to March 1, 1907.

A change of ownership has occurred on the electric-light plant at Lake City, Iowa. It is understood the new owners will make improvements to the system, and may install a heating plant.

The Seattle Electric company has put a four-cent fare in force and also issues transfers, dating from September 5th.

The new waterpower plant of the Snoqualmie Power and Electric company, near Seattle, Wash., is approaching completion. The plant is one of the most complete in the country, and will have a capacity of 10,000 horsepower.

R.

PERSONAL.

W. F. Richardson, secretary of the National Telephone Equipment company of Detroit, was a recent visitor in Chicago.

Erwin Dryer of the Chicago office of the Westinghouse Electric and Manufacturing company, underwent an operation last week at Garfield Park Sanitarium for a severe case of appendicitis. The operation was successful and Mr. Dryer is steadily improving.

C. H. Hooper, cashier of the Gregory Electric company of Chicago, is about to leave for Phœnix, Ariz., for a protracted stay, in hopes of materially benefiting his health. J. E. Nicholas, formerly with the Siemens & Halske company, is a recent addition to the business staff of the Gregory company.

The death of Mr. John B. Davidson at his home in Medford, Mass., recently, removes a venerable figure from the ranks of old-time telegraphers. Mr. Davidson was 75 years old, and for 40 years had been in the continuous employment of the Western Union Telegraph company. He became associated with the company in 1857, and from that time until 1893 was continuously at work. After three years' retirement at a country estate in New Hampshire, he again engaged in the business, his desire for an active life overcoming the infirmities of age. He was employed intermittently by the company from then almost up to the time of his death.

ELECTRIC LIGHTING.

The Westville Electric Light and Power company of Danville, Ill., capitalized at $20,000, was a recent Illinois incorporation. The incorporators were Michael Kelly, M. W. Kelly and Edward J. Kelly.

A new electric-light plant to cost $25,000 is to be built at Windber, Pa.

Newcastle, Pa., has passed an ordinance for the building of an electric-light plant.

The Curwensville (Pa.) Electric company has been incorporated, with a capital stock of $10,000.

The mayor of Houston, Texas, has decided to readvertise for bids for building the electric-light plant.

Bronson, Mich., has contracted with W. Fredericks to erect an electric-light plant to cost $10,000.

The Portland Railway and Terminal company of Portland, Me., will erect an electric-light plant, to cost $100,000.

The Meyersdale (Pa.) electric-light plant has been sold to the Summit Electric Light, Heat and Power company for $20,000.

At a special election held in Iola, Kan., recently, an issue of $80,000 in bonds to build an electric-light plant was authorized.

A large electric plant is to be established on the canal of the Roanoke Navigation and Water Power company at Weldon, N. C.

The Vineland (N. J.) Borough Council has advertised for bids for a new municipal bond issue for $25,000 for an electric-light plant.

The Shamokin and Coal Township Light and Power company of Shamokin, Pa., was recently incorporated, with a capital stock of $40,000.

The question of issuing $50,000 worth of bonds to build a municipal electric-light plant in Covington, Ky., will be decided at an election in November.

The Irondale Water, Light and Power company of Irondale, Ala., has been incorporated, with $100,000 capital stock, by F. W. Turpin and N. H. Sewell.

The city of Laurel, Md., has issued bonds for the building of an electric-light plant and bids will be received by J. C. Howell, secretary of the Laurel water board.

A $50,000 electric-light and ice plant has just been completed at Winona, Miss. The plant is now in operation and Winona is said to be one of the best lighted towns in the state.

An ordinance has been favorably reported to the Bay City (Mich.) City Council, giving to the Traction and Power company of Bay City a franchise to erect an electric-lighting system.

At a meeting of the City Council of Litchfield, Ill., recently, it was decided to submit the question of the city's building a municipal electric-lighting plant for lighting the city, to a vote of the people. Plans and specifications will be prepared for the plant, after which a special election will be called. The plant will cost about $15,000.

Responsibility for the death of the two patrolmen who were killed in St. Louis on the night of September 3d by electric shocks while using the police telephones has been placed on the Seckner Contracting company by Coroner Lloyd. The coroner said he found the Seckner company's "power wire," which had been crossed with the telephone wire, was improperly placed. The wire which caused the accidents supplied 48 arc lamps and carried a total voltage of 3,360 volts.

On September 25th all the property, real and personal, of every kind and description, belonging to the Suburban Electric company of Covington, Ky., will be sold at public auction in Covington. The sale will include the rights and franchises of the company and also its electric-lighting plant, equipment, real estate, etc. Full information in regard to the sale will be given upon application to Charles H. Shaw, trustee in bankruptcy, of the Suburban Electric company, Covington, Ky.

At a recent meeting of the Appleton Electric Light and Power company of Appleton, Wis., several changes were made in the management. A. L. Smith, L. E. Barnes and J. M. Baer of Appleton and Arthur D. Wheeler of Chicago resigned from the directory and a new board was elected consisting of John I. Beggs, H. D. Smith, J. S. Van Nortwick, Henry C. Payne and Charles F. Pfister. Mr. Beggs was elected president and H. D. Smith secretary and treasurer. The executive committee consists of J. I. Beggs, H. D. Smith and J. S. Van Nortwick.

ELECTRIC RAILWAYS.

A 20-year franchise has been granted the Paris Street Railway company by the City Council of Paris, Ky.

The power house of the Philadelphia and West Chester Traction company at Philadelphia was completely destroyed by fire September 4th.

"Commutation tickets for dogs on this trolley line, 25 cents a year," is a notice that has been posted by the Westfield and Elizabeth Trolley company of New Jersey. Dog passengers will be carried when accompanied by their owner and a commutation ticket. It is said to be the only trolley road in New Jersey that issues dog tickets. Each dog ticket must bear the name, address and description of the dog.

The Atlanta (Ga.) Railway and Power company has applied for a franchise to extend its line on Washington and several streets in Atlanta. C. J. Simmons is president of the company.

Surveys have been made and rights-of-way secured for the proposed line between Berlin, Weyauwega, New London and Wautoma, Wis., about 70 miles long, to be operated by electricity.

The City Council of Elwood, Ind., has granted a franchise for 50 years to the Union Traction company, which proposes to connect its line from Kokomo to Indianapolis, with a branch from Elwood to Tipton.

A charter of the Denison and Sherman Railway company has been filed at Denison, Texas. The company, which is capitalized at $100,000, will construct and operate an electric railway between Denison and Sherman.

The Logansport, Rochester and Northern Traction company will soon begin the construction of an electric railway between Logansport, Ind., and Warsaw, a distance of 53 miles. J. T. McNary is the president of the company.

Certificates of incorporation were filed at Dover, Del., recently for the Newark and Granville Street Railway company of Newark, Ohio, to maintain and construct a street railway in Ohio. The capital of the company is $300,000.

The Ohio Valley Electric Railway company has been incorporated, with $1,000,000 capital stock, to construct an electric-railway line from Huntington, W. Va., to Ironton, Ohio. T. J. Ryan and H. S. Calo of Huntington are interested.

The car barn of the Mansfield (Ohio) Street Car company on North Main street collapsed September 2d and is a total loss. The company was arranging to utilize part of the car barn as an addition to its engine room, and the changes in the supports of the roof evidently weakened the structure.

The Albany and Schoharie Valley Railroad company of Albany, N. Y., has submitted its yearly report to the state railroad commissioners, in which it announces the intention of building 48 miles of main line and eight miles of branches and sidings. H. W. Burgett is president of the company.

Condemnation proceedings have been begun in the Circuit Court of Chicago by the Metropolitan West Side Elevated Railroad company against the owners of property along the extension of its right of way from the present terminus of the Douglas Park branch at Twentieth street and Western avenue to Albany avenue. The width of the strip of land which the company seeks is 34 feet. All the owners of property with whom the railroad company has been unable to agree are made defendants to the action.

Work is being pushed rapidly on the power house of the Boston Elevated Railroad company, which is being erected on Lincoln wharf, at Atlantic avenue and Battery street, near the North ferry house. The building, for which the foundations are completed, will be about 160 feet square and 107 feet high. The exterior will be of brick and limestone, while the engine and dynamo rooms will be lined with enameled cream-colored brick. The great brick stack, now about half built, will be 250 feet in height. The generators to be installed are designed to operate 90 trains of three cars each, at a rate of 40 miles an hour.

AUTOMOBILES.

At the tri-state fair to be held at Guttenburg, N. J., September 18th to 22d, an added attraction will be an automobile exhibition and race meet. The latter, on September 18th, will be under the auspices of the Automobile Club of America.

Miss Emlen S. Blye, 6325 Monroe avenue, Chicago, took the examination for automobile operators September 7th and was granted certificate No. 315. She announced that she was taking the examination for business and not private uses, and that she intends to conduct a school of instruction, teaching other women the method of managing and operating automobiles.

John Brisben Walker and his son, Justin, of Denver, ascended Pike's Peak to the timber line in a steam automobile on September 8th. They are believed to be the first to ascend the peak in an automobile. Mr. Walker had intended to climb the entire distance to the United States signal station, but beyond an altitude of 11,000 feet he found the roads unfit for an automobile. The return trip to Manitou was made at a very high rate of speed, but without accident.

H. E. Fielding, of New Haven, Conn., is reported as having in process of construction an automobile to be run by gunpowder. The power is to be generated by a succession of miniature explosions of cartridges, each not unlike the explosion of an ordinary 42-caliber cartridge, so that a man will ride in the new vehicle over hundreds of exploding

cartridges at a great velocity. It is stated that experts who have examined the machine say that it will prove to be a successful experiment. The powder contained in a 10-pound tin will be enough to drive a machine 300 miles.

A newspaper account states that a Russian named Hutal Serky has invented a new kind of automobile. The account says: "He has discovered a new system of locomotion based on the use of a certain kind of salt, the composition of which is, as yet, his secret. Two pounds of this salt placed in the box of the automobile, and subjected to a certain heat, forms a gas which puts a cylinder in movement. The automobiles that were tried in Moscow produced the best results. The Emperor of Russia, who takes great interest in this invention, intends to send Serky to Paris to make known his secret. The Russian press is of opinion that it will cause a great revolution in the trade."

PUBLICATIONS.

"A Talk About Locust Pins and Brackets" is the title of an attractively worded pamphlet issued by the Blue Ridge Locust Pin company, manufacturer of locust insulator pins and brackets, Asheville, N. C.

The Watson-Stillman company, New York, has just published a catalogue on jewelers' and die sinkers' hydraulic tools. The catalogue is composed of illustrated sheets showing the hydraulic machinery manufactured by the company.

Westinghouse, Church, Kerr & Co. have published a sales list of the Roney mechanical stoker, which contains a long list of some of the recent purchasers of the company, with the total horsepower which will be installed when the present orders are completed.

The Tic-a-toc automatic grease cup is illustrated and described in a little pamphlet issued by its manufacturers, James L. Robertson & Sons, New York. This new cup, which attaches to the eccentric or crank-pin, to either a horizontal or vertical engine, in any position, is said to be creating much interest among the electrical fraternity.

Two handsome publications have recently been issued by the Kellogg Switchboard and Supply company, Green and Congress streets, Chicago. One is an illustrated pamphlet, with artistic cover, and pertains to the history, methods, facilities and products of the Kellogg company. Illustrations are given of the company's factory and some of the departments of the business, and views are also shown of some interesting parts of the large switchboards the company has built, including those at the Columbus, St. Louis and Wilkesbarre, Pa., exchanges. The other publication is a 20-page bulletin and relates particularly to the Kellogg company's product in the line of telephone instruments. Both publications will be sent postpaid to any person or corporation on request, and the Kellogg company is particularly desirous that all persons interested in the Independent telephone movement shall send their addresses for the catalogues.

TRADE NEWS.

Dixon's pencils are brought to the attention of consumers by neat blotters for September, issued by the Joseph Dixon Crucible company, Jersey City, N. J.

The American Battery Compound company of Chicago has removed its offices and factory from 31 and 33 South Canal street to 224 and 226 South Clinton street, where it is prepared to continue its business as formerly.

The Janesville Electric Light company of Janesville, Wis., has contracted with Evans, Almirall & Co. of Chicago for the installation of the Evans exhaust hot-water heating system for a central-station heating plant, in connection with its power plant.

The Jandus Electric company, Cleveland, Ohio, is putting out an enclosed alternating arc lamp with features not heretofore in use and which is said to excite much interest in the lighting field. A new bulletin with special reference to this lamp may be had for the asking. The Chicago office is at 1537 Monadnock building.

The Dicke Tool company of Downers Grove, Ill., has been awarded a bronze medal on linemen's tools at the Paris Exposition. This was the highest prize awarded on linemen's tools. C. H. Dicke was in attendance at the exposition, and the exhibit created considerable interest among foreign manufacturers. Thomas G. Grier of 141 South Clinton street, Chicago, is the western representative of the Dicke Tool company.

H. E. Plass, of the H. E. Plass Electric Supply company, 21 Barclay street, New York, is taking a five weeks' trip through the middle West and South, visiting St. Louis, New Orleans, etc., in the interest of the electrical novelties and staples of his own manufacture, of which he has an extensive line. Mr. Plass has brought out a new and comprehensive catalogue which will be ready soon, and he will be pleased to send a copy to anyone interested.

A course of instruction by mail in chemistry is announced by the International Correspondence Schools, Scranton, Pa. The course includes mathematics, physics, theoretical, inorganic and organic chemistry, qualitative and quantative analysis. George Herman Dimpfel, Ph. D., who is in charge of the chemistry course, is a graduate of the University of Leipsic, Germany, and also studied in the universities of Strassburg and Heidelberg. Later he was an instructor in the latter institution, but was induced to take up commercial work, and after an extended experience in European cities, he came to this country and is now principal of the school of chemistry.

The very extensive application of the chloride accumulator, manufactured by the Electric Storage Battery company of Philadelphia, is indicated by a statement of the installations of chloride accumulators that have been contracted for during the last two or three months. Among the street-railway plants are mentioned 34 installations by companies operating in Wickford, R. I.; four companies in Providence, R. I., Brayton, R. I., Brooklyn, New York city; two in Boston; three in Washington, Bellows Falls and Springfield, Va., Detroit, Mich., Philadelphia, Mechanicsville, N. Y., Glens Falls, N. Y., Biddeford, Me., Portsmouth and Keene, N. H., Newtonville and Fairfield, Mass., Forestville, Conn., Buffalo, N. Y., Joliet, Lemont and Spring Forest, Ill., Dayton, Ohio, and Indianapolis, Ind. In the list of central-station lighting plants are mentioned those at Atlanta, Ga., Boston, Cincinnati, Detroit, Indianapolis, Providence and Pawtucket, R. I., New York city, Brooklyn, Cleveland, and Hamilton, Ont. A list of 15 isolated plants includes apartment houses and hospitals in New York city; Eddy Manufacturing company, Middletown, N. Y.; United States Government, Fort Totten, N. Y.; Westinghouse, Church, Kerr & Co., New York city, etc.

BUSINESS.

The Electric Appliance company, Chicago, is general western agent for Richmondt electro-galvanized conduit. The company has lately gotten out a conduit catalogue, which should be in the hands of every electrical worker.

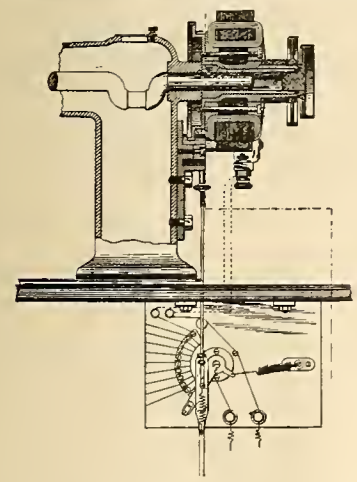
The Buckeye Electric company is having an excellent demand for its specialty, the Buckeye incandescent lamp. Working on the theory that illumination is the basis of investment in an incandescent lamp, the company is building a special cellulose filament which is guaranteed to produce an average 16-candlepower illumination for an average burning period of 600 hours. The Chicago branch probably carries the largest stock of lamps in the city, insuring immediate delivery. A catalogue and prices may be obtained by addressing the Chicago or home office.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 4, 1900.

657,090. Pneumatic Dispatch-tube Apparatus. James T. Cowley, Lowell, Mass., assignor to the Lamson Consolidated Store Service company, Newark, N. J. Application filed March 23, 1899.

The apparatus has an electromagnetic device operated by a traveling carrier to close an air-inlet valve.



NO 657,165.

657,104. Method of Stringing or Supporting Electrical Conductors. Louis Hackethal, Hanover, Germany. Original application filed December 20, 1898. Divided and this application filed April 20, 1900.

A series of single insulators and a pair of insulating conducting wires are each supported by the opposite sides respectively of each single insulator of the series and each pair of wires is crossed between the adjacent insulators in the series, and a mechanical connection secures the wires together at the crossing points.

657,159. Rheostat Controller. John Dillon, Milwaukee, Wis. Application filed June 4, 1900.

The invention comprises a pivotal rheostat arm having a weight in connection therewith, a governor mechanism in gear with the arm against power of its weight, a main switch lever, gear-control mechanism operative in conjunction with the main switch lever to permit gravity throw of the rheostat arm subsequent to a circuit-closing operation of the lever, but which restores the arm to normal position previous to a circuit-opening operation of the lever, a reversing switch bar and means in connection with the gear-control mechanism for actuating the bar.

657,165. Sewing-machine Motor Attachment. Francis P. Huyck, Swanton, Ohio. Application filed June 7, 1900.

The attachment consists of a bracket, means for detachably securing the same to a sewing-machine arm, an electric motor mounted upon the bracket and means for detachably securing the armature of the motor upon the shaft of such sewing machine. (See cut.)

657,170. Automatic Railway Signal System. Jacob W. Lattig, West Bethlehem, Pa. Application filed June 6, 1900.

In the system, combined with an insulated track section or block, a track circuit and a relay included therein, are a signal, actuating mechanism for the signal including a fluid-pressure cylinder and piston, a pump for supplying the cylinder with fluid, an electric motor to actuate the pump, an electric circuit including the motor and two sets of contacts in the motor circuit controlled the one by the track relay and the other by means actuated by or from the signal-actuating mechanism.

657,195. Automatic Safety Cut-off for Elevators. George G. Guenther and Arthur G. Guenther, Orange, Cal. Application filed February 26, 1900.

The device comprises a switch box adapted to be attached to the casing of an elevator shaft, a tubular socket sunk in the door jamb and projecting through one side of the casing, an endwise movable operating pin guided in the tubular socket and having a stop to engage the inner end of the socket, an insulating base in the side of the switch box opposite the socket, a pair of parallel insulating guide bars extending across the casing from the base, a pair of electrodes secured to the base and a spring-pressed switch bar pivoted to one of the electrodes, adapted to contact with the other, guided between the parallel guide bars and bearing against the inner end of the operating pin.

657,196. Submarine Cable. Theodore Guillcaume, Mülheim-on-the-Rhine, Germany. Application filed October 19, 1899.

An electric conductor for submarine cables has a central conducting wire and laid up around this wire a number of wires of iron or other magnetic metal arranged, either alternately or in groups, with a number of wires of copper or other metal of high conductivity.

657,199. Electric Lamp for Dental Purposes. Byron E. Lawton, Providence, R. I. Application filed October 23, 1899.

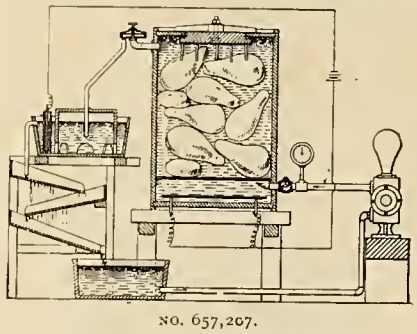
The lamp combines a bowl and the electric lamp contained in the bowl, with a mirror and a space for the passage of the rays of light from the lamp in the bowl past the edge of the mirror to light up the mouth when operating upon the teeth.

657,202. Electric Furnace. Henry C. McBrair, Middletown, N. Y. Application filed May 13, 1899.

In an electrically heated furnace are two hinged parts, an electric heating circuit in each part and insulated electric connections between the circuits, the connections consisting of contact parts which move on each other, when the hinged parts are operated, and maintain a continuous electrical connection between the circuits.

657,207. Apparatus for Curing Meat. George A. Washburn, Cleveland, Ohio, assignor to B. B. Quinn, trustee, Cleveland, Ohio. Application filed August 18, 1898.

The operation described consists in submerging the meat in a curing solution in a vat adapted to be closed, causing the solution to circulate under pressure through the vat and around the meat, and in passing an electric



NO. 657,207.

current through the curing solution between two electrodes, of which the negative electrode is submerged in the solution, while the positive electrode is contained in a porous cup which sits in the solution. (See cut.)

657,211. Electric Lock. Henry G. Carleton, New York, N. Y., assignor to the Carleton Electric company, New York, N. Y. Application filed January 13, 1900.

In the lock, combined with one of the engaging parts, are a slide for withdrawing the same, a controller stationary with respect to the slide and normally engaging the same, and an electromagnet, the attractive force of which operates the controller to release the slide when the lock is to be opened.

657,213. Trolley. Joseph E. Connolly, Newark, N. J. Application filed December 5, 1899.

An improved trolley arm is described which has at its upper end a head providing bearings for a main contact wheel and supplemental contact wheels, the supplemental contact wheels being disposed to rotate in a horizontal plane and overhang the periphery of the main

wheel tangent thereto and closely adjacent, the peripheries only being presented to the power wire and the peripheries being shaped to form with the main contact wheel a passage way for the power wire.

657,221. Static Relay. Isidor Kitsee, Philadelphia, Pa., assignor to Charles E. Wilson, Philadelphia, Pa. Application filed May 20, 1899. Renewed March 17, 1900.

The relay consists of conducting leaves in juxtaposition to conductors connected with the interposition of a battery to an electromagnetic device and to the ground, the conducting leaves being provided with means for connecting the same to one terminal of the receiving circuit.

657,222. Wireless or Space Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor to Charles E. Wilson, Philadelphia, Pa. Application filed May 20, 1899. Renewed March 12, 1900.

A receiving instrument for space telegraphy is described. It consists of a chemically prepared paper resting on a metallic support connected to the ground in combination with the terminal of the aerial conductor secured in juxtaposition to, but not in actual contact with, the paper, and means for carrying successively successive parts of the paper between the support and aerial conductor.

657,223. Receiving Device for Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor to Charles E. Wilson, Philadelphia, Pa. Application filed May 20, 1899.

The device consists of a polarized and differential relay, one of the circuits of which is provided with microphonic material, the other circuit of which is provided with an adjustable resistance, a local circuit, an electromagnetic device placed therein and a resistance in the latter relay circuit adapted to be shunted through the action of the electromagnetic device, the local circuit being adapted to be closed through the action of the polarizing differential relay.

657,224. Wireless or Space Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor to Charles E. Wilson, Philadelphia, Pa. Application filed September 18, 1899.

In wireless or space telegraphy, a "calling-up" device consisting of a movable conductor and two contact points forming part of the receiving circuit, one contact point being also connected to a local battery and an electromagnetic device, the other pole of which is connected to the movable conductor, the second contact point being connected to the ground. (See cut.)

657,258. Process of Curing Meat. George A. Washburn, Elyria, Ohio, assignor to B. B. Quinn, trustee, Cleveland, Ohio. Original application filed August 18, 1898. Divided and this application filed August 23, 1899.

The described process of curing meat and the like consists in immersing the same in a curing solution, in passing an electric current from the positive electrode through a fluid conductor and the curing solution and in preventing the fluid conductor and the product of the electrolytic action therein from commingling with the curing solution.

657,288. Telephone Transmitter Arm. George R. Kennedy, Allegheny, Pa. Application filed April 12, 1900.

Combined with a tube having an open ball threadably attached to each end are a transmitter cup having a threaded opening formed through its rear wall, a cup threadably secured within the opening of the case to receive the ball at one end of the tube, a jam collar threadably secured upon the cup to engage with and retain the ball in its seat, an induction-coil case having an opening formed through its front wall, a cup secured upon the face of the case over the opening to receive the ball at the opposite end of the tube and a jam collar threadably secured to the cup to engage with and retain the ball in its seat, all arranged and combined with one another.

657,305. Means for Relieving Telephone Lines from Deleterious Electrical Charges. Chester H. Arnold, Boston, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed December 22, 1899.

A metallic-circuit telephone line is combined with means for freeing the conductors of the line from intrusive and detrimental electrical charges, the means consisting of a bridge between the main conductors of the line containing only a single electromagnetic coil wound continuously in one direction, and a resistanceless ground connection centrally attached to the coil and constituting a leak to earth from both conductors at the same point, offering low impedance to the charges, but high impedance to the working current.

657,311. Closed-conduit Electric Railway. Léon Dion, Boston, Mass. Application filed March 6, 1899.

The system comprises a closed conduit having an upper conductor located beneath the surface of the roadway, and a series of conductive members projecting from the conductor at intervals and having their ends located above the roadway surface.

657,315. Telephone Switching Apparatus. David S. Hulfish, Chicago, Ill., assignor to the American Bell Telephone company, Boston, Mass. Application filed April 12, 1900.

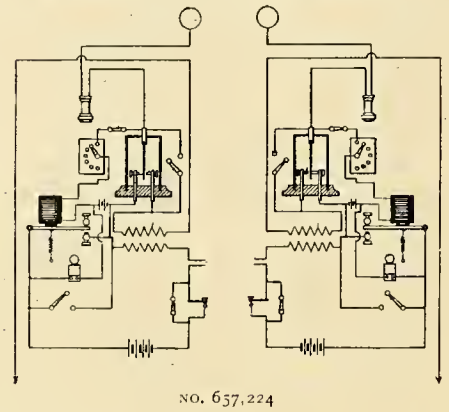
In the apparatus are a switch plug and cord circuit comprising two terminal switch plugs, each having contact surfaces adapted to register with corresponding contacts in the switch sockets of substation circuits; two switchboard conductors normally uniting the corresponding main-circuit contact surfaces of the two plugs; a repeating induction coil, and a key or switch controlling the relation of the switch-cord conductors, with the terminals of the two windings of the repeating coil, and adapted when operated to sever the conductors and to connect them in two loops from the two plugs respectively, the loops containing respectively the windings of the repeating coil, thus dividing the plugs conductively and uniting them inductively.

657,316. Telephone Trunk Circuit. David S. Hulfish, Chicago, Ill., assignor to the American Bell Telephone company, Boston, Mass. Application filed May 25, 1900.

In a telephone-exchange apparatus are combined a trunk circuit extending between two switching stations and provided at each with switch devices, an independent signaling circuit normally open at both stations, comprising a visual signal, a source of signaling current and two circuit-closing relays controlled by the switch devices at the two switching stations adapted to be operated serially by the switch devices to, first, complete a circuit through one relay and the source of current and simultaneously therewith complete a second circuit through the source of current and cause the display of the signal, and second, to complete a circuit through the second relay and the source of current and open the signal circuit.

657,330. Electric Railway. Theophilus P. Chandler, Philadelphia, Pa. Application filed July 27, 1900.

The inventor describes the combination of two suspended insulated cables mechanically connected at intervals and supplying currents of opposite polarity, with an electrically propelled truck having one or more grooved driving wheels running upon the upper cable, an electric motor arranged within the rim of each driving wheel and comprising field magnets, one of the parts being connected to and rotating with the driving wheel, a depending frame connected with the other part of the motor and extending to a point below both suspended conductors, an insulated current-contact device carried by the depending frame making a traveling contact with the under side of the lower suspended conductor, and a receptacle for containing merchandise, etc., carried by the depending frame and located below both the suspended conductors.



NO. 657,224

657,338. Central-battery Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply company, Chicago, Ill. Application filed April 28, 1899.

Combined with a pair of telephone lines, each having two limbs, are a third conductor connected with each telephone line at the sub-station and a source of electricity at the central station adapted to be connected to send current over a circuit including in series the third conductor and the two telephone lines.

657,339. Plug and Socket for Telephone Systems. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply company, Chicago, Ill. Application filed April 28, 1899.

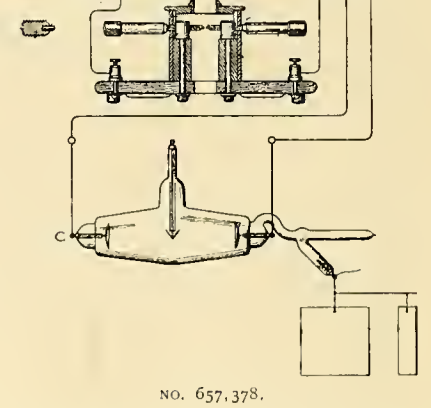
A telephone switch socket having an opening for the insertion of the plug and provided with a central rigid terminal and a spring terminal at one side thereof, is combined with a plug having a portion to rest within the socket opening and carrying a central spring rod or terminal to engage the rigid switch contact and an outer terminal to engage the spring contact of the switch.

657,342. Trolley Catcher. Frank J. Fairchild, Wyandotte, Mich. Application filed October 12, 1899.

A device for catching a trolley wire is described.

657,359. Thermostat. Henry E. Reeve, New York, N. Y., assignor to the Automatic Fire Alarm and Extinguisher company, Limited, New York, N. Y. Application filed November 15, 1899.

The thermostat comprises a shell, a metal disk within the shell having upturned feet which are secured to the shell, insulating disks carried above and below the metal disk, two contact plates carried beneath the bottom insulating disk, rivets passing through the contact plates, both insulating disks and the metal disk, and a thermostatic device carried by the contact plates and arranged to control an electric circuit when influenced by sufficient change in temperature.



NO. 657,378.

657,378. Roentgen-ray Apparatus. William S. Andrews, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 20, 1898.

The method of maintaining a vacuum tube in operative condition at a predetermined vacuum is described. It consists in passing current through the tube and taking a discharge from the point in the circuit to a body capable of absorbing and returning electrical energy, causing the discharge to vary the vacuum in the tube, and varying the discharge in accordance with the vacuum in the tube. (See cut.)

657,413. Hanger for Battery Elements. James L. Hayes, Salida, Colo., assignor of one-half to George F. Stodghill, Salida, Colo. Application filed April 30, 1900.

A hanger for a galvanic battery element consists of two intertwisted pieces of wire having a central eye and divergent ends, and means for clamping the battery element to the central eye.

657,414. Fuse. Rudolf Hundhausen, Wilmersdorf, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed November 18, 1899.

The inventor describes the combination with a fuse portion, of a tension device adapted for separating the terminals of the fuse portion upon rupture, a second fuse portion in secondary relation with the fuse portion, and a support associated with the second fuse portion for receiving the tension due to the tension device, the weakest portion of the fuse portion being thereby relieved of tension.

657,416. Speed Controller for Electric Elevators. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Elevator company, East Orange, N. J. Application filed November 27, 1897.

A shunt-wound motor and circuits and connections for controlling the same are combined with an open shunt around the armature terminals of the motor, including a resistance device and means for closing the shunt and including resistance between the armature terminals.

657,432. Electric Arc Lamp. Joseph Melzer, Cleveland, Ohio, assignor to the Interstate Electric company, Cleveland, Ohio. Application filed April 2, 1900.

The lamp combines permeable magnet heads, a two-part spool therefor, one part of the spool being of permeable material having a large external diameter, and the other part of non-permeable material having a relatively smaller diameter.

657,433. Electric Arc Lamp. Joseph Melzer, Cleveland, Ohio, assignor to the Interstate Electric company, Cleveland, Ohio. Application filed May 2, 1900.

In the lamp are a solenoid magnet, comprising a supporting tube, an iron ring secured thereon, a magnet-core tube external to the ring, a magnet head secured to the core tube at the other end thereof, a magnet head secured to the ring of the supporting tube, in combination with an iron ring external to the core tube and extending for about one-half the length thereof.

657,450. Electric Arc Lamp. Irving R. Prentiss, Lynn, Mass., assignor to the General Electric company of New York. Application filed July 15, 1899.

A focusing arc lamp comprising relatively movable positive and negative electrodes, a series regulating coil for the positive, a shunt coil for intermittently lifting the negative, and a clutch fixed to the lamp for supporting the negative when fed upward.

657,477. Piano Action or Other Keyboard Instrument. Thaddeus Cahill, New York, N. Y., assignor to James B. Lambie, E. Hilton Jackson, George Frederick Cahill and Arthur T. Cahill, trustees. Application filed September 8, 1894.

In combination, in a keyboard mechanism, are a key at the keyboard, a motor normally inactive, motor-controlling means operated by the key and acting, when the key is depressed, to bring the motor into action, and means thereupon acting to restore the motor to its normal position in advance of the release of the key.

657,484. Closed-conduit Electric Railway. Léon Dion, Boston, Mass. Application filed March 6, 1899.

In a closed-conduit electric-railway system are a surface conductor, a casing carried by the car and supporting at its lower end a collecting shoe adapted to run in contact with the conductor, and a magnet inclosed in the casing.

657,485. Electric Arc Lamp. Thomas E. Drohan, Chicago, Ill., assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed August 26, 1899.

The arc lamp combines a carbon carrier, a swinging arm carried by the carbon carrier, a revoluble clutch member rotatably supported by and bodily movable with relation to the swinging arm adapted for engagement with the carbon, and electromagnetic means for releasing the clutch member from engagement with the carbon.

657,487. Electric-railway System. Emmerich Frischmuth, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed February 12, 1900.

In a double-track electric-railway system are two conductors for the two tracks, span wires extending to the conductors, the span wire for one conductor crossing the other conductor, and means for elevating the crossing span wire an extent to prevent its interfering with the current-collecting device, which travels along the conductor which it crosses.

657,502. Support for Electric Lamps. Willis A. Swan, Providence, R. I. Application filed January 6, 1900.

A support for electric and other lamps combines a suitable attaching plate, one or more adjustable sections pivotally joined to the attaching plate by two yokes, one of the yokes being capable of a rotary motion, whereby the section or sections may be adjusted to various positions.

REISSUE.

11,852. System of Train Control. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric company of New York. Application filed March 16, 1899. Original No. 608,301, dated August 2, 1898.

The inventor describes the combination of motor cars, each equipped with a motor or motors, a controller and trolley, with means for controlling the different motor equipments from a single point when the cars are joined in a train, the means comprising a cable for connecting the different motor equipments, switches or switch contacts in the trolley circuits of the different cars and other switches or switch contacts for opening or closing the ground circuits of the different cars, and coupling up the motor equipments in series or parallel.

DESIGN.

33,177. Switch Lever for Electric Circuits. Edward S. Baldwin, Peabody, Mass., assignor to the Boston Pump company, Boston, Mass. Application filed July 16, 1900. Term of patent, 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, SEPTEMBER 22, 1900. No. 12

Power Development of the Drainage Canal at Joliet.

Illinois probably has as little natural waterpower capable of development for the generation of electrical power as any of the states in the Union. Outside of one plant on the Mississippi River, the total amount of hydraulic power at present developed for electrical uses probably does not exceed 5,000 horsepower. The reason for this small development in a state the size of Illinois is accounted for by the fact that the state is practically a large, flat prairie, and where there is any elevation the rivers are small and the waterpower insignificant. So, when it is announced that a plant is building for the development of about 8,000 horsepower at a single point in the state, the details of the announcement are of interest.

The Economy Light and Power company of Joliet, Ill., for nearly 10 years has been furnishing electric light and power from a combined water and steam plant. The waterpower, which was comparatively small and unreliable, was derived from the Illinois and Michigan canal and the Desplaines River, where the two came together and crossed at what has been known as dam No. 1, just north of the Jackson street bridge in Joliet. When the Chicago Drainage Canal was completed last January and the water from Lake Michigan and the Chicago River turned into the Desplaines River through the controlling works at Lockport, five miles above Joliet, the water rights of the Economy company suddenly became of considerable value. Early last fall the company commenced work on a plant which will eventually be capable of utilizing the entire waterpower at that point. The old plant was entirely removed and a temporary steam plant installed on the south bank of the river. Then construction work was begun on a new power plant, running parallel with and on the south side of the river.

Under the present flow of the Drainage Canal 300,000 cubic feet of water a minute passes through the controlling works at Lockport. However, the available maximum head at the Economy company's dam in Joliet is only 15 feet, while the lowest limit reaches nine feet, the average being about 12 feet. Consequently, to develop all the horsepower available a special construction had to be adopted which would provide for a large number of waterwheels, each operating under the total head available. To utilize a future flow of 600,000 cubic feet a minute through the Drainage Canal, an amount which it is expected will ultimately be handled, the plant has been designed to have 40 turbines and to develop a total of 8,000 horsepower. When completed the plant will undoubtedly be the largest hydraulic plant in the United States operating under such a low head.

As a preliminary step to the construction of the power house, a cofferdam over 1,000 feet in length was built. This cofferdam was constructed from the end of a flatboat. It consists of sections formed by wooden planks and filled with stone. The turbine bays and foundations of the power house are built of concrete and rest on the solid rock. The tailrace, which was cut out of the solid limestone, the rock that is common to that locality, is 1,200 feet long, 80 feet wide and from 30 to 35 feet deep. The turbine bays are 24 feet long in a direction at right angles to the river, and 16½ feet wide. The floor in the bays is one foot above the tailwater at low level and at high water the depth in the bay is 15½ feet. At extreme high water the tailwater is about six feet above the floor in the bays.

To prepare the foundations for the turbines and also to cut out the tailrace, it was necessary to excavate 9,000 cubic yards of rock and 4,000 cubic yards of earth. The amount of concrete used in the construction of the wheel bays and foundations was about 12,000 cubic yards. The construction is noteworthy as compared with older engineering works of a similar nature, in that nothing but concrete was used for the entire construction. This concrete work, which has been completed for some weeks, is well shown in Fig. 2, on the next page, which is reproduced from a photograph taken on June 26th. The solid-rock foundation of the power house is shown in this picture, as well as the arched openings leading from under the turbine bays, the view being taken while the water was low, the controlling works at Lockport being temporarily closed. Thomas T. Johnston, consulting engineer of the Chicago Sanitary District, is acting as consulting engineer for the Economy Light and Power company, and it is under his supervision that the power plant has been designed.

When completed the power plant will comprise 40 turbines of the S. Morgan Smith company's manufacture. Two of these wheels will be 48 inches in size and will be capable of developing 125 horsepower under a head of 10 feet. They will be directly connected to two 75-kilowatt, 125-volt, direct-current exciters. The other 38 turbines will be 66-inch wheels, capable of developing 500 horsepower each under a head of 14 feet. Of these, 36 wheels will be connected in units of six wheels each. The turbines of each unit will be directly connected by bevel gears to a main shaft, on one end of which will be a 750-kilowatt generator. These six turbines will be connected so that the generator can be driven by but three of the wheels in case of high water, the other three being arranged so that they can be thrown into gear when needed. Each unit is designed to operate with but three wheels under high water, and with all six turbines under low water. Each wheel will also be provided with regulating valves, so that any variation in the head can be quickly provided for. The harness for the waterwheels of the entire plant will be furnished by the Edward P. Allis company.

The two 66-inch turbines not included in the six-wheel units are to be located at the extreme south end of the power plant, where they will drive a 375-kilowatt generator. The wheels of this half-unit, as it is called, will discharge their tail-water into either one or both of two channels. One of these channels will be the common tail-race, while the other will be a tunnel built under the dam shown in Fig. 3, and emptying into the Illinois and Michigan Canal at the opposite side of the river. The necessity for the construction of this tunnel arose out of some litigation which required that the Economy company should supply the old state canal with 30,000 cubic feet of water a minute. To furnish this amount of water the tunnel was built. It is six feet high and eight feet wide, and has a length of about 350 feet. It is built about 20 feet up stream from the crest of the dam, and is really a part of the dam structure. The gates opening into this tunnel may be seen in Fig. 3 and also at the left of

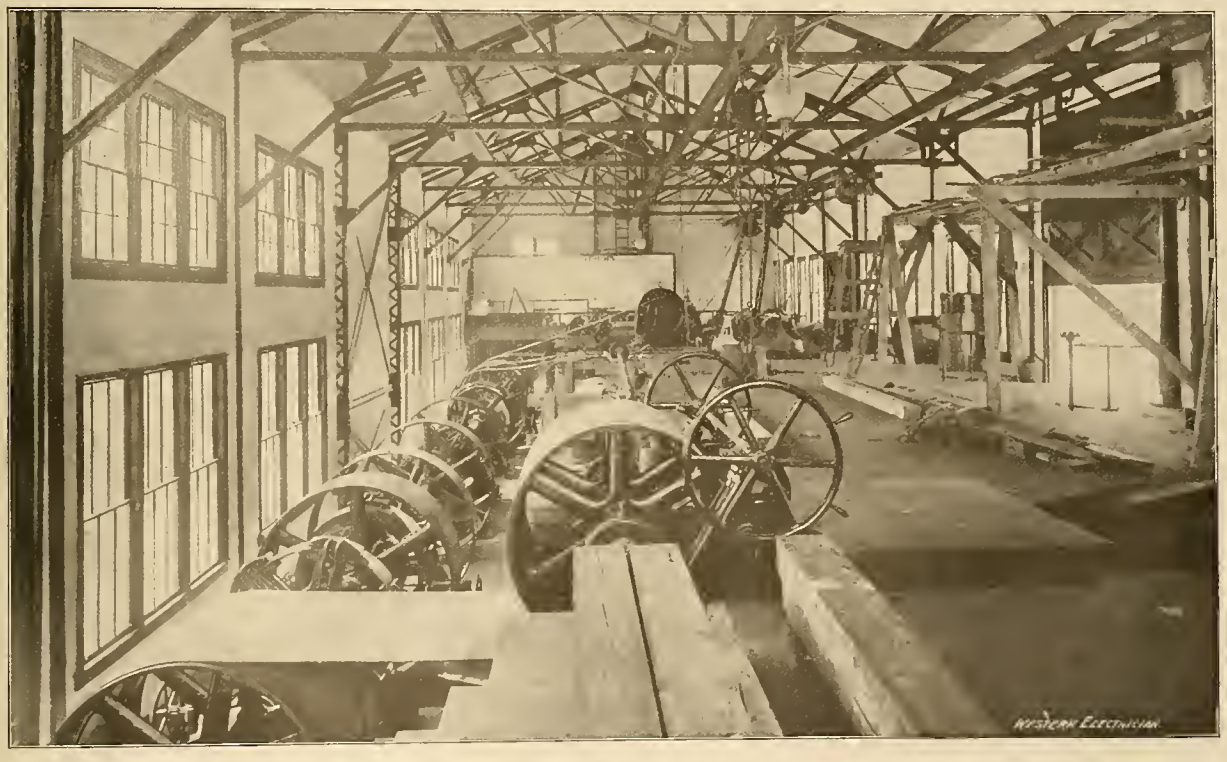


FIG. 1. POWER DEVELOPMENT OF THE DRAINAGE CANAL AT JOLIET.—INTERIOR OF POWER HOUSE.

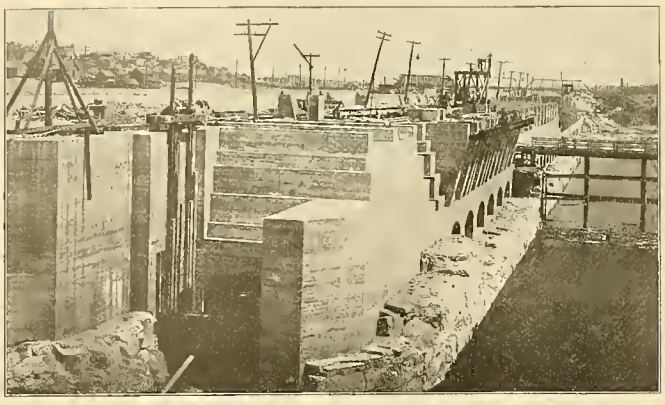


Fig 2. Concrete Work.

Fig. 3. Dam.

POWER DEVELOPMENT OF THE DRAINAGE CANAL AT JOLIET.

Fig. 2. At the time the picture (Fig. 3) was taken the head at the dam was 14 feet 11 inches.

The electrical equipment of the plant will eventually comprise one 375-kilowatt and six 750-kilowatt generators. The first installation will consist of two 750-kilowatt and the one 375-kilowatt machines. They will all be General Electric generators of the revolving-field type, and each will furnish three-phase, 60-cycle, alternating current at 2,300 volts. When completed, the new power house will have an average width of 28 feet and a total length of 850 feet. Near the center of the building the structure will swell to a width of 40 feet for a length of 60 feet. This larger portion will contain two of the 750-kilowatt units, the two exciter units and the switchboard controlling the entire plant. By his arrangement the farthest generator, the half-unit at the south end, will be approximately 400 feet distant from the switchboard. The board to be installed at first will be 21 feet long and nine feet high. It will be built of white Italian marble and will be equipped with oil switches for high-tension work. The switchboard will be furnished and erected by the General Incandescent Arc Light company.

It is expected that the new plant will be ready for operation next spring. In order to shut down its present steam station, the Economy Light and Power company has installed a temporary plant at the south end of the new power-plant site. This building is shown in Fig. 4. This picture also shows the general situation of the power plant. The broad span of water at the left is really made up of the Chicago Drainage Canal, the Desplaines River and the old Illinois and Michigan Canal. The Drainage Canal and Desplaines River, before they join the old canal, may be seen in the distance in the center of the picture, while the latter is seen at the right of the power station, extending straight to the north. The tail-race is shown in the foreground at the right, while at the left may be seen a portion of the dam through the Jackson street bridge.

The power station already constructed will be a part of the final power plant, although it has been built primarily to house the temporary water and electric plant which will be operated to carry on the company's city service until a portion of the new plant can be installed. The building is located over the six turbine bays that will hold the first six-wheel unit of the new plant. Seven old turbines have been installed in the building, and these drive a main shaft reaching along the west side of the building under the floor. Fig. 5 shows the bevel gear of the northernmost wheel and a large pulley driving an intermediate shaft, the rest of the main shaft extending beyond the pulley. In Fig. 1 is given an interior view of this building. It shows the intermediate or jack-shaft at the left and at the farther end of the room, a switchboard and a 180-kilowatt Westinghouse alternator and an exciter belted to the shaft. When the picture was taken this unit was all that had been transferred from the steam plant. The floor plan of this room, given in Fig. 6, shows the arrangement of the jack-shaft and the location of the electrical machinery which the company has on hand now and which will be operated until the new plant is ready for operation. Briefly, this electrical machinery consists of two 180-kilowatt alternators, a 200-kilowatt and a 75-kilowatt direct-current generator, four 100-light arc machines and four 50-light arc machines.

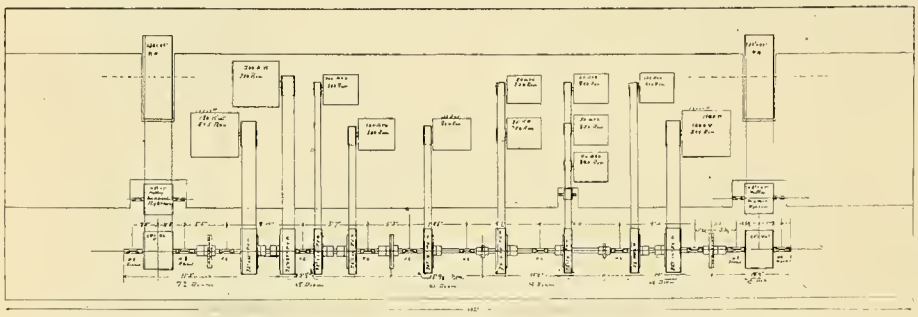


FIG. 6. POWER DEVELOPMENT OF THE DRAINAGE CANAL AT JOLIET.—PLAN OF POWER HOUSE.

The jack-shaft is formed of two sections, and either section can be driven by either of the two pulleys placed at the ends of the main shaft. The generators will all be belted from friction pulleys on this jack-shaft. A cross-sectional elevation of the power house, showing a turbine, gearing on the main shaft and belting from the jack-shaft to some of the generators, is shown in Fig. 7.

The present service of the Economy Light and Power company consists of series arc, 500-volt, direct-current power and 1,200-volt, single-phase, alternating-current circuits. About 500 arc lamps are supplied throughout the city of Joliet. This includes 265 arcs for street lighting under a municipal contract, the remaining being for commercial lighting. About 9,500 incandescent lamps are supplied, the voltages being 110 and 52. The power service includes motors ranging from one-half up to 30 horsepower, aggregating about 150 horsepower. When the new plant is completed it is expected that large quantities of the power will be contracted for by new customers. The American Railways company, which now operates a line from Joliet to Lockport and which is extending its line northeast to Chicago, will probably contract for the use of one of the 750-kilowatt units. Several contracts with large manufacturing concerns are now under advisement by the officers of the Economy company, and when the new power is turned on it is probable that it will all be contracted for. The average price of the power will be in the neighborhood of $25 a horsepower.

The Economy Light and Power company is incorporated, under the laws of Illinois, with a capital stock of $400,000. John L. Norton of Chicago, and one of the pioneers of Will County, where Joliet is located, is president of the company. The secretary-treasurer of the company is R. L. Allen of Joliet. He is also the active manager of the company and is personally overseeing the construction of the new plant. Louis A. Ferguson, general superintendent of the Chicago Edison company, is acting as consulting electrical engineer of the Economy company.

It is interesting, in conclusion, to review, briefly, the waterpower which the Chicago Drainage Canal has made available. First in importance is that at Lockport, on the property of the Sanitary District; the second is at Joliet, on the property of the State Canal Commission and at present leased by the Economy Light and Power company; the third is at Hickory Creek, below Joliet, on the Sanitary

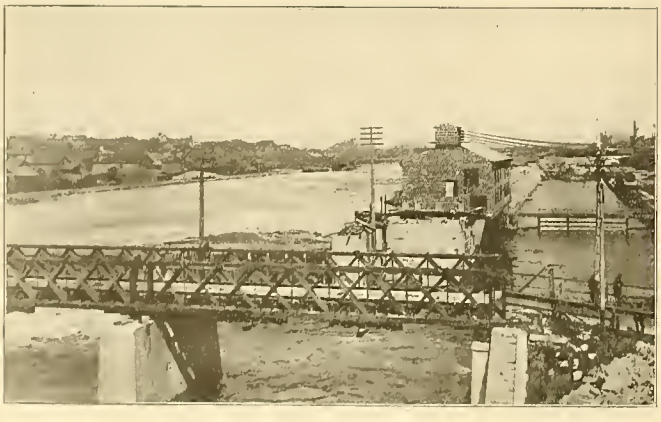


Fig. 1. View of Power Plant.

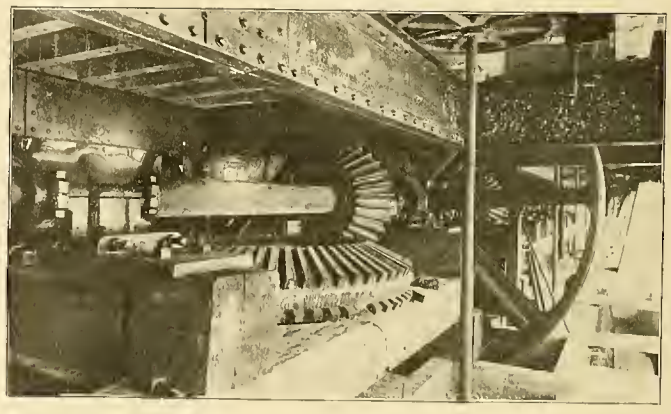


Fig. 5. Main Shaft.

POWER DEVELOPMENT OF THE DRAINAGE CANAL AT JOLIET.

District's property, where it is estimated that a total of from 8,000 to 12,000 horsepower can be developed. The waterpower at Lockport is generally estimated at 20,000 horsepower, with a flow of 300,000 cubic feet of water a minute. It is this Lockport waterpower which might be made valuable to Chicago by the erection of a power-transmission plant. At the present time the Sanitary District is engaged in building a small two-turbine waterpower

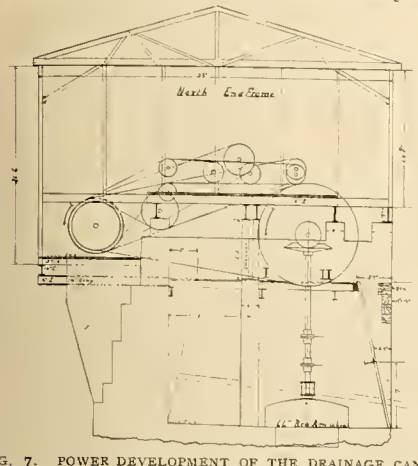


FIG. 7. POWER DEVELOPMENT OF THE DRAINAGE CANAL AT JOLIET.—SECTION THROUGH POWER HOUSE.

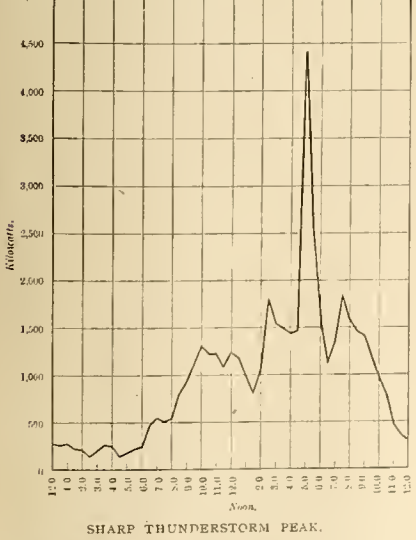
plant at Lockport, which will be utilized to generate electricity for the illumination of the dam and controlling works and also the road to the town of Lockport.

Joliet-Chicago Electric Railway.

The American Railways company, which has control of the Joliet (Ill.) Railroad company, now operating in Joliet and between that city and Lockport, is extending the line to Chicago. The track from Lockport to Lamont is completed and regular service over that part of the line was inaugurated this week. It is expected the entire line will be completed before winter. The road will reach Chicago at Archer and Fifty-ninth avenues, whence its cars will come into the city over the tracks of the Chicago City Railway company. The line follows the Chicago Drainage Canal closely. The American Railways company announces that it will soon consolidate the Chicago and Joliet Rapid Transit company, the Chicago and Desplaines Valley Electric Railway company and the Desplaines Valley Electric Railway company. These companies were granted the original franchises for the Chicago-Joliet line. A new corporation will be formed and this will be operated in connection with the Joliet Railroad company.

Sharp Thunderstorm Peak.

The English electrical journals show the unusual central-station load-curve peak herewith reproduced. The diagram reproduces the load curve of the Dickinson street electric-light plant of the city of Manchester for Tuesday, August 21st. On that day



SHARP THUNDERSTORM PEAK.

Manchester was visited by a very severe thunderstorm between 4:30 and 6 p. m., causing the sharp and sudden demand for lighting current shown by the load curve. The plant is equipped with a storage battery, which enabled it to meet the sudden strain put upon it.

Damage to Electrical Interests by the Texas Storm.

The tornado that raged over Galveston and the coast of Texas on September 8th and 9th wrought untold havoc with telegraph and telephone property throughout all that section. Amid the awful loss of life and personal property, the utter wreck of a thriving and populous city and ruin of smaller towns, the damages to lines of communication have passed comparatively unnoticed. Yet it is only through the heroic and almost superhuman efforts of the employes of the telegraph and telephone companies in rebuilding lines and clearing away miles of wreckage that the country has been so speedily put into communication with the sufferers and the splendid agencies of relief set in operation.

The telegraph companies were themselves foremost in generous efforts of relief. Col. R. C. Clowry, vice-president and general superintendent of the Western Union company, tendered the free use of the company's wires to the governor of Texas, the mayor of Galveston and all relief committees, for the transmission of messages in aid of the sufferers, as soon as the first communication was established. The Postal company was equally liberal.

Not only was every pole on the island of Galveston leveled and every wire down, but even the cables of the Mexican Telegraph company were twisted off by the fury of the tidal wave and the cable house destroyed. The ends of these cables were not secured until the 14th, when communication was again established via the City of Mexico and regular service resumed.

The Western Union company brought a cable from Chicago by passenger train and laid it across the channel between the island and the mainland. By its means the first message by wire, after the storm, was sent out of Galveston at 4:16 p. m. of the 13th. A very cheering piece of news was that the entire telegraph force of Galveston was reported safe.

Wire connection between New Orleans and Houston, however, had already been restored. One duplex was running to Houston early on the 11th and one or two more later in the day.

C. H. Bristol and J. C. Barclay, with a carload of material and a large force of operators, left Chicago for Galveston at the first news of the disaster. District Superintendent T. P. Cook has full charge of the repairs. It is proposed now to put in a double line of cables between Galveston and Houston, to be immune from storms hereafter.

By Sunday the company had five lines into Galveston and the situation had been relieved.

The following dispatch was received on Friday at the general offices of the Postal Telegraph and Cable company in New York from General Superintendent English of that company at Houston, Tex.: "Three of our operators have just arrived at Houston from Galveston. Chief operator lost his whole family and is badly bruised. Reported that our manager and his family are saved. There is not a telegraph pole standing on the island. The telegraph line of the Gulf and Interstate railroad is completely washed away for fifteen miles. Telegraph lines completely wrecked. Newspaper reports not exaggerated."

Assistant General Superintendent E. J. Nally stated that the Postal company's force set up six miles of poles across the island on Friday, the 14th, during the hours from sunrise to sunset. Two lines were up that day, four more early on Saturday morning, and it was expected to put in six additional ones before Saturday night. The company has a small army of men at the work of repair, toiling day and night. Its business all through Texas and neighboring states has become enormous, owing to the messages for relief, inquiries after the missing, etc. The relay stations at Kansas City, Memphis, Chicago and St. Louis were simply overwhelmed with work. At the latter station operators were on duty 33 hours at a stretch without relief.

Employes of the telegraph companies in the storm district were themselves heavy losers and generous aid has been given them from fellow operators throughout the country. J. H. Bunnell & Co. of No. 20 Park place, New York, have sent a check for $100 to J. B. Taltavall of the Telegraph Age to start a fund for the benefit of the telegraphers who have suffered by the disaster. As yet there has been no time nor inclination to figure the damages sustained by the telegraph interests.

At Houston the Western Electric company was installing a new telephone exchange for the Southwestern Telephone company at the time of the storm. It reports no indoor damage to the Houston telephone plant except to the intermediate distributing frame of the switchboard, which was slightly injured by water. The overhead telephone wires all through that section suffered correspondingly with those of the telegraph companies. On the 11th there were in operation in Houston 400 lines out of an existing 1,800. Repairs are going on with great rapidity, the Southwestern company alone having a force of 500 men at work in Galveston restoring connections, under the direction of Superintendent Baker. The total loss to this company is estimated by him at $300,000.

Charles J. Glidden, president of the Southwestern Telephone company, offered, in the interests of his company, free use of the telephone service to Virginia Point and Galveston in aid of the sufferers. The company also contributed $1,000, and Mr. Glidden made a personal contribution of $500.

Besides the office at Houston the Western Electric company is installing telephone exchanges at Austin, Waco and Dallas, but suffered no losses in these towns.

A view of the handsome Galveston exchange, as it appeared before the great storm, is shown herewith.

The electric-light and street-car interests of Galveston suffered severely. The plant of the Brush Electric Light and Power company was wrecked and the city was in absolute darkness for several nights. Only a few concerns which operate their own illuminating service were enabled to do business. Nearly every residence has gone back to the primitive candle. The absence of street lights drives all who have no imperative business on the streets to their homes at nightfall, but the work of the patrol system is made more difficult thereby and the opportunity for looting greater.

The Galveston City Railroad company suffered in a similar manner. The motormen deserted their

GALVESTON TELEPHONE EXCHANGE.

cars when the fury of the wind and the rush of the water made it no longer possible to operate them. Attempts are being made now to get the cars in shape again. The great destruction of live stock has eliminated the carriages and cabs as a means of transportation and the need of the trolley promises to become a most pressing one when rebuilding begins.

Kansas City Convention.

Preparations for the convention of the American Street Railway association, to be held in Convention Hall, Kansas City, on October 16th to 19th, inclusive, are well under way. The street-railway conventions are always largely attended, and this year's gathering, for which a good programme has been arranged, is expected to prove no exception to the rule. The Kansas City people are arranging suitable entertainment features, and there is no doubt that all visitors will leave the city with the memory of an agreeable sojourn. The list of papers to be read shows a sensible choice of topics for discussion. With the names of the authors, it is as follows:

Daniel B. Holmes, counsel of the Metropolitan Street Railway company of Kansas City: "Consolidation of Street Railways and Its Effect Upon the Public."

C. F. Bancroft, electrical engineer of the Massachusetts Electric Companies, Boston: "Comparisons of the Various Systems of Electrical Distribution for Street Railways."

F. T. C. Brydges, superintendent of car shops for the Chicago Union Traction company: "Painting, Repainting and Maintenance of Car Bodies."

N. S. Hill, Jr., general manager of the Charleston (S. C.) Consolidated Railway, Gas and Electric company: "The Storeroom and Storeroom Accounts."

N. H. Heft, president of the Meriden (Conn.) Street Railway company: "Double-truck Cars—

How to Equip Them to Obtain Maximum Efficiency, Under Varying Conditions."

A large and representative display of street-railway apparatus is assured. About all the space has been taken, although a few locations may be had by prompt application on the part of prospective exhibitors. Secretary T. C. Penington, 2020 State street, Chicago, or W. A. Satterlee, Metropolitan Street Railway company of Kansas City, can give further information.

Electricity at the Pan-American Exposition.

The construction work at the Pan-American Exposition is being rapidly pushed forward, and it is now reaching a period in which all who are interested in making exhibits are desirous of knowing more of the plans and scope of the electrical department. The electrical building was designed by Architects Green and Wick of Buffalo. The structure is 500 feet long from east to west and 150 feet wide, giving an exhibition space of 75,000 square feet. The south facade fronts the Mall and the north fronts the Midway. The east end is toward the massive electric tower, the foundation of which has just been placed, while the west end of the electrical building faces the Grand Canal. The building is long, low and inviting, and the design of the facade shows artistic grouping. The openings of the loggias, placed at frequent intervals, will present a delightful effect, showing more and more of the details of the pilasters and openings as the eye travels to the end of the building farthest away from the observer.

In the northwest corner of the electrical building, as shown in the accompanying floor plan of the building, will be located the 5,000-horsepower transformer plant. This plant will consist of 19 250-kilowatt General Electric air-blast transformers, which will transform the Niagara Falls polyphase current from 11,000 volts to 1,800 volts for distribution about the grounds. Smaller step-down transformers will be used in several hundred transformer pits about the grounds and in the various buildings, where the current will be reduced from 1,800 volts to 104 volts. At this pressure lights and electric motors and other appliances will be operated.

In addition to the 5,000 horsepower obtained from the Niagara Falls Power company, an auxiliary power house will be located on the grounds for operating several thousand arc lamps, which will illuminate the drives around the grounds, and for supplying direct current of 500 volts and 110 volts for various purposes. This building is already completed and is about ready for the installation of the apparatus. There are to be installed at first, for use during construction, about 16 Brush arc machines of a total capacity of 3,000 lamps. These machines will be driven by steam power, as will all the generators in the auxiliary power house. There are also to be four Westinghouse 180-kilowatt alternators for incandescent-lighting purposes. The direct-current apparatus for power purposes will consist of five 200-kilowatt, 500-volt Westinghouse generators, and for the low-tension direct-current circuits there will be provided two 90-kilowatt, 110-volt machines.

Professor George F. Sever, who is the superintendent of electrical exhibits, has issued an announcement that is of interest to prospective exhibitors and also to those who intend visiting the exposition. He gives an outline of the enormous development in the application of electricity to scientific and commercial uses and also indicates what may be observed among the electrical features at the coming exposition. He says:

"Due to the adaptability and convenience of electrical illumination, this method has been adopted for the Pan-American Exposition grounds and buildings. It is probable that all the buildings will be outlined by rows of incandescent lamps, and the Electric Tower, which will form one of the most important and central features of the whole setting, will be similarly illuminated. Besides these features, there will be many novel and interesting electric fountains and displays, with combined water and electric effects, being designed as marvels of beauty. In order to carry out the various projects, over 200,000 incandescent lamps will be utilized, and to the end that this beautiful display may not be marred by other sources of light, the use of arc lighting will be confined exclusively to the borders of the exposition grounds. It is intended that the illumination of the aisles and the interior of the buildings shall be effected by a suitably arranged system of arc lamps.

"The building which is being erected for the location of the electrical exhibits is placed in the northwestern section of the grounds, fronting the Mall. The location of the Electricity and the Machinery buildings in such close proximity to each other will enable visitors to make clear comparisons between the closely allied apparatus. There will be many operative electrical devices in the Machinery building, necessitated by the increased employment of electric motors for such work. The eastern end of the Electricity building fronts the Electric Tower, and will afford an excellent opportunity for viewing the magnificent illumination of this feature during the night displays.

"The area covered by this building is 75,000 square feet, but, owing to the architectural features which have been incorporated in order to make it conform to the general architectural setting, there remains, for exhibit purposes, approximately, only 25,000 square feet of space. The aisles have been made sufficiently wide to accommodate the large number of people who will be attracted by the extensive exhibits of historical and operative features of electrical science and engineering. The main longitudinal aisle will be 15 feet wide, the side aisles being 12 feet, this breadth being considered sufficient for the convenient observation of the exhibits. The cross lines in the accompanying installation plan indicate areas two feet square. The spaces which are indicated by the letters (E), (J), (K), (L) and (P) are to be devoted either to concessions or to some special exhibits of an electrical nature. These are particularly desirable for the exhibit of some important feature, such as telephones, electric-lighting specialties, batteries or electro-chemical products. The floor of this building has been made especially strong, in order to carry the heavy concentrated weights which are a feature of electrical machinery.

"It is proposed to make the electrical section of this exposition unique. Heretofore electrical exhibits at expositions have been largely confined to large spaces filled by individual exhibitors, so as to demonstrate the amplitude of their resources.

"For the Pan-American Exposition each manufacturer is invited to contribute only such articles as may be considered really novel or of interest, thus making the exhibit a collective one, rather than one exclusively composed of individual commercial exhibits. If the electrical manufacturing firms in the United States will each contribute only one or more exhibits, the total will make a formidable showing, instructive to the engineer and most interesting to the general public. Where it is necessary to make the contrast stronger, historical apparatus may be introduced, together with the most recent developments. Another important factor, which has necessitated a selective exposition in this particular instance, is the small amount of exhibition space, as compared with the area occupied by the buildings.

"The exhibits will, with this object in view, be divided into two groups:

"First—The collective exhibit. This will consist of retrospective exhibits of historical interest, illustrative models or practical contrasts, showing the advances in the art.

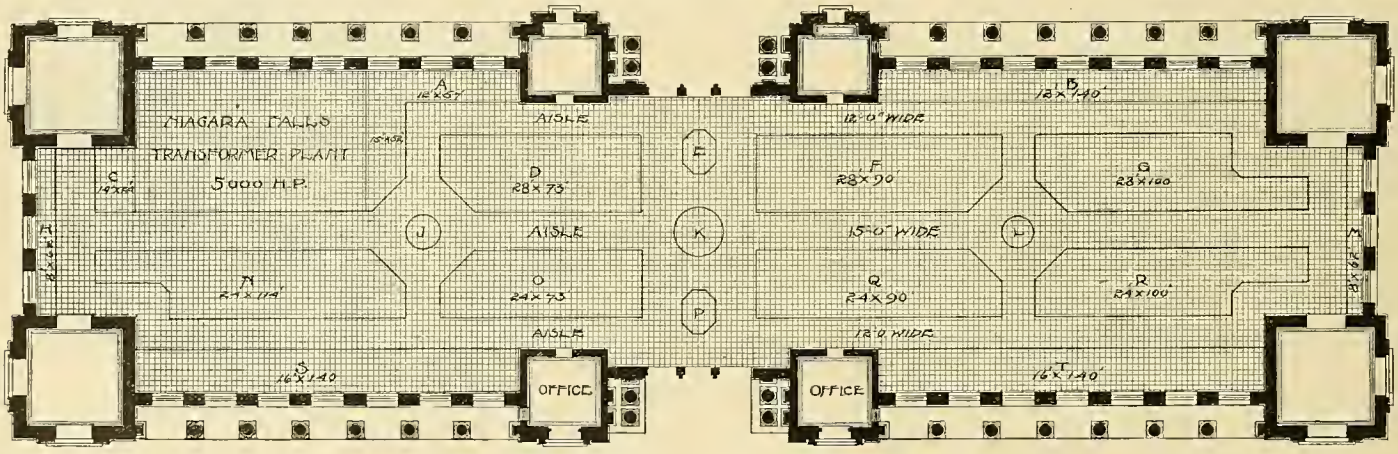
"Second—The commercial exhibit. This will be composed of those exhibits possessing distinctive merit, whether this consists in workmanship, novelty or useful applications.

"One of the most important features of an exposition is the classification of exhibits. By means of this the exhibits are arranged and the awards made. After a careful study of the various classifications adopted for other expositions, the following arrangement has been selected for the electricity section of the Pan-American Exposition:

"Group 1, history and literature of electric science; group 2, apparatus illustrating the phenomena and laws of electricity and magnetism; group 3, apparatus for electrical measurements—laboratory and commercial; group 4, electric batteries; group 5, dynamo-electric machinery and apparatus for the transmission, conversion, distribution and regulation of electric power; group 6, electric lighting; group 7, electric telegraph and signals; group 8, the telephone and its appliances; group 9, electro-metallurgy and electro-chemistry; group 10, electric-heating apparatus; group 11, electro-therapeutics; group 12, miscellaneous applications.

"In the arrangement of the electricity exhibits it is desired to place the commercial and operative exhibits together and in one section of the building, while the historical features, with the models, may be placed in another section of the building where a close inspection and study of them can readily be made. With such an arrangement as this, excellent opportunities will be afforded for comprehensive study of electrical science from its inception to the most advanced applications at the present time.

"The charge for space in the Electricity building will be $1 and $1.50 a square foot. Much of this space has already been applied for, great interest being manifested in the electrical section by many manufacturers, but as the assignment of space will not take place for some time, opportunities still exist for the remaining manufacturers to enter exhibits in this building. It is proposed to show at this exposition all the important advances in the various lines of electrical engineering, and if the expectations now held are realized, as there seems to be no reason to doubt, the electrical exhibits will equal, and will probably surpass, those that have been made at any exposition of equal magnitude."



FLOOR PLAN OF THE ELECTRICITY BUILDING, PAN-AMERICAN EXPOSITION.

Telegraphy in the Philippines.

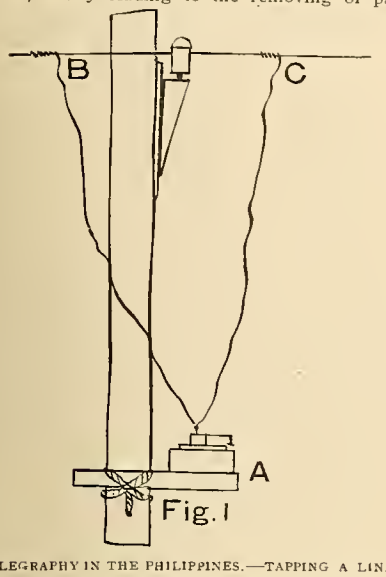
By G. D. Rice.

The establishment of telegraph and telephone lines in the Philippine Islands has opened up considerable new territory in the new possessions of the United States and has also given a new line of work to the natives. The Americans have been doing nearly all of the construction work on new lines, but recently have secured the services of the better classes of natives for the general mechanical work and the lower classes for the laboring work. In this way the natives are gradually working into the ways of telephone and telegraph-line construction.

The average Filipino is a poor mechanic, and some of the work on wires and poles is very poor. The Filipinos have for a hundred years or more neglected to make any study of the sciences, and all industrial and mechanical pursuits appear to have had a secondary place with them. The consequence is that to-day they are incapable of managing any of the modern machines or labor-saving devices of the age. The manufacturers of the islands must confine their efforts to the production of the crudest forms of articles. There can be no shoes made here, because the natives are not possessed of sufficient mechanical ability to operate shoe machinery. The Filipinos cannot handle the wrench to good effect, and many a good electrical device which has been sent here as a specimen on trial has been ruined by the recklessness of a native tinker. I have seen electrical devices of all descriptions put out of service in short order by these bungling native mechanics. These men have never had the proper training. They are good enough at hammering at and wrenching with bars the heavy rolls of a sugar-grinding machine, for the Spanish builders evidently supposed that the native mechanics would do this sort of thing. Therefore the rolls are cast and turned in immense proportions, and there is not a local mechanic possessed of enough strength to wield a hammer and break these rolls. On the other hand, the packing presses for the to-

bacco and hemp products of the islands are not so firmly designed, and many of these presses may be found idle, owing to the deft manner in which the crude mechanic of the Philippines can swing the hammer and smash things.

As soon as a telegraph instrument of any sort is in the hands of the Filipinos, their curiosity is so great that they must pick it to pieces to see how it works. The mode of operation consists in inspecting carefully every nut, screw, pin and connection, finally leading to the removing of parts.

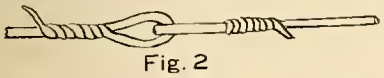


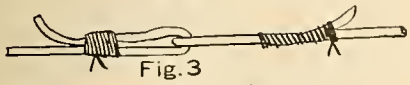
TELEGRAPHY IN THE PHILIPPINES.—TAPPING A LINE.

The natives will gradually pick the apparatus to pieces, and then they are too lazy to put it together again. After they have torn a machine apart they lose interest and want to go to sleep. There is the most peculiar lot of mechanical people working about the lines in the Philippines one ever saw. The only way that the soldiers can get any service out of them is to use the rod and frighten them into working. I accompanied several corps of linemen across the southern islands of the Philippine group, and the sergeant of the outfit had to attack the native assistants with a good-sized stick every day to get any work out of them.

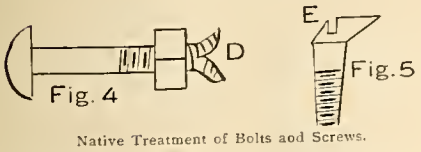
For a great many years it has been the custom of the natives to sleep a great part of the time. The Filipinos are willing to work until nearly noon, and then they want to sleep till about three o'clock. The active Americans connected with the lines in the Philippines do not desire to lose the best part of the day in sleep, and they object to have operations stopped on the erection of new lines or in the repair of old ones, just to permit these lazy fellows to take a nap. Therefore there is considerable disputing about noontime each day.

In nearly all cases the regular Signal Corps men are employed so far as is possible in the line work on the islands, but there are not nearly enough, and the natives have to be used and trained. The natives do all of the laboring work, such as digging holes, getting the poles, and the like, and some of them who were in the Spanish army are competent to use the instruments. The touch of the Spanish





Natives' Wire Joints.



Native Treatment of Bolts and Screws.

Primitive Wire Cutting.

TELEGRAPHY IN THE PHILIPPINES

operator is delicate, and when the American operators are broken in upon in the middle of a message by someone tapping the wires, they usually recognize the more delicate touch, and they know to whom to credit it.

For a long time on Panay a Spanish pupil tapped the wires of the military service by the plan shown in Fig. 1. He connected his wires at (B) and (C) and attached the instrument to the pole at (A). This man had been employed by the Spanish for years and was a competent operator, being familiar with the English language and capable of taking American messages from the wires. He has not been caught, but his operations have been stopped by the use of a code for all important military telegrams.

The Filipino, and, in fact, those Spanish linemen and operators who are in the field here in the interest of the rebel army, are about as poorly equipped in mechanical training as they possibly can be and still hold their places. In Fig. 2 is shown the usual mode employed for joining the wires, and many of the Spanish and native workmen cannot even make this sort of a union. In Fig. 3 is illustrated the simpler pattern they use. They lap a piece of wire over and wind it with fine wire, sometimes using hemp twine for this purpose. This sort of a splice usually breaks in a short time.

I have also seen them try to make a nut hold to a bolt by splitting the end of the bolt outside the nut, as at (D), Fig. 4. Of course, this makes the nut stay in its position, but the next man who wishes to remove the nut will experience some trouble. These native mechanics who follow in the wake of the Signal Corps, or who are employed by the wire tappers of the insurgent army, expose their operations by the way in which they do their work. After a part of the system has been tinkered with one may see the heads of screws broken off, as at (E), Fig. 5, through the native delivering a blow with the hammer or with a rock, instead of trying to turn out the screw with a screw-driver, in the proper manner.

The Filipino method of cutting a little wire is most laborious. The natives make the hardest sort of work of it, and for this reason the heavier wires are well protected. I remember seeing in one lo-

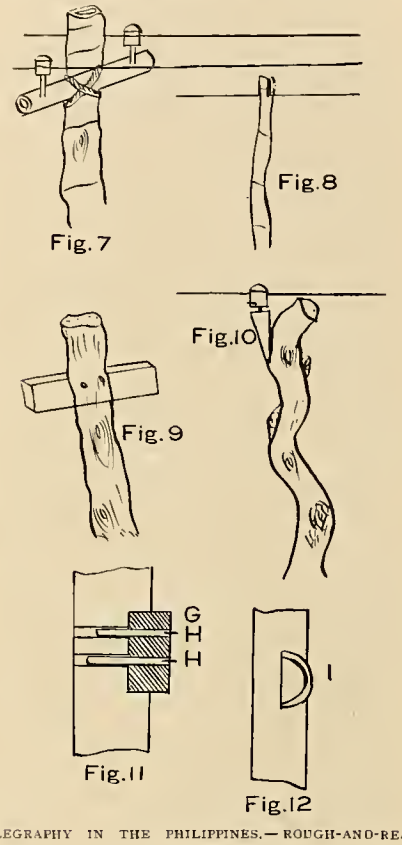
TELEGRAPHY IN THE PHILIPPINES.—OPERATOR'S ROOM IN CONVENT.

cality a dozen poles dug up and thrown to the ground by the rebels, in hopes of cutting the line. But the wires held together, and the linemen went there the next day and merely stood up the poles and replaced them as before. Those of the natives who have cut the wires, instead of using the proper instruments with which to perform the work, look about for a couple of round stones. They then ascend a pole, and, with a stone in each hand, proceed to pound the wire in one place until it flattens out and becomes so thin that it breaks, as at (F), Fig. 6.

I have been in many places on the islands after they have cut the wires and discovered that some local machinist, farmer or bull-cart driver happened to want a piece of good wire and could see no easier or cheaper way than to climb a pole and chop out the needed amount. This, of course, is dangerous, for the Americans are ordered to shoot all whom they see about the wires acting in a suspicious manner.

Although there are plenty of valuable woods in the Philippines for pole service, the lack of means to get at these poles and put them in shape for use in the construction of new lines makes it impracticable to utilize them. There are immense forests of cedar woods in many sections of all the islands of the group, and some day someone is going to enrich himself by establishing mills for getting out this timber for telephone and telegraph service, etc. The cedar not only exists in vast quantities, but it can be had very cheaply, as the owners merely hold old Spanish land grants, which they are always willing to part with for a very low cash price. Lands worth thousands of dollars are frequently purchased for a few hundred. I have seen soldiers and guards and operators and others of the service buy mineral and timber lands for a few dollars, which some day are going to be worth thousands of dollars. All that is delaying the matter now is the lack of the proper lumber cutting and milling machinery with which to develop the lands. One lineman making about $20 a month has bought some wooded properties on the island of Panay that will make him wealthy as soon as the country is developed. One piece of land bought for $10 gold had forests of mahogany on it. On others I have seen rosewood.

Putting in a line in a new country where the enemy is present and constantly shooting into the men does not make it practical to go out far for suitable poles, and usually the best at hand are



TELEGRAPHY IN THE PHILIPPINES.—ROUGH-AND-READY LINE CONSTRUCTION.

used. Often the pole is a cocoanut tree, like in Fig. 7, and if nails and bolts are short, the insulators are attached with the cross-piece lashed on with hempen rope. One long line I saw was put up in a hurry for special purposes by using little bamboo poles, about 10 feet long and two inches in diameter, with a slot cut in the top for the wire, as at Fig. 8. This was for telephone service, and the wire was protected, so that it could operate while on the ground. Ten miles were put up by two parties, operating from either end, in 48 hours, and remained serviceable for about four weeks, when new poles of the proper sort and more substantial were erected.

In Fig. 9 another form of pole is used, while in Fig. 10 we have the plan of nailing the insulator direct to the pole. Some of the cocoanut poles are perfectly straight, but there is a species of harder wood found in abundance along the roadside and in the jungle which makes good poles, but which is very crooked. This kind is shown in Fig. 10. The crookedness is usually regular, and the pole can be ascended regularly by using the projections and turns as steps. Frequently nails or other supplies give out before a line is finished, in which case the native carpenters are called into service, and these men usually have some pretty good modes for attaching wooden parts without any ironwork. First the pole is mortised and the cross-piece sunk in like (G), Fig. 11. Then the parts are bored through and wood pins inserted. These pins are made secure by driving into the ends of each little wood wedges (H) (H). This makes a firm job, but it takes the carpenter a long time to finish the operation. But his wages are only about 20 cents a day, and the linemen can secure any number of them to work.

In Fig. 12 is shown the process of using a bamboo cross-arm. The pole is cut out to the proper proportions to receive the cross-arm (I). The arm is split bamboo and is light and tough. At the point where the insulators are connected, back pieces are put on, thus making the securing part strong.

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CONVENTIONS AND EXPOSITIONS.

International Association of Municipal Electricians, Pittsburg, Pa., September 25th to 27th.

American Electro-therapeutic association, New York, September 25th to 27th.

American Street Railway association, Kansas City, Mo., October 16th to 19th.

Automobile Show, New York, N. Y., November 10th to 24th.

Illinois State Electric association, Peoria November 27th.

Mr. Tesla has made so many curious statements in relation to what he proposes to do that it is pleasing to note a generous recognition of the valuable work that he has actually accomplished. Such a tribute is paid in the recent opinion of Judge Townsend, upholding the rotating-field patents granted on Tesla's brilliant discovery. Through the daily and technical press this judicial decision has gained wide publicity and will serve to bring again to mind an important portion of Tesla's really beneficial work.

The plans, projects and perturbations of what was the Harrison Telephone company of Chicago are over and done for; the glory of Ichabod has departed. The story of the passing thereof is terscly told in a paragraph from Springfield, Ill., in the daily papers, under the heading "New Illinois Corporations:"

Chicago Harrison Telephone company, Chicago; name changed to Chicot Lumber company; object changed to manufacture and deal in lumber; capital stock decreased from $4,000,000 to $300,000.

Thus the Chicago Harrison Telephone company that caused some commotion a few years ago is now but a reminiscence—transformed into a prosaic lumber company, with capital stock decreased a matter of 92½ per cent. An effectual metamorphosis, surely! But Chicago has at least three distinct operating telephone companies left, and can regard the change with equanimity.

The importance of Scotland as a market for manufactures may not be fully understood in the United States. It must be remembered that, disregarding textile fabrics and whisky, Scotland is not a manufacturing country; it is probable that the great manufacturing industries of the entire country do not number more than half a dozen. Comparatively few of the articles in common use are manufactured there, but are imported from England and abroad. In proportion to population and wealth Scotland is, in the opinion of those who are well informed, a better market for American goods than is England, although the latter country, being much greater both in population and wealth, is a much larger field to cultivate. But the trade of Scotland is well worth striving for, as many German and Belgian manufacturers long ago discovered to their present profit.

How the "Edisonian point of view" has developed and broadened is shown by the presidential address of Mr. Lieb at the convention of the Association of Edison Illuminating Companies at Saratoga early in the present month. The Edison association is an organization of influential and representative central-station men, and, aside from its discussion of business matters, it has accomplished much useful work of a technical nature, as in lamp standardization and the like. In the early days it was intensely direct-current and low-tension in its practice and advocacy, but of late years it has broadened and developed, as Mr. Lieb relates, and now seeks the best methods of applying electrically transmitted power to industrial conditions, more with the broad-mindedness of the judge and less with the zeal of the advocate. In relation to the publication of its proceedings the association has always taken an ultra-conservative position, carrying the idea that the organization was merely a private business association rather too far in the direction of clannishness and unnecessary secrecy. But the association has been a good thing for its members and is also entitled to credit for work of general benefit to the industry, although one cannot forego the remark that the amount and effect of such work might have been still greater, with no ill result to the Edison companies, had a policy having a wider outlook and one of greater publicity been adopted.

If it shall prove that the Philippines can contribute appreciably to the world's supply of rubber the value of the islands will be greatly enhanced. It is reported from Washington that, upon the recommendation of the War Department, the Agricultural Department is preparing an order, setting apart as forest reserves the island of Romblon, which is north of the island of Panay; also the island of Pauitaui, which is one of the extreme group of the Jolo islands. Officers of the army who have been investigating the islands have found, so it is said, that these are the richest lands in the world for rubber trees, and it is the intention of the Washington authorities to have the trees preserved and cared for. The cost of rubber is a very serious item to electrical and other consumers. It is said that more than $100,000,000 worth of this product has been imported into the United States during the last four years and more than $60,000,000 worth in the last two years. A decade ago the annual importations of india rubber amounted to about $15,000; now they exceed $30,000,000, and are steadily increasing. Practically all of the importations of rubber come in crude form for the use of manufacturers, who are constantly extending the application to various new lines of industry. Northern Brazil, Southern Mexico, the West Indies, Central Africa, India, the Straits Settlements and the Dutch East Indies supply this increasingly important feature of our importations. If the Philippine Islands add to these sources to a considerable degree there is the welcome possibility that lower prices may prevail.

Linemen and others whose duties require them to work among bare electric wires carrying heavy currents know well the value of the rubber glove, but nevertheless, from carelessness or over-confidence or a desire to work with unimpeded fingers, they sometimes neglect to use it. It too frequently happens in such cases that serious accidents happen, sometimes resulting in death. Such a fatality occurred on Staten Island the other day, when an inspector for an electric-light company was shocked to death on a pole. The dead man was experienced in the business, but had failed to put on his gloves, and an accidental short-circuit through the hands caused death. The moral is very obvious; it is a warning that has been often repeated and is continually disregarded.

In France, it seems, it is thought that there is opportunity for improving the protective devices for the hands. The Association of French Manufacturers for the Prevention of Accidents to Employes has opened an international competition for insulating gloves for the use of working electricians. The gloves should serve as an efficacious protection to the hands and lower arms. They should be of substantial make, and capable of resisting not only electromotive force, but also accidental perforation which might be caused, for example, by the roughness of the wire. Persons desirous of competing should send to the president of the association, before December 31st next, two pairs of gloves, together with an explanatory statement. A prize of 1,000 francs will be given to the inventor of the gloves which are pronounced to be the most satisfactory.

A telegraphic message from England gives the information that at the meeting of the British Association for the Advancement of Science at Bradford, on September 8th, Sir William Preece announced that he had successfully transmitted intelligible speech eight miles across sea without the aid of wires and that the establishment of such a system for commercial communication was practicable between ships or between ships and the land. This announcement, if the newspapers report it correctly, certainly marks a great advance in wireless telephony, for heretofore the numerous experimenters in this direction have been unsuccessful in transmitting really intelligible speech. In the employment of Hertzian waves to transmit speech it is necessary to decohere the particles in the coherer with a rapidity greater than that of the speech-transmitting wave impulses, and, as the frequency of the sound waves is high, this has been found to be a hitherto unsurmountable obstacle. The sharp, distinct signals of the Morse alphabet are transmitted, at a slow rate of speed, through the coherer, but when the attempt is made with the sound waves of the human voice the resulting sound has been broken and indistinct. However, Professor Graham Bell has expressed a belief in the ultimate possibility of wireless telephony, and as it is possible that Sir William Preece does not employ the coherer at all, there is little reason to doubt the explicit statement of the dispatch. Eight miles is a considerable distance in telephony, and if the speech transmitted is, in truth, intelligible, and if the apparatus employed is workable under commercial conditions, Sir William has given to the world an invention of great value.

The Employment of Condensers.[1]

By P. Boucherot.

The possible applications of condensers, aside from those dealing with laboratory measurements, of which we will not speak, may be divided into two categories—applications in which the energy in play is of small import, and where, in consequence, the price of the apparatus does not figure to any extent, and those which, on the contrary, demand condensers storing considerable amounts of energy, in which the dielectric is subjected to high tensions in order to reduce as much as possible the price of the apparatus.

Of applications in the first class we will say little, for they are already well known. We will cite only that which Foucault made to the Ruhmkorff coil; the applications to telegraphy; to simultaneous telegraphy and telephony; to induction telegraphy at a distance; to the production of high-frequency currents; to wireless telegraphy, etc. All these applications have been made without meeting obstacles in the construction of the condenser itself. It is not so, however, with the second series of applications, that to commercial alternating currents, and one which hitherto has not been on a large scale, owing to difficulties which will be explained below.

All applications of condensers to such alternating currents may be considered as consequences of electrical resonance, and, as a result, of the oscillatory charge and discharge.

If C is the capacity of a condenser, L the coefficient of self-induction of the discharge circuit, R the resistance of the circuit, the discharge will be non-oscillatory, for

$$R^2 > \frac{4L}{C}.$$

The discharge, on the other hand, is oscillatory, for

$$R^2 < \frac{4L}{C}.$$

That is, the discharge current becomes zero after having passed through a series of positive and negative values. The case then corresponds to that of an ordinary pendulum vibrating in air and but slightly damped.

The period of discharge is constant; it is independent of the value of the electric charge itself and has for its analytic expression,

$$T = \frac{2\pi}{\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}}.$$

In the particular and entirely theoretical case where the resistance of the circuit is zero, the period becomes

$$T = 2\pi\sqrt{LC}.$$

In this case the energy originally stored in the condenser cannot dissipate itself, since there can be no I^2R losses; the duration of the discharge is indefinite, i. e., there exists indefinitely in the circuit an alternating current of period $T = 2\pi\sqrt{LC}$. If it is desired that the alternating current shall be always the same, i. e., that the amplitude of the current oscillation shall be independent of the time, it is necessary that the impressed electromotive force have the same period as the alternating current due to the circuit formed by the condenser and the self-induction, the resonating circuit; that is to say, that the period of the impressed electromotive force shall have the value give above. If such be the case we have resonance, by analogy with acoustic phenomena. For this current alone will Ohm's law hold without taking account of the electromotive forces of induction or capacity.

The impressed electromotive force may be introduced into the circuit in any manner whatever. We will examine the most important applications, first stating, once for all, that a condenser and self-induction will always be considered as so adjusted that there exists between them the relation

$$\frac{4\pi^2}{T^2} LC = 1.$$

1. Condenser in series.—We open our resonating circuit and connect to the free terminals a source of alternating current; e. g., an alternator whose period is exactly $T = 2\pi\sqrt{LC}$. Under these conditions the intensity of the current passing through the circuit will be exactly that which would flow if there were resistance only therein. It is curious to note that if we now have, for example, 100 volts at our circuit terminals, given by the alternator, we may perfectly well have 1,000 or 10,000 volts at the terminals of the self-induction coil, or between the armatures of the condenser, as a result of the great quantity of energy which may be stored in each of these devices, compared with that furnished by the alternator during one period.

This property has been applied in certain alternating-current motors for the excitation of the fields, and can be utilized wherever we wish to produce an alternating magnetic field without greatly exceeding the actual power expended in heat effect, and without requiring an electromotive force greater than that corresponding to the ohmic drop of the exciting circuit.

2. Condenser in Shunt.—Return to our original resonating circuit and place a source of current in shunt with the condenser, the source having a period equal to that of the resonating circuit. Under these conditions the currents which the alternator will give to the condenser and to the self-induction and resistance may be each much larger than their sum, larger than the total current given to the two circuits. This property may receive numerous applications. It permits us to reduce by means of condensers the magnetizing currents absorbed by all devices not producing their own magnetic fields, such as transformers, impedance coils and asynchronous motors.

3. Splitting of an Alternating Current.—We come to other applications of condensers in which the effects produced appear to proceed less directly from resonance. In these applications we have superposed upon the current of resonance, properly so-called, other currents of equal importance which complicate the phenomena.

By connecting with a source of alternating currents two shunt circuits, one containing a resistance ρ and self-induction ρ, the other a resistance ρ and a condenser of reactance $-\rho$ these circuits will be the seat of alternating currents differing in phase by 90°. Now, if we replace each of the resistances by the field circuit of an asynchronous, di-phase motor, and modify the reactances in circuit so as to take account of the reactances of the motor circuits, we may thus drive the asynchronous motor with a simple alternating current.

This application, with that of condensers in derivation, presents the most of interest; but there are serious difficulties of realization from the fact that the capacity varies at each instant with the charge.

4. Arrangements for Constant Current; Resonators.—Condensers may serve, combined with induction coils, to produce circuits for constant current by means of constant potentials, and inversely.

It is sufficient to place each constant-current circuit in shunt around a condenser put in series with a self-induction coil, in connection with the source of constant potential. The same result may be obtained more advantageously by a double resonator thus arranged: Connect two coils and two condensers, properly adjusted, so as to form a quadrilateral A B C D, in which similar parts are in opposite sides. Then by connecting two opposed corners, A B, to a source of constant potential, we obtain, in a circuit placed between the two other corners, D and C, a current of constant intensity whatever may be the impedance of this circuit.

Of further applications, we will mention only that the employment of two resonators permits the coupling of two alternators in series, thus furnishing an apparatus equivalent to the ordinary transformer.

5. Excitation of Alternators.—Condensers placed in derivation with the armature of an ordinary alternator may, by the proper proportioning of this alternator, serve for the production of its field; they are also, if placed in derivation with the field of an asynchronous motor with rotating field, capable of performing as a generator. The fact of particular interest with all these generators excited by condensers is that one may thus adopt with these machines the same means of excitation as with direct-current dynamos. If the condensers are placed in shunt the characteristic of the machine is the same as that for a direct-current shunt dynamo. If they are placed in series the characteristic is that of a series machine for direct currents; that is to say, the electromotive force of the machine is zero on open circuit, and increases with the diminution of the external resistance.

Finally, by combining the two preceding methods, we have a machine whose characteristic is that of direct-current compound machines. As in these the shunt excitation may be given before or after the series. We can likewise hypercompound the machine.

From this brief account of the more important applications of the condenser it is seen how valuable in the art of alternating currents this device might become, did not two chief reasons oppose its development. These are, first its cost, which is yet of too large a figure for the generality of applications, and second, the phenomena of resonance themselves, which become in certain cases harmful and destructive to the dielectric of the condensers.

A great variety of materials has been tried for the dielectric, among solid bodies, glass, mica (which seems to have given only moderate results), paraffined paper, ebonite, oiled paper, paper glazed with wax, and lately stearate of lead and simple paraffin. Certain liquid dielectrics have been also tried.

Of all these dielectrics it seems to us that paraffined paper has been most approved. It has the disadvantage of a low-melting point and too great inflammability, and it is to be hoped that a dielectric may be found having the insulating qualities and the specific inductive capacity of paraffin without its drawbacks.

At the present time the cost of condensers applied under normal conditions, for frequencies of 40 to 50 per second and for tensions between 600 and 3,000 volts, lies between 80 and 150 francs a kilowatt, designating as a condenser of one kilowatt that for which the product

$$\frac{2\pi}{T} E^2C$$

is equal to 1,000. The cost is sensibly proportional to the output, a condenser of 100 kilowatts, for example, being built of 100 condensers of one kilowatt each. As a result the cost, though not great, compared with that of small machines (200, 300, 500 francs a kilowatt), is very large compared with the cost of large machines (70 to 80 francs a kilowatt), a fact which hitherto has restricted the application of condensers to small units.

But the second obstacle which has opposed the employment of condensers in large installations is perhaps more important. This regards the accidental production of very high resultant tensions due to effects of resonance, of sudden variations of load and of short circuits by poor insulation.

It appears, then, that regardless of price the adoption of condensers in large installations may be dangerous at times, for the condensers and for the whole plant. We would not be surprised, however, if certain installations are already in the neighborhood of this maximum of tension, through the capacity of their cables, and that for such plants the addition of condensers of great power may be beneficial, both for bettering their power factors and for conditions of safety.

Electrolytic condensers (capacity of polarization), consisting of electrodes plunged in a solution of carbonate of soda, absorb much energy; their resistance is sensibly equal to their reactance for a frequency of 40 periods. Thus it is only in particular cases, such as the starting of monophase motors, that they can be applied. One would not think of leaving them in circuit.

In conclusion, we believe that such appliances cannot be substituted for the condenser, properly so-called, and that it is above all to this device that efforts should be directed, to develop an apparatus less costly and truly commercial.

1. Paper read at the Paris International Congress of August 18–25, 1900.

New Board of Trade Telegraph Company.

The Exchange Telegraph company, which proposes to connect the commercial exchanges of the country with the Chicago Board of Trade, recently submitted to the latter body two forms of contracts for its approval. One contract related to the exclusive privilege of the floor of the exchange for 10 years and the collection of quotations. There were also agreements that will prevent the quotations falling into the hands of bucket-shops.

The other contract related to the distribution of the quotations and statistics furnished, and it is an agreement by the telegraph company to put in operation a proper system of telegraph wires between the exchange hall of the Board of Trade and the cities of Peoria, Indianapolis, St. Louis, Kansas City, Omaha, Minneapolis, Duluth, Milwaukee, Toledo, Cincinnati, Detroit, Philadelphia, Baltimore, Boston, Buffalo and New York, and thereafter operate it for the transmission of messages for the period of 25 years. It is also agreed by the telegraph company to do a regular telegraph business for members of the various exchanges mentioned and at rates not to exceed the rates now in force over the Postal and Western Union companies. The annual rental to be paid the board for floor space and facilities is $5,000 quarterly, and an agreement to maintain a proper force of messenger boys was inserted.

At a meeting of the Board of Trade, held on September 14th, the contracts were approved, and the officers of the board were authorized to sign the papers with the representatives of the Exchange Telegraph company. It is expected that the new company once in operating order will be able to begin business with sufficient pledged business from members of the various boards of trade included in the system to pay excellent dividends from the start. The action of the membership of the exchange was an evidence of the strong support which is being given the present administration in its stand against the telegraph companies.

Woodpecker Story from the "Sun."

A dispatch bearing the date-line "Topeka, Kan., September 9th," and published in the New York Sun, reads as follows: "Woodpeckers are destroying the Missouri Pacific railroad station at Lydon. In two weeks they have perforated the east end. The boys of the town drive them away with stones and clubs, but they always return and renew their work of destruction. The station agent says they peck away in unison with the ticks of the telegraph instruments. The upper half of the east end of the station is a wreck. In the early morning these red-headed birds may be seen flying toward the station from every direction."

Electrotherapeutics.

One result of the recent electrotherapeutic congress in Paris was the establishment of a permanent international body which is to meet every two years. Thus the next international electrotherapeutic congress will assemble in Berne, Switzerland, in 1902.

Dr. L. M. Hall-Brown of Brooklyn, who attended the Paris conference and who has invented a medical electrode, says that the electrical equipment of the European doctors, especially in the line of static machinery, is not equal to that employed by the corresponding specialists on this side.

The Asheville (N. C.) and Biltmore electric line has been purchased by the Asheville Electric company of Asheville, the consideration being about $50,000. The purchase was made through J. H. Cutler.

DEVELOPMENT OF THE TELEPHONE FIELD.

Wanted: A Telephone Meter.

By D. M Bliss.

The telephone business is slowly but surely reaching the point that all great industries must attain before they can be considered uniformly stable and profitable investments. When the monopoly was broken a few years ago the attractive openings for investments from every part of the country caused many to stray from the straight and narrow path of conservative investment to the broad and tempting one of opposition business. Many of the failures attendant upon these earlier ventures were not due to poor management and wild-cat financing so much as they were to cheap, unreliable apparatus and defective engineering generally.

The want of uniformity and total absence of any definite standard in design and workmanship a few years ago seems appalling, considering the progress reached in other branches of electrical engineering in the same period.

It is apparent, however, that the tide has turned, and telephone apparatus, from the receiver to the switchboard, may be readily obtained in the open market, equal, if not superior, to that made by the trust, and modern exchange systems have reached a very high stage of development.

The final and greatest problem, however, is still very much in evidence, and upon its successful solution depends the status of the telephone business as a safe and profitable investment. This problem, viz., best system of charges and rates, is occupying the earnest attention of telephone managers throughout the country, as shown by the numerous papers and discussions of the subject at local and general conventions. It is not a question of cheaper service so much as proportionate rates. The measured-rate system represents the latest development of the situation, but it cannot be considered a satisfactory disposal of the problem.

The modern telephone exchange is identical with any other system of electrical distribution, excepting in the pleasing fact that the subscriber furnishes the energy, or rather directs the application of it, and pays for the privilege.

A telephone meter attached to each subscriber's instrument indicating accurately the number of connections secured, by the calling subscriber, or, better still, the total length of time the line is used on outgoing calls during a given period, is what is needed. Such an instrument would undoubtedly be universally adopted, when it can be shown that it will meet all the necessities of the case.

Such a meter must fill all the following conditions:

First—It must be simple, durable in construction and easily read.

Second—It should register accurately all connections actually obtained on outgoing calls, or the length of time the line is used by the calling subscriber only.

Third—It must not interfere in any way with the talking or signaling currents.

Fourth—It must not involve any additional complication at the switchboard and must be equally adapted to the magneto or central-energy system.

Fifth—No special local batteries or clock movements should be required at the subscriber's instrument, and the meter should be secure from any accident or tampering short of malicious intent.

Sixth—Last, and by no means least, it must be cheap in construction and call for no increase in operating expenses.

Such a device would at once leave the operators free to attend to their legitimate work and increase their capacity accordingly. Errors in charges would be reduced to a minimum, and the subscriber would have the satisfaction of checking the meter, if he so desired; and, finally, a large amount of additional business would be secured in every exchange that now fights shy of measured rates or any other method of charges based on rates impossible to check and out of proportion to their needs.

Independent Telephony in New York.

In a recent interview President W. H. Eckert of the Knickerbocker Telephone and Telegraph company of New York is thus reported: "We are going ahead with the work as quickly as possible, and are making favorable progress. It will probably take fully a year, however, to get all of our lines laid and in full operation. Although we have been at work now only about five months, we have our lines laid all over Queens, and we have done much work in The Bronx and in Manhattan. In Nassau, also, we have laid many lines. Our lines in Manhattan are not widely placed as yet, but in Queens, as far as the trunk lines are concerned, the work is almost complete. We will go ahead with the work in Manhattan as quickly as we can get the material we require. The Knickerbocker company is an assured fact. It is here to stay. It is the only attempt at competition since the inception of the telephone, and we believe the public will appreciate it. We are already operating our Broome street and Twenty-third street exchanges, though with a limited number of subscribers, and so may say we are a full-fledged working company. The work of testing cable is going on all the time and we mean to have everything up to date. We have experienced no special trouble in getting rights-of-way. We are asking for nothing that we are not entitled to."

Telephone Troubles in the Mountains.

Some criticism of the telephone service in the Cripple Creek district has recently appeared in one of the local newspapers. In reply to an inquiry E. B. Field, vice-president and general manager of the Colorado Telephone company, sent a letter to the paper in question explaining the cause of the trouble. The letter is interesting as illustrating one of the difficulties likely to be encountered by a company operating a telephone line through the mountains. An extract follows:

The truth is that the Colorado Telephone company is working under a very great disadvantage between Colorado Springs and Cripple Creek, and therefore to the entire outside line connection in the state from Cripple Creek, and has been working under this disadvantage for several months. The construction of the Colorado Springs and Cripple Creek railroad has well-nigh paralyzed our business. It is an almost daily occurrence that when the blasts are shot off our entire line is knocked down, and although we have four men, with wagons and horses, all ready to rush to the front and repair the break, it frequently happens that our line will be knocked out at 10 o'clock in the morning and we cannot get it up again until 4 o'clock in the afternoon. You must know what this means to our business.

COMMUNICATION.

The Situation in Wisconsin.

To the Editor of the Western Electrician:

The development of the Independent telephone field, as chronicled in the weekly issues of the Western Electrician, is of great interest to all persons in any way connected with an Independent telephone company. But the time has arrived when something more is required than the organization and operation of a local telephone exchange or even a short system of toll lines to cover the ground as it should be covered.

I will endeavor to state what is required.

First, we must bear in mind that it is possible for the Independent companies to give first-class service at rates much less than those charged by the Bell companies, and, second, that where good service is given, there is no lack of patronage, but, on the other hand, the demand is so great that more capital is required than local capitalists are able to invest, and hence the development of the field is seriously crippled.

There are to-day upward of 90 Independent companies in the state of Wisconsin, with several large exchanges and several thousands of miles of toll lines. The exchanges are growing rapidly, and the toll business is increasing, but to develop the field thoroughly, if to supply no more than the actual demand, a large amount of capital is required. Most of the larger companies have erected substantial pole lines and have the same equipped for carrying extra toll circuits, but most Independent toll lines in the state are of iron and heavily loaded with local subscribers and toll stations. But few miles of copper circuits have been strung in Wisconsin.

What is needed now, and there is money in it for those who have money to invest, is the formation of one large company to either absorb all Independent companies into one company, by purchase or lease, or else to connect all Independent exchanges throughout the state with copper circuits. Long-distance toll lines are a necessity, and local exchanges are greatly benefited by having such connections. The interests of the toll lines and the exchanges are mutual; the one benefits the other. While there is a good profit in the operation of a local exchange and a short toll-line connection, yet for the same investment with a state system of toll lines and all local patrons supplied who will use telephones, the profits would be doubled. I know of instances where the Bell company has maintained exchanges of over a hundred subscribers free for several years for toll business alone.

Having been connected, since their organization, with two of the largest Independent companies in the state, which have been developed by local capital, and knowing by experience the great demands for telephones and toll lines and the struggles to supply those demands for lack of capital, and having been obliged to allow several valuable franchises to expire for lack of funds with which to build the exchanges and connecting toll lines authorized, I know whereof I speak when I say that to develop thoroughly the Independent telephone field in Wisconsin requires the organization of a company with capital sufficient to supply the demands. As president of the state association of Independent telephone companies of Wisconsin, I urge that steps be taken, at an early date, for the formation of such a company. I shall be pleased to correspond with any person interested in the formation of such company and to co-operate, so far as possible, in uniting the interests of the various Independent companies of the state.

A. L. HUTCHINSON.

President Independent Telephone Association of Wisconsin.

Weyauwega, Wis., September 17, 1900.

The Man with the Party Line.

By Tiffin Gilmore.

[Written after seeing mental wrecks of the great American Bell. With apologies to Markham, Millet and all.]

Crazed by the waste of business hours he leans
Upon his 'phone, and gazes on the floor,
Anguish of unanswered calls upon his face,
And ruffled up and bristling is his hair.
Who made him dead to rapture and despair,
A thing that waits on, and that ne'er receives
An answered call, a brother to the ox?
Who overheard his awful muttered curse?
Whose is the hand that holds his throbbing brow?
(Whose hand blew out the transfer on the board?)
Is this the Thing the Lord God made and gave
To have communication over sea and land;
To trace lost baggage, to search the earth for trade;
To feel the passion of electricity?
Is this the dream he dreamed who shaped the 'phone
And builded switchboards and the like?
Down the long lead of poles to its last cable-box
There is no shape more terrible than this,
More tongued with censure of the Bell's blind greed,
More filled with curses of the party line,
More fraught with menace to the "Genesee."

What gulfs between him and the quick "Hello?"
Slave of the party line, what to him
Are copper circuits, or the swing of crossing lines?
What the long reaches of the cable strong,
The buried conduit, the clearing of the lines?
At this dread shape the suffering public looks,
For tragedy is in that aching stoop
Of this dread shape, if only he,
Plundered, ignored, and misinformed,
Can reach the superintendent's chair
Through "trouble shooters" standing everywhere.

Stockholders, landlords, directors in all lands,
Is this the service you would give to all?
Condemn this monstrous thing!
How will you ever straighten out this mess;
Touch it again with popularity;
Give back metallic circuits and the rights;
Rebuild in it the currents strong and clear;
Make right the cross-connecting board,
Short-circuits and the insulation woes?

Stockholders, landlords, directors in all lands,
How will the Future reckon with this 'phone?
How answer calls in that last hour
When whirlwinds of rebellion shake the plant?
How will it be with 4 on 1144—
With those who want him at the telephone—
When this poor maniac shall reply to God:
"Busy? Good Lord, He's on a party line!"

Illinois Company Expands Its Field.

The Illinois Telephone and Telegraph company of Chicago recently filed with the county recorder at Chicago a document seeking to amend its corporate powers. The original charter of the company permits it "to acquire, construct, build, buy, sell, lease and operate plants for the conveyance of sounds and signals by electricity." The new powers which the company seeks are "to distribute, convey and deliver telephone messages, telegraph messages, packages, mails, newspapers and general merchandise, and to convey, distribute, deliver and furnish power, heat and light by steam, water, air, electricity or otherwise, but not by railroad; also in connection therewith to manufacture, buy, sell and deal in all kinds of instruments, appliances, apparatus, licenses, patents, patent rights, and to take and to hold property necessary or useful in carrying out such object: also to acquire, construct, build, buy, sell, lease to or from others and operate such plant or plants as may be necessary or useful in carrying out such object." President Wheeler, of the Illinois company, when asked what the plans of his company were, refused to discuss the matter at all.

Decreasing Output of Bell Telephones.

Boston, September 17.—The instrument statements of the American Telephone and Telegraph company for the month ended August 20th and for the eight months to that date compare with those of previous years for the corresponding periods as follows:

	1900.	1899.	1898.	1897.
Gross output	45,555	42,140	24,863	15,767
Returned	27,208	15,389	12,022	10,154
Net output	18,347	26,751	12,841	5,613
Since December 20:				
*Gross output	457,164	432,039	212,747	143,545
Returned	189,961	125,154	95,328	62,001
Net output	267,203	306,885	117,419	81,544
Total outstanding	1,847,708	1,432,135	1,036,540	855,393

Reported Consolidation Denied.

In relation to a report that the Central Union Telephone company (Bell), serving territory covering parts of Ohio, Indiana and Illinois, had absorbed the Iowa Telephone company, also a Bell company, President W. A. Jackson of the first-named company says: "There is nothing whatever in the rumor of a consolidation between this company and the Iowa Telephone company, and nothing of the sort is contemplated."

Pittsburg and Vicinity.

On account of the rapid growth of its business, and in order to simplify matters all around, the Central District and Printing Telegraph company (Bell) of Pittsburg has inaugurated a complete revolution in its system of telephone exchanges, whereby each of its 11 exchanges has been renamed with a name of but one syllable, save in one instance. By the old method, when a new exchange was established, it was designated by the name of the locality in which it was situated. Now all this is changed, and the exchanges designated as follows:

"Grant," for the present Pittsburg exchange at Seventh avenue and Montour way.
"Court," for new exchange at Fourth avenue and Cherry alley.
"East," for East End exchange.
"Park," for Bellefield exchange.
"Wood," for Hazelwood exchange.
"South," for South Side exchange.
"Hill," for Allentown exchange.
"West," for West End exchange.
"North," for Allegheny exchange.
"Brady," for Manchester exchange.

A Pittsburg rumor hints at a possible union of interests between the two Independent telephone companies, the Federal and the Pittsburg and Allegheny. The Federal company, pursuing an active policy outside of Pittsburg and Allegheny, has built plants in almost all the cities and towns within a radius of 50 miles of Pittsburg, and has at present about 40 exchanges and over 2,500 telephones in operation. The Pittsburg and Allegheny has but a few telephones in operation, but is rapidly getting into shape to give service to its Pittsburg subscribers. A union between the two within the next six months, it is thought, would give a service almost equal to the Bell company's Pittsburg district. It was also rumored that the Federal had bought out the Pittsburg and Allegheny, and vice versa. In an interview with Mr. Fred DeLand, president of the Federal Telephone company, regarding the rumors, he stated that the Pittsburg and Allegheny company cannot buy his property, but hints that he is ready to purchase the other plant at a fair price. As to entering into an agreement for exchange of service, Mr. DeLand states that his company, under certain conditions, will enter into such an agreement, as he does not deem it wise to parallel the two systems in Pittsburg, unless forced to do so. In case his company cannot get an exchange of service with the Pittsburg and Allegheny company, it will build an exchange in Pittsburg and another in Allegheny. Mr. Crum, the new superintendent of the Pittsburg and Allegheny company, was non-committal concerning the rumors of the sale, or of a working agreement with the Federal, but it is known that he called at the offices of the Federal people only a short time since.

The Pittsburg and Allegheny Telephone company is considerably behind in its estimates of progress as regards time, and may have to reckon with the Pittsburg authorities on account of the delay. The company was to have 1,200 telephones in operation by May 1, 1900, but at the present time has not one-fourth of that number operating. Controller Lewis sent a letter to Director J. O. Brown of the Department of Public Safety, asking that the bureau of electricity make an investigation of the delay and report at once. It seems that when the company accepted the franchise granted by the council, it gave a bond of $25,000, with the Equitable Trust company as surety, binding it to the fulfillment of certain stipulations. One of these states "that the Pittsburg and Allegheny Telephone company shall commence the work of construction on the streets of Pittsburg, not later than May, 1899, and the said company shall push the work to completion as soon as possible, and the said company shall not fail to place and have in operation and connected with the Central exchange of said company at least 1,200 telephones per annum for a period of three years from May, 1899." The bond clearly states that $25,000 is to be paid to the city as liquidating damages, in case any part of the ordinance is not complied with.

The Federal Telephone company has been pursuing an active policy, and with its 160 construction men has completed many new exchanges within the last three months. Besides, many improvements have been made in the properties it has acquired by purchase. In the Monongahela Valley the company is operating in McKeesport, Versailles, Otto, Glassport, Port Vue, Dravosburg, Duquesne, Elizabeth, Monongahela City, Charleroi, Belle Vernon, Fayette City, Speers and Black Diamond, with trunk lines connecting the above-named cities and towns. In the same valley plants are in the course of construction at California, Coal Center, Elco and Brownsville. In the Ohio Valley its lines are operating in Esplen, Bellevue, Avalon, Ben Avon, Emsworth, Clifton, Coraopolis and Sewickley. The trunk line in this valley extends from the Allegheny City limits to Rochester, Pa., a distance of 30 miles. In addition to this, lines or exchanges are in the course of construction in Dixmont, Glenfield, Haysville, Agnew, Quaker Valley, Shields, Leetsdale, Fair Oaks, Economy, Baden, Conway, Freedom, Aliquippa and Monaca. Franchises are pending in Beaver, Beaver Falls, Rochester and New Brighton. In the Allegheny Valley exchanges are in operation in Millvale, Etna, New Kensington and Freeport, and plants are in the course of construction in Oakmont and Verona. In the Kiskiminetas Valley lines and exchanges are now in operation in Hyde Park, Avonmore, Salina, Edri and Leechburg. Connected with these exchanges are Kittanning, Ford City and Blairsville. Along the Pennsylvania railroad, east of Pittsburg, lines and exchanges are operating in Wilkinsburg, Wilmerding, Pitcairn, Latrobe, Youngstown, Baggaley, Whitney and Oakville. Trunk lines connecting Pitcairn, Wilmerding, McKeesport, and with these all the Monongahela Valley, will be in operation within 10 days. In the Chartiers Valley lines and exchanges are operating in Carnegie, Elliott and Canonsburg. Exchanges will shortly be built in Washington, North Washington, East Washington, West Washington, McDonald and Bridgeville. A trunk line extending from Washington to Pittsburg is projected.

The Johnstown Telephone company (Independent) has given out the contract for an underground-conduit system, and it is now negotiating with the Kellogg company for multiple switchboards and telephones.

The Bell company has troubles of its own in McKeesport. Sometime since it erected a handsome exchange and office building. When it was completed, it asked the council for an underground ordinance. This has thus far been refused. At the last meeting of the council, it asked permission to erect a sufficient number of poles to enable it to enter the new building; this the council refused to do. It looks as if the fine new structure would be used for offices only. M.

Telephone News from the Northwest.

The Minnesota Telephone company is setting poles and stringing wires at Pine City, Minn., for an exchange.

The Nicollet County Telephone company is arranging to connect with the Northwestern Telephone Exchange company at St. Peter, Minn.

The Wisconsin Telephone company lost its case in an encounter with the city of Sheboygan, Wis. The company started to extend its lines when the city stopped the work by an injunction. The company refused to accept a franchise tendered by the city and the city refused to pass a franchise suggested by the company. The company then sought to have the city show cause why it should not grant an acceptable franchise, but was defeated.

The council of Manitowoc, Wis., passed a resolution requesting the Wisconsin Telephone company to place its poles on Eighth street inside the curb, on account of the paving now being done. The company thereupon suspended all work. It has been rebuilding the exchange.

The Wisconsin Telephone company has applied to the council of Appleton, Wis., for permission to place its wires underground.

The West Salem (Wis.) Telephone company has increased its rate from $1 to $1.50 a month for business houses and from 75 cents to $1.25 for residences.

The Forman Telephone company is making improvements on its system at Lisbon, N. D., to cost $2,000.

The Maquoketa (Iowa) Telephone company will be formed at once, and has already secured 167 subscribers. The same stockholders who control the Tri-city Telephone company of Clinton, Iowa, will own this company.

Workmen were removing an old cable in Marshalltown, Iowa, when the wire accidentally fell across several electric-light wires and telephone wires of the Marshall Telephone company. The result was the burning out of between 300 and 400 telephones. Workmen began repairs at once, and by working all night, managed to get the crippled service into pretty fair shape.

The Western Telephone and Telegraph company has secured a bill through the provincial Parliament of British Columbia, securing for itself the same rights as its rival, the Vernon and Nelson Telephone company. The Western company proposes to build lines through the Nelson and Slocan districts, to connect the boundary district with Vancouver.

Seattle, Wash., complains that, in spite of all promises, the service of the Sunset Telephone company is worse than before the strike.

The stockholders of the Ottumwa (Iowa) Long-distance Telephone company have reorganized and elected new officers, to prosecute the case against the old officers for illegal and fraudulent sale of the company to the Bell company. The stockholders are confident that they will recover their property.

The Iowa Telephone company has replaced the automatic central calls on its Denison (Iowa) exchange with bell cranks.

The city of Duluth, Minn., has commenced suit against the Duluth Telephone company in the District Court, asking that the poles and wires of the defendant be removed, as they are a public nuisance and are on the streets without right or authority.

The county auditors of Iowa are in distress over the problem of listing the telephone mileage by school districts. The companies report by townships and corporations, which do not correspond completely to the school districts. In cases of dispute the county surveyor will be required to survey the lines of the companies in dispute.

The farmers of Northern Guthrie County, Iowa, will begin the construction at once of a line between Panora and Yale. Each farmer is to furnish the poles and wire to build the line through his own farm and to put in his own instrument.

The transfer has been completed of the Pacific, Sunset, Inland and Oregon Telephone companies to the Pacific States Telephone and Telegraph company, the change occurring on August 31st. The new corporation has a capital stock of $15,000,000. The headquarters are at Portland, Ore. The company plans considerable extensions and improvements to the exchanges throughout its system.

It is thought the erection of a new exchange building in Grand Forks, N. D., by the Northwestern Telephone Exchange company has been deferred until next year.

F. H. Juergens has been granted a franchise at Jordan, Minn., for a local exchange.

The Iowa Telephone company seeks a new franchise at Creston, Iowa.

The county has fixed the assessments on the telephone companies in Des Moines, Iowa, as follows: Mutual Telephone company, $15,000; Iowa Telephone company, $5,300; Boone Telephone company, $1,240; Central Telephone company, $930; American Telephone and Telegraph company, $670; Hawkeye Telephone company, $300.

The voters of Sioux City, Iowa, will vote on granting a franchise for a local exchange to F. B. Rowe, the projector of a long-distance line through Northern Nebraska and into the Black Hills.

The Annaton and Preston Telephone company of Annaton, Wis., is completed and in operation. The system consists of five divisions, and it has 75 members.

The Jefferson Telephone company plans to extend its lines from Glidden, Iowa, to Carroll, and thence to Ida Grove.

A company has been formed to build a line between Stanwood and Olin, Iowa.

A number of farmers south of Riverside, Iowa, have arranged to build a line to connect their homes with Riverside. R.

GENERAL TELEPHONE NEWS.

The Board of Review of Cook County has raised the personal-property assessment of the Chicago Telephone company from $2,225,000 to $4,225,000.

The Pacific States Telephone company made a net gain of 1,550 subscribers in August. The total number connected is now 78,852, which includes 19,819 in San Francisco.

The Erie telephone system made a net gain of 2,972 subscribers in August. The total number connected on August 31st was 131,548. The number awaiting connection was 3,878.

The Stark County Telephone company of Canton, Ohio, was incorporated on August 24th, with $100,000 capital stock, by Ferdinand Herbruck, Robert S. Shield, Henry W. Detmering, Augustus Dennemiller, H. A. Cavnah, John C. Welty, James B. Rose, Thomas H. Phillips and Louis A. Loichot.

Articles of incorporation were recently filed at Guthrie, Okla., by the Citizens' Independent Telephone company, which has been organized for the purpose of erecting, building, purchasing, maintaining and operating a system of telephone exchanges in Oklahoma City. The corporation is to exist for 50 years and the capital stock is $60,000. The stockholders are W. M. Reece of Salina, Kan.; R. G. Hays, T. F. McMecham and A. C Root of Oklahoma City.

The directors of the Citizens' Telephone company of Racine, Wis., met recently and elected John B. Simmons president of the company. The contract for the construction of the system was awarded to Jones & Winter of Chicago. The work will cost about $56,000, and will commence about September 30th. It is expected the plant will be completed and in operation by January 1st. The capital stock of the company is $125,000 and it will probably be increased to $150,000. There has been subscribed $62,000. Four hundred and fifty persons have agreed to use instruments, and a telephone war is expected with the Wisconsin Telephone company. Every stockholder of the Citizens' company is a resident of Racine.

MANUFACTURERS AND DEALERS.

The Sumpter Telephone Manufacturing company of Sumpter, S. C., has received official notification that its exhibits at the Paris Exposition has received the medal of highest award on telephones.

The Farr Telephone Construction Supply company of Chicago has been notified that it has been awarded a bronze medal for its telephones, which are now on exhibition at the Paris Exposition. This certainly speaks well for the goods manufactured by this company.

The Kellogg Switchboard and Supply company, 229 South Green street, Chicago, has recently departed from its previous practice of taking only the largest contracts. By recent additions in the way of floor space and machinery, it is now able to fill orders of any size for anything in the telephone line, from a part of one instrument to the complete equipment of the largest exchanges. It is now soliciting business from the small and medium-sized exchanges. The well-known high standard of this company in its larger contracts will undoubtedly be maintained in its smaller ones. The company also announces its willingness to build exchanges complete, including all construction work. The advantages of having one company responsible for an installation in its entirety are obvious.

Nernst Lamp at the Paris Exposition.[1]

One of the most interesting displays in the Electrical Palace is that of the Nernst lamp, shown in the pavilion erected by the Allgemeine Elektricitäts Gesellschaft. Two different types of the Nernst lamp are made at present. In the first it is necessary to heat the conducting filament by a match, an alcohol lamp, or the like. The general appearance of this type of lamp will be seen in Fig. 1. From the base project two metal rods, which are braced at the ends by a short tube of porcelain, and to the ends of the rods is soldered a rather thick platinum wire. To this wire the ends of the conducting filament are soldered by a process analogous to that employed for the incandescent lamp. This filament, made up of refractory oxides, is perfectly white and homogeneous, resembling otherwise a short carbon filament. As the resistance of the filament diminishes when in a state of incandescence, it becomes necessary to insert a resistance in the circuit to cut down the current to the right amount.

The form of resistance used here is shown below the porcelain rod. A very fine platinum wire is wound around a porcelain rod about one inch long, and this is contained in a small glass bulb. The outer end of the wire is connected with a stout wire which passes back parallel to the rod. The terminals are formed of two wires fused into the glass. A lamp base of the ordinary Edison or screw type is used, to which is fitted a globe somewhat resembling an ordinary incandescent-lamp globe. This, however, is open at the end and serves only to protect the filament from dust, etc. When the flame of a match is applied to the filament, it soon commences to glow and finally reaches a brilliant incandescence, giving off a white light which is very pleasing in color. The light is much whiter than that given by a carbon filament, owing to the higher temperature of the refractory oxides, and is entirely free from the disagreeable green hue of the Welsbach burner.

Fig. 1. Externally Heated Type.

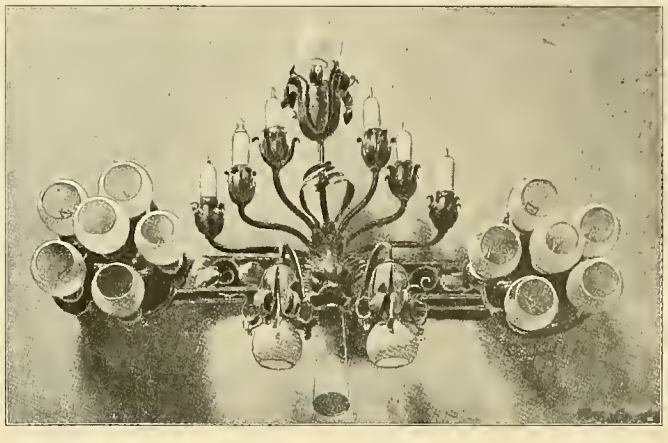


Fig. 3. An Electrolier.

NERNST LAMP AT THE PARIS EXPOSITION.

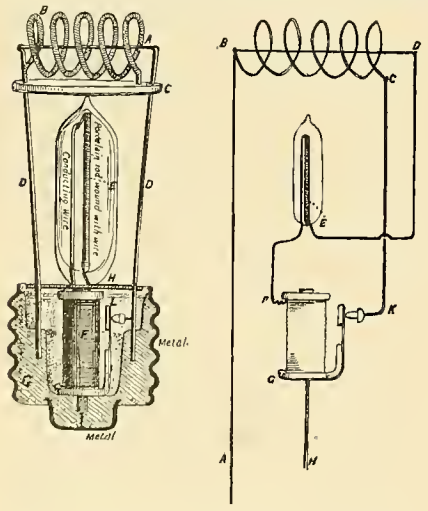


FIG 2. NERNST LAMP AT THE PARIS EXPOSITION.—DIAGRAM OF AUTOMATIC TYPE.

It is, of course, quite desirable to have a lamp which is entirely automatic in its action, particularly when it is placed in inaccessible positions, and accordingly an automatic form has been devised, in which the filament is heated by the passage of current through an exterior conductor, and when its resistance has been thus reduced and it allows the passage of a sufficient current to bring it to incandescence, the circuit of the heating conductor is interrupted by a special device. The general disposition of the working parts is seen in Fig. 2. From the socket rise two stout wires (D) (D), which support a porcelain disk (C). Upon the disk is supported the filament (A), and surrounding it is a spiral tube of porcelain (B). The porcelain tube carries on its surface a great number of turns of fine platinum wire, which has been wound on while the tube is still straight and before baking the porcelain. The wire is almost completely imbedded in the porcelain and is visible only upon close examination.

This exterior tube serves to heat the filament by the passage of current in the fine platinum wire. A thick wire, not shown in the diagram, passes below from the right-hand end. A small glass bulb placed below contains the resistance wire wound around a porcelain rod (E). This resistance is of the same type as for the first lamp, only one form being used throughout. The lamp base (G) resembles the ordinary screw type, but the interior body of porcelain is recessed to receive the automatic cut-out device; it also supports the wires (D) (D). The cut-out consists of a small electromagnet (F), fitting in the cavity of the socket. The upper end of the bobbin is of soft iron, and below an iron piece curves up and supports a small armature (L) by means of a flat spring. The armature rests normally against a contact piece to the right, but when a sufficient current passes in the coil, the armature is attracted and leaves the contact point, thus cutting off the current from the heating spiral. The action will be clearly seen by referring to the diagram of the electrical connections. The current takes two paths: First, through the filament, the resistance bulb and the magnet, following the circuit (A), (B), (D), (E), (F), (G), (H); or, second, through the heating spiral, the contact (K), the armature of the magnet and return, or (A), (B), (C), (K), (H). Owing to the high resistance of the filament when cold, the current passing in the circuit of the magnet is not sufficient at first to attract the armature but a few seconds after it is turned on, the spiral commences to heat up, and the temperature of the filament is raised sufficiently to allow a large current to pass; it thus becomes incandescent, and its resistance being lowered, a large current passes in the magnet; the armature is attracted and the circuit of the heating spiral broken at (K). When the lamp is turned off, the reverse action takes place; contact is made at (K), restoring the original conditions.

The price of a lamp with the automatic illuminating device is, of course, much higher than for the ordinary type, on account of the two extra pieces, the magnet and the heating spiral. The magnet, of course, does not deteriorate. The spiral, being subject to alternate expansions and contractions, lasts a reasonable length of time, but not indefinitely. It is, however, easily replaced and is taken back for two-thirds of its original value. It is probable, besides, that the platinum wire will be replaced by a material which will give the same service at a less cost. The parts of the lamp which need to be replaced, the spiral and the filament, cost but little, and it is estimated that the cost of the lamp renewals is not greater than in the case of the ordinary incandescent lamp. The duration of the filament depends somewhat upon the manner in which it is brought to incandescence, whether heated quickly and thus subjected to a violent rush of current, etc. In general, it is less than that of a carbon filament. If the changes in voltage do not greatly exceed the normal, one may count upon an average life of 300 hours for this lamp. The life is diminished gradually by a molecular change, which is produced, little by little, under the action of heat, accompanied by a diminution of solidity and often an increase of resistance which diminishes its brightness. The expenditure of energy in the present type of Nernst lamp is from 1½ to 1¾ watts per candlepower, which is about one-half that of an incandescent lamp. For a 16-candlepower lamp the energy consumed is thus from 24 to 28 watts, representing 27 to 30 lamps per horsepower. At present the Nernst lamp is manufactured for 25, 50 and 100 candlepower, under a tension of 110 or 220 volts. Fig. 3 shows a chandelier of Nernst lamps.

1. From the Scientific American.

The City Council of Paris, Ky., has granted a franchise to a company of local capitalists, headed by H. A. Power, for the privilege of building and operating a street-railway system in the city.

The Phillips Clambake of 1900 at Providence.

It is perfectly safe to make the statement that during the year no pleasanter task comes to the electrical newspaper man than the assignment to "cover" that now historical electrical gathering so well known as "Phillips' clambake." Like the samples of "good cheer" dealt out so generously every August or September by Mr. Phillips, the American Electrical Works banquet goes on from year to year improving with age. And the latest, the twenty-second annual clam dinner, may be said to have surpassed in attendance any of its 21 predecessors. It is estimated that on this occasion the number of guests ran up to a point very near the 400 mark.

It was a most informal affair up to the time when the party sat down to the tables. There was a ball game at one end of the grounds, participated in by two picked nines, and at another place a target had been set up, where some of the marksmen of the party tried to show what they could do with a rifle. In the upper hall an orchestra rendered some of its best music, and on the verandas and about the grounds the members of the party gathered in groups enjoying themselves each as he thought best. On the arrival of the guests each was provided with a white duck cap and a white silk badge, and the supply of both was nearly exhausted before the dinner was served.

A lunch was provided at 11:30 o'clock, and this proved to be not the least pleasant of the features of the day.

Shortly before 2 o'clock, the dinner hour, the band played the assembly calling the men to the slope south of the club house, where their pictures were taken, after which the guests went again to the house and for an hour devoted all of their attention to the great event of the day, the Rhode Island clam dinner. Many of them tasted one for the first time, and many, like Prof. Elisha Gray of Chicago, had traveled several hundred miles to make its acquaintance. They were not disappointed, for everything from the chowder to the black coffee and cigars was the best of its kind. The lower floor was filled with tables, which were set even on the piazza. The dinner cards were in imitation of quahaugs, which opened to disclose what the diners were eating. During the meal handsome souvenirs of the twenty-second annual bake were passed around in the shape of copper match safes bearing on the side an embossed mailed hand, from which electric rays are shooting, the name of the donor and the date.

Mr. Phillips presided, and after expressing a most hearty welcome to his guests introduced T. D. Lockwood, who acted as toastmaster and did it in a most acceptable manner.

Prof. Elisha Gray was asked to respond to the toast: "The Telegraph." Prof. Gray gave a few reminiscences relating to progress in electrical science in his day.

Letters of regret were received by Mr. Phillips from Governor Gregory, from Mayor Baker of Providence, Mayor Maybury of Detroit, President Faunce of Brown University, President Angell of the University of Michigan and others.

Chicago Automobile Meet Opened.

The Chicago international automobile exhibition and race meet opened on Tuesday, September 18th, at the grounds of the Washington Park Club. From the indications of the first day the meet will be a success, provided the weather is favorable. On Tuesday the box-office receipts showed a very good attendance. Of the exhibitors, the Woods Motor Vehicle company and the Hewitt-Lindstrom Motor company had the greatest number of vehicles on exhibition on the opening day, most of the other exhibits not being completed at that time.

The afternoon was given up to the events scheduled in the programme announced last week. The 10-mile free-for-all race proved to be the most interesting event. This was won by Alexander Winton, in a four-wheeled automobile in 16:00⅘, with K. A. Skinner, in a motor cycle, second. In the grand automobile parade for manufacturers the first prize, a gold medal, for the greatest number of practical designs, was awarded to the Hewitt-Lindstrom Motor company; the second prize, a gold medal, for the greatest number of vehicles in line, was given to the same company, and the third prize, also a gold medal, for the most practical design, was awarded the Woods Motor Vehicle company. The rest of the events were run off in order. A full account of the winners of the different events will be published in next week's issue of the Western Electrician.

London Electric-railway Projects.

There is continued rumor of extensive electric-railway undertakings in London, but no very definite announcement is made. The name of Mr. C. T. Yerkes of Chicago has been connected with these projects, but the statement that Mr. Yerkes is to manage a big London traction scheme is as often denied. One proposal is to connect all the termini of the various trunk railroad lines in London by a tunnel electric railway. This plan involves an enormous expenditure, but it is said that the idea has already found wide financial support.

The Field and Work of the Association of Edison Illuminating Companies.[1]

By John W. Lieb, Jr.

The object of this association, as defined in the constitution and by-laws, is "the mutual protection of business interests and the collection and dissemination among its members of technical and business information relative to the Edison electric-light system and auxiliary systems operated in connection therewith." You will thus see, at the start, from this statement of the objects of the association, that there is a striking difference between our organization and kindred organizations, such as the American Institute of Electrical Engineers, the National Electric Light association and many of the state organizations. Instead of being a purely technical body, like the American Institute of Electrical Engineers, this association, while, in one sense of the word, technical, has, in addition, important commercial interests to safeguard. One of the conditions of membership requires that its members be licensees under the Edison patents; that is, licensees of the Edison Electric Light company, the Edison General Electric company or the General Electric company.

There is one striking peculiarity in our organization, and that is that companies and not individuals constitute the membership of the association. The officers are merely representatives of the companies constituting the association. This fact, which is peculiar to our organization, has advantages, and possibly some disadvantages. It is, of course, to be expected that in a body of this character, in which manifold interests are represented, and which has such a wide field of activity, the larger companies take a predominant interest. This must be the case from the connection of many of its representatives with the original Edison interests; it must also be so from the fact that the larger companies have large executive and operating staffs, and therefore are more largely represented in the conventions and as authors of the papers that are brought before it. I think you will agree with me, however, that in the work of the association, due weight has been given to the value of the membership of the smaller companies, and that every effort has been made to stimulate their interest and attendance, and I am happy to say that in this respect we have been markedly successful. The smaller companies, by their attendance and active interest in the work of the association, have, in turn, stimulated the larger companies in their work in its behalf.

The main work of the association is done by its standing committees. In addition to the executive committee, we have a lamp committee, one of its sub-committees, and, as standing committees of the association, a meter committee, a committee on grounding of the neutral, an automobile committee and a committee on Welsbach light and acetylene gas. As indicative of the work which the association does, and its peculiar nature and scope, I will refer briefly to the work that the lamp committee has in hand.

This feature was started originally by four of the larger companies who were buying incandescent lamps in great quantities, and who felt that it was time to institute some new method or basis of purchase, safeguarding themselves as to the quality of the product by framing an agreement incorporating a set of specifications. In order to insure compliance with the specifications, a lamp-testing bureau was organized, and these companies advanced a guarantee fund with which to conduct the business of testing lamps. The mutual relations of the General Electric company and our member companies made it possible to prepare a tentative agreement covering the desired features, and it is impossible to see how, except through the relations which existed between the parent company and its licensees (members of this association), such an agreement could have been made. It was purely experimental in its nature, and, of necessity, there must have been a great deal of "give and take" until a mutually satisfactory basis was framed. As a result, we made a lamp agreement which was sufficiently liberal and elastic in its terms to make it acceptable, and a clause was embodied in the agreement that in case the specifications agreed upon, and which defined the quality of the lamps in terms of a new unit, were shown to work a hardship to either party, the specifications were to be amended at once by mutual agreement.

The meter committee has also been actively at work, and we hope that the outcome of its efforts will be of as much value to the association as the work of the lamp committee, and that the purchase of meters designed to best satisfy the requirements of our members will be facilitated by the making of an agreement containing specifications which shall be the basis of a standard product to be furnished to our members at the lowest price consistent with good workmanship and a reasonable profit to the manufacturer.

The automobile committee has in hand the work of recommending to the companies standard charging posts and plugs in connection with the charging of automobiles to facilitate the delivery of current to automobiles as they journey from city to city. Permit me to suggest at this time that our field of usefulness could be developed advantageously by adding to these standing committees a committee which would undertake the standardizing of switches and other electrical appliances. All of our members are purchasers in large quantities of switches of various kinds for station switchboards, service work and interior installations, and it is certainly undesirable that each company should have a standard of its own, as the conditions to be met are practically the same. In different cities the requirements of the fire underwriters and local authorities are usually the same, and if standard specifications could be agreed upon to enable all manufacturers to bring out standard types which could be produced in large quantities, the result would be a cheapening in the cost of production and a reduction of cost to the user.

Another subject of considerable importance which we have not specifically taken up is municipal ownership, and I think it would be wise at this time to have a standing committee on that subject. Such a committee could keep in touch with the agitation that is occupying the attention of some cities, advocating municipal ownership as well as supervision and control of gas and electric works, traction enterprises, etc. Many of the smaller companies have the greatest difficulty in battling against these attempts to legislate them out of existence, and I believe that a committee of this association that would collect, tabulate and distribute information on this subject of an accurate and up-to-date character would be of distinct value and assistance to members requiring ammunition for their defense.

In the early days of the electric-lighting industry the standardizing committee of the Edison interests did valuable work in the standardizing of Edison chemical meters and many Edison appliances. One of your former presidents, Dr. A. E. Kennelly, rendered valuable service in this field. Much of this early work has been of value, not only to the Edison interest, but has become part of the history of the art. Many of Dr. Kennelly's investigations and experiments conducted in connection with this standardizing work have become the accepted reference data in electrical engineering work. I need only refer to his tests on the carrying capacity of wires under different conditions—cross-section, insulation and environment.

This association, through its member companies and their technical staffs, has done valuable work for the industry generally. Through the close relations of these companies they have been able to find useful applications for newly developed apparatus, and once found, these types have had prompt and general adoption to the material benefit of the companies and the general advantage of the electrical industry. I refer in this connection to the stimulus given to the application of storage batteries to central-station service by the pioneer work of some of the larger companies, by the interchange of experience in their use inducing others to determine, each for itself, the advantages which it might derive from their use. There can be no doubt that the work of the companies constituting your membership and the reports of your committees have materially contributed toward the development and improvement of what is now considered an invaluable adjunct to central-station and distributing equipment.

I will also refer, briefly, in passing, to the influence which the members of the association have had in stimulating the manufacturers to produce new apparatus, to meet new requirements as they arose, and to the influence of the individual companies in stimulating the development of such apparatus as the first examples of direct-connected units, arc lamps on low-tension circuits, rectifiers, phase and frequency changers, composite generators, etc. The members of this association have exerted a constant pressure upon the manufacturing companies in bringing them to realize that they must develop apparatus to satisfy the new conditions and requirements as the extension of their business developed new wants. It is unquestionably true that the manufacturing companies have in turn profited by the development of this apparatus, being able to find at once purchasers and an outlet for their product among our companies, whose close connections enabled them to promptly appreciate the value of newly developed apparatus.

During the existence of the association, the member companies have gradually broadened their business field. Originally confined to companies that were Edison licensees, exploiting exclusively the Edison system, most of the companies now find themselves in new relations with their former powerful and conservative competitors, the gas interests; new relations in connection with the development of transmission lines in conjunction with their distributing systems; new relations in connection with alternating-current generation and distribution, and new relations in connection with the joint operation or absorption of series arc systems. It is hardly necessary to say that contact with these new interests and the assumption of these new relations must be of great benefit to us.

Take, for instance, the gas interests. For years they have been developing their business and organization, and their knowledge of the public and its requirements must be vastly superior to the knowledge possessed by those engaged in our more recently developed electrical industries. Their methods and policy have been developed on conservative lines, their usually strong financial position attesting executive ability of the highest order, and we certainly must profit by closer relations with this older, well-established industry. They, in turn, must profit by feeling the youthful pulse of the new industry, which, in spite of opposition and keenest competition, in spite of large vested interests arrayed against it, has been able to assert itself and claim a permanent position as one of the safest, as well as most remunerative, fields of investment.

It seems to me, therefore, that these new relations, which are daily increasing, must be mutually profitable. It is also true that the new relations with transmission systems, the various forms of distributing systems, joint operation in combination with railway systems will enable electric companies to broaden their field of operation, and these features will all be helpful in enabling the supply company to generate its product at reduced cost.

I know of no body of men which could so successfully handle these new demands, assimilate, cooperate with or become an adjunct to new interests and broaden the field of industrial enterprise as the men constituting the administrative and technical staffs of the companies that are members of this association. The readiness with which the Edison companies have assimilated new systems, the fertility of resources they exhibited in combining with other systems, retaining what was best, discarding the less satisfactory features, often modifying or even entirely changing the strictly Edisonian point of view, where contact with other systems and other apparatus showed this to be of advantage in meeting the new situation—these qualities of the organization, system and equipment which the Edison companies displayed are sufficient refutation of the statement one hears, now and then, that the Edison companies are narrow viewed, ultra-conservative and non-progressive, adhering to antiquated traditions and slow to rise to the new responsibilities.

We claim that this association can with pride assert itself to have been the pioneer in developing broad lines, and the uniform success of the Edison companies which are members of this association amply demonstrates the excellence of the lighting and power system with which we began our development and the faithful energy with which the business has been pushed.

I would refer to the fact that the association has enjoyed the sympathy and good will of the press, notwithstanding the fact that we have supplied it with only brief reports of our conventions, or business proceedings, many of the papers presented and the discussion thereon being, in great measure, of a confidential character. The good work we are doing and its advantage to the industry at large have, however, secured us the sympathy of the press—a substantial aid in the prosecution of any undertaking, in the benefits of which the public has a share.

While the few remarks I have made are hardly such an address as you may have expected, or as I should have desired to present, I hope they will be helpful to you in obtaining a just and adequate idea of the work which the association is doing and what it may be called upon to undertake, and they may stimulate the mutual co-operation of our members and the interchange of information to our mutual benefit.

1. Presidential address at the convention of the association, held at Saratoga, N. Y., September 4-6, 1900.

International Association of Municipal Electricians.

An unusually large number of delegates and visitors are expected to be in attendance at the fifth annual convention of the International Association of Municipal Electricians, which is to be held in Pittsburg, September 25th, 26th and 27th. Morris W. Mead, chairman of the executive committee, reports that large delegations will go from New York, Boston and other eastern cities. Many delegates from the telegraphers' convention held in Minneapolis this week are expected to stop off in Pittsburg and participate in the sessions. The Central Passenger association has granted a rate of a fare and a third, on the certificate plan, to those attending the convention.

The social features of the convention include a the ladies on the afternoon of the 26th, and theater lines of the traction companies, carriage rides for the ladies on the afternoon of the 20th, and theater parties or inspection of some of the large iron and steel mills in the evening. The crowning pleasure event of the convention will be an excursion and banquet on the steamer Mayflower down the Ohio River to Davis Island Dam, seven miles and return, then up the Monongahela River, 45 miles and return, on the afternoon and evening of the 27th. Arrangements have been made for a fine electrical display by the city in Schenley Park on Saturday evening, September 28th, at which the picture of George Westinghouse and a number of electrical machines will be shown in incandescent lights.

Mica in Maine.

It is said that discoveries of mica in large deposits in the southwestern part of Maine have created the greatest interest in mining known in the state since the copper and silver excitement of 1878, and, unlike the so-called copper and silver mines, it is believed that the mica deposits are of such a character and extent as to leave no doubt of their great practical value. On top of Mount Lander, in the town of Rumford, a man who was prospecting for tourmalins a few months ago discovered an extensive deposit of mica, and a company is now working it, having purchased 14,000 acres of land. This company, which has mines in Canada, North Carolina and New Hampshire, has such confidence in the value of the Maine property that it will erect upon

it a large mill. In South Waterford a mine has recently been opened that is said to rival that in Rumford in the extent and purity of its deposit. It was discovered accidentally last summer by Elbridge Kimball, while walking through a piece of woodland, the mineral cropping out on the surface to such an extent as to attract notice even in the underbrush. A company was organized recently to work this mine.

CORRESPONDENCE.

London Letter.

London, September 4.—Signor Marconi has found a fortune as well as fame in wireless telegraphy. Many of the great powers have now adopted his system. The British Admiralty, with its incurable distrust of innovations, has taken two years to arrive at a decision, but now it has given a preliminary order for 25 sets of Marconi apparatus. The young Italian will draw a royalty of $500 per annum on each of these for 15 years. In addition, there is the cost of the sets, which, of course, Marconi, or his company, will supply. It is curious to reflect that the discovery which has brought fame to the Italian was anticipated, to some extent, at any rate, by Captain Jackson of her majesty's navy. Before Marconi was heard of, it is said that experiments in wireless telegraphy were being carried out on board H. M. S. Vernon, and at the naval maneuvers a year ago the Jackson system conveyed messages for 20 miles. This was the limit. Marconi on the same occasion succeeded in transmitting and receiving messages over a distance of 50 miles and more. If only the Admiralty had encouraged experiments with the Jackson system a few years ago, there might have been no necessity for it to go outside for a system of wireless telegraphy. It is said that in the next 15 years over $2,500,000 will be expended by the Admiralty in installing the Marconi system.

An Englishman named Gardner, living at Fleetwood, near Liverpool, has also been experimenting with automatic wireless telegraphy. He has invented a device for use at the transmitting station to emit electrical sparks corresponding to the dots and dashes of the Morse code. These signals are collected by the receiver of an approaching vessel and recorded on the tape in the usual way. At a trial made at Fleetwood a wire was erected on shore at the transmitting station and a conductor of about the same height was attached to the mast of a vessel lying off the coast. The vessel was then towed out in the direction of the Morecambe Bay lightship. When about two miles out the transmitter was set in motion and the bell of the receiver on board rang. This was followed by the click of the receiver and the warning "Fastnet," the signal selected, came through, printed on the tape, in three minutes. It was repeated with equal clearness again and again as the vessel proceeded on its way outside the lightship. The record was taken up to the seven-mile limit, the extremity of the zone provided for.

A new substance with, perhaps, a commercial future before it, is said to have been produced at Dunga, Zanzibar. A certain kind of fruit which grows in the neighborhood yields a white fluid on being tapped with a knife. When placed in boiling water the liquid coagulates into a substance closely resembling guttapercha, and on being allowed to cool, becomes hard. It can be molded into any shape during its soft condition and retains the form in hardening. The fruit which yields the liquid resembles a peach in shape, but is of the size of a small melon. Samples are on their way to London, if they have not already arrived, and expert opinion is to be invited as to whether the substance is guttapercha or not. Probably it will be found to be an inferior order of the article. It is permissible, however, to hope that some use may be found for it, in order to relieve the tension of the guttapercha market. There would be no difficulty, apparently, in producing large quantities of the new material, and a fresh source of revenue would thereby be created for the tropics.

The recent great development in Liverpool and vicinity of traveling facilities by means of electric traction received a further addition on Friday, when a new line serving the residential country districts was opened for traffic. The new line has been provided by the Liverpool Overhead Railway company, and is really intended to form a combination of its electric railway, which skirts the docks throughout its entire course of seven miles.

The company owning the "Twopenny Tube" has discovered a new method of increasing its dividends. Over each of the stations there is soon to be built a series of flats and offices. The machinery for the elevators is, of course, ready to hand, and for people who want to live near a railway station, the scheme has its advantages.

Electricity is shortly to join the ranks of the dockers. It is going to be the means of landing trunks from the mail boats at Dover. Complaints have been made as to delays in the starting of mail trains and other trains at the dockside, and the explanation given was that these delays were due to the unconscionable time taken in moving trunks by sliding them down a chute to the quay. This difficulty is to be overcome by the erection of a number of electric cranes, which will convey all the baggage ashore.

At a meeting of the Dublin corporation last week it was decided by a majority of 38 to 14 to carry out the electric lighting of the city as a municipal concern, instead of accepting the proposals of the Electric Tramway company. The decision was a very popular one, and the lord mayor, Sir Thomas File, who strongly resisted the proposal to hand over the enterprise to the tramway company, received an ovation from the gallery. W. H. B.

New York Notes.

New York, September 15.—The annual report of the Metropolitan Street Railway company for the fiscal year ended June 30th was filed this week at Albany. The gross earnings of the company show an increase over the preceding year of $1,562,920 and the operating expenses a decrease of 0.44 per cent. For 1899 the operating expenses were 48.70 per cent. and 48.26 per cent for 1900. The operating expenses of the Brooklyn Rapid Transit company for 1900, figured on the same basis as the Metropolitan employed, were about 66 per cent. The statement filed is exclusive of the lately acquired Third avenue system, which comprises 209 miles of track. Following is a summary of the Metropolitan's statement:

	1900.	1899.	Changes.
Miles operated	217	217	
Gross earnings	$14,721,550	$13,158,630	Increase..$1,562,920
Operating expenses	7,104,607	6,408,711	Increase.. 695,896
Per cent	48.26	48.70	Decrease.. 00.44
Net earnings	$ 7,616,943	$ 6,749,919	Increase. $ 867,024
Fixed charges	4,608,768	4,477,757	Increase.. 131,011
Balance	$ 3,008,175	$ 2,272,162	Increase..$ 736,013
Other income	351,985	366,893	Decrease.. 14,908
Total income	$ 3,360,160	$ 2,639,055	Increase. $ 721,105
Dividends paid	3,145,891	2,471,675	Increase.. 67,,216
Surplus	$ 214,269	$ 167,380	Increase..$ 46,889

During the fiscal year of 1899 the capital of the company was increased from $30,000,000 to $45,000,000, which accounts for the increase of $674,216 in dividends paid. The miles of track operated in 1899 and 1900 were the same, but while horse and electric power was used on the Amsterdam avenue line during part of 1899, only electric power was used in 1900. This accounts, in a measure, for the decrease in the operating expenses. The average cost of operation per mile by electric power is 13 cents, whereas, by horse power, it is 19.43 cents.

At a meeting of the Manhattan Railway company on Tuesday the directors declared the regular quarterly dividend of one per cent., payable October 1st. The company also decided to discontinue its Westchester express, which has been running during the summer season from South Ferry to Willis avenue, and the special Saturday New York and Putnam express. Russell Sage, who was present at the meeting, said that the work of electrically equipping the Manhattan elevated lines was proceeding satisfactorily, and that on or about the first of next month the company will be in position to show what it can do in the actual running of trains by electricity on the Second and Ninth avenue lines.

Four electric ambulances are being built for private hospitals in New York. Two will be used by the Roosevelt Hospital and one each by the Presbyterian and New York hospitals. The vehicles, which are being built by the same firm that built the one now used by St. Vincent's Hospital, will be seven feet six inches long and will weigh 4,800 pounds each. A speaking tube will connect the ambulance surgeon with the driver.

The Unique Electric Device company of this city has been incorporated, with a capital stock of $10,000, by James P. Hines, Michael Sorahan and Michael Hines, to manufacture electrical machinery and appliances.

Articles of incorporation of the Telegraphers, Stenographers and Typewriters of America were filed with the secretary of state recently. It is proposed to band together all acceptable telegraphers, stenographers and typewriters for social and fraternal purposes and to maintain a clubhouse in New York city. The directors are Philip W. Staylor of Baltimore, John H. Crain of Chicago and Earl A. Ramsey, James P. Cullen and Orvan H. Davidson of Brooklyn.

Bridge Commissioner John L. Shea has granted the request of the Brooklyn Rapid Transit company for permission to operate the motor trains over the Brooklyn bridge. He imposes two conditions, namely, that the trains are to be operated on the bridge only between 10 a. m. and 4 p. m. and 8 p. m. and 5 a. m., and that experienced men who are now employed on the bridge trains will have charge of the motors while crossing that thoroughfare. The Brooklyn Rapid Transit company, beginning next Thursday, will run elevated trains from the Brooklyn end of the bridge to Bath Beach every half-hour from 7 a. m. until midnight. The trains will be operated over the Fifth avenue elevated to Thirty-sixth street, and thence along the old West End route. Stations will be fitted up at West Brooklyn, Borough Park, Blythebourne, Van Pelt Manor and Bath Beach. Persons desiring to go to Bensonhurst, Ulmer Park and Coney Island will be transferred to trolley cars at Bath Beach. The running of the motor cars to Manhattan Beach will be discontinued to-morrow. They will continue to run to Brighton Beach.

Residents along Broadway and property owners have organized a society known as the West Side Taxpayers' association, with A. R. Keene as president, and Walter Laurence as treasurer, to protect trees and property interests against the sub-contractors of the rapid-transit subway. The association will try to secure an injunction against the contractors.

The Metropolitan Street Railway company has begun to make the necessary changes in its Park Row tracks opposite the postoffice, in order to provide additional terminal facilities for its various lines. Those cars of the Sixth and Eighth avenue lines which now have their terminal at Canal street and Broadway are to be run through Canal street to Center street, and thence south to the bridge and the postoffice. The Metropolitan tracks and those of the Third avenue line will be connected with those of the Broadway line in front of the postoffice. The work of preparing the Broadway cable line for the use of the electric system will be completed, so far as the work on the street itself is concerned, by September 20th. The change from cable to electriicty will not, however, be made until next spring, according to a statement made by President Vreeland, as there is still a great deal of work to be done. M. L. G.

From the Buckeye State.

Columbus, Ohio, September 15.—The Columbus Railway company has made a new proposition to the City Council for a 20-year franchise, but it is very little different from the first one, which was rejected. The people insist upon a reduction of the fare, and to this the company objects. It is said that a syndicate of eastern capitalists is after the city franchise and is willing to make a good offer for it. What there is in this report cannot be said. The matter is being kept very quiet, and if it is true it may possibly be that the Columbus road is interested in any move that may be made in that direction.

The Rev. Dr. Gladden has formulated a plan for the city to procure a new electric-light plant. It is yet too early to say what will become of it. There has been so much trouble over the old plant that the City Council is slow to take up any suggestion in that direction.

The Urbana, Mechanicsburg and Columbus Railway company has secured the consent of abutting property owners in Madison County and a majority of those of the other counties through which the road will pass. It now lies with the Columbus council whether a franchise will be granted the road for an entrance into the city. If the right is given, the officers of the company say that work will be begun at once on the line and that cars will be running over a portion of it by the first of the coming year.

The plant of the Niles Electric company, Niles, Ohio, was sold a few days ago at receiver's sale, to J. H. Herring, for $1,500. It is worth $10,000, at a low estimate, it is said.

The Northern Ohio Traction company has reduced the fare from Akron to Cuyahoga Falls from 10 to five cents. The company took this action because it could afford to do so, it is said, by the officials, but the Akron and Cuyahoga Falls company asserts that the cut was made in competition and that it will follow suit.

John T. Adams of Toledo has filed a letter with the Board of Public Works in Columbus, requesting that the Columbus Railway company be prevented from operating its cars on the tracks of the Columbus Central lines, and saying that the franchise is void, as the work of construction has not been completed according to agreement. He threatens to resort to injunction proceedings if the board does not take action.

Director of Public Safety Kauffman of Columbus has put himself on record as opposed to admitting any more electric roads which wish to use grounded circuits. If these roads come in, he insists that they use a complete metallic circuit to prevent the destruction of the water and gas pipes by electrolysis. The Urbana, Mechanicsburg and Columbus Electric Railway company has consented to this to satisfy the director.

J. J. Walsh, formerly superintendent of the street-railway and electric-lighting plant at Ironton, is in New York on business, and it is said he is planning for a new light plant for that city. The power plant of the Ohio Valley Electric Railway company will in all probability be moved to Ashland, and this will necessitate the establishment of another light plant

The Big Consolidated at Cleveland is arranging to run cars on Euclid avenue every 2½ minutes, instead of every three minutes, as at present.

L. G. Hallock, H. S. Sands and J. H. McKee, capitalists of Steubenville and Wheeling, W. Va., have secured the franchise to build an electric line between Coshocton and New Comerstown, Ohio, a distance of 14 miles.

It is said that a plan is on foot to build an electric line from Canton to Steubenville.

An eastern syndicate is negotiating for the franchise for an electric road between Mansfield and Wellington. The franchise was granted in Mansfield a year or more ago, and at that time people thought the road would be built at once, but so far nothing has been done with it.

All the employes of the Lima Street Railway company of Lima went out on a strike last Sunday because of an objectionable notice placed in the cars by the company. They declared that the notice was in the nature of a warning to the public that the employes were all thieves, and they did not propose to work under any such a cloud.

The Dayton, Springfield and Urbana Electric Railway company has secured a franchise in Clifton and will likely build a branch from Springfield to that place. It is said this company will build several other branches out from the main line, and that

its connection with the Columbus, London and Springfield will be so close that it will be practically all one line.

The managers of the Columbus, Buckeye Lake and Newark Railroad company think they will have their entire line in operation by early spring. The machinery will be installed as soon as it is completed.

The cars of the Gallipolis and Point Pleasant electric road, which was operated by the Hocking Valley Railroad company, have been sold to the Kanawha Traction company.

Work on the Alliance, Sebring and Salem road has been commenced at Beloit. This road will extend from Alliance to Salem, a distance of 13 miles, and the promoters will have a portion of it in operation before severe winter weather begins, if possible.

The Columbus Railway company is arranging to build a line out Fifth avenue, Columbus, to Arlington, a suburb. The distance is about four miles.

It is said that the Sandusky and Interurban Railway company has changed its course a little and will pass through the town of Vermilion, west of Lorain.

It is now stated that the financial end of the Chillicothe, Mount Sterling and Columbus Electric Railway company's affairs has been arranged and that the promoters will soon be ready to announce the beginning of work on it. For some reason this matter has been delayed for some time.

A temporary injunction has been granted the Sandusky and Interurban Electric Railway company, to prevent the Cleveland, Elyria and Western from interfering with the tracks already laid by the Sandusky people at Lorain. The City Council of Lorain had ordered the Cleveland company to lay its tracks on the ties of the other company. The Sandusky and Interurban company is to connect with the Cleveland and Lorain Electric Railway company at this point, and there is great rivalry between the two Cleveland roads.

Work is progressing rapidly on the roadbed of the Dayton and Troy Traction company. It is now stated that the power house of this road will be located at Troy.

Manager Sloat of the Southern Ohio Traction company has denied the report that his road will haul freight as well as do an express business. He says the road will carry express matter and light packages, but nothing in the way of freight. Mr. and Mrs. Sloat will go to California for a three months' visit within a short time, and during his absence his duties will be looked after by Auditor Bicknell.

The Mansfield and Shelby electric road will likely pass directly through the town of Shelby. Representatives of the road are now at work getting the consents of the property owners.

The Northern Ohio Traction company will soon put 15 new cars in service at Akron. They are of the closed variety, and will be used for winter traffic. The offices of the company have been moved to the Hamilton block in Akron. This company is installing new machinery for a light plant in the power house, and will soon have it ready for operation.

The Millcreek Valley Electric Railway company of Cincinnati has a force of men at work on its extension to Glendale, and there are prospects that this will be finished by November 1st. O. M. C.

Northwestern Notations.

Minneapolis, September 15.—The Hughes Electric Light company has completed its new system at Dickinson, N. D., and put it in operation.

A Davenport (Iowa) man wants a franchise at Reinbeck, Iowa, for an electric-lighting system.

The Equitable Electric Light company at Lake Geneva, Wis., has awarded a contract for the erection of a power house.

The council of Wyoming, Iowa, is considering an application for a franchise to operate an electric-light and power plant.

The plan adopted at Fergus Falls, Minn., of constructing a new flume for the waterpower while changes were being made has proved unsuccessful. The water soaks through into the old channel and causes continual cavings. Hence the electric-light committee has decided to drain the pond and rush the work as rapidly as possible. All lights will be off until the work is far enough along to permit of refilling the pond.

The electric-light and power company of Iowa Falls, Iowa, will reorganize, with a capital stock of $40,000.

Arrangements are completed for the Wisconsin Traction and Power company to rebuild its power station at Appleton, Wis., and make the projected Kaukauna extension. The extensions will hardly be done this season, but work will be pushed on the power house at once. A. L. Smith has been relieved of the management of the company, at his own urgent request. He has been with the company since its inception, 19 years ago.

The Electric Light company of Belle Plaine, Iowa, is making a number of improvements to its system. The power house is being enlarged and a repair room will be installed in the additional space. Condensing apparatus will also be installed.

The Board of Water Commissioners of St. Paul finds that the mains of the city have been greatly damaged by the electricity passing through the conduits placed in close proximity to them. A resolution was passed requesting the city engineer to refer applications for permits to lay electric conduits to the board, in order that the water board might protect its mains from further damage in that direction.

The new electric-lighting system at Elkader, Iowa, has been completed and put in operation.

Thief River Falls, Minn., will install an electric-lighting plant, to cost about $3,700. George A. Ralph of Crookston, Minn., is the engineer in charge.

The council of Duluth, Minn., recently provided for 72 additional street lights in the suburbs. Now it is found that the charter provides for a maximum tax of one mill for lighting, which will provide about $22,000, and this amount is already taken up by the lights already in use. As the charter will not permit of borrowing from other funds, it is probable that the additional lights will not be secured.

A. R. Jackson of Albia, Iowa, has bought the old engine of the Centerville (Iowa) Electric Light company, and will install it in his plant at Albia.

The electric-light plant at Atlantic, Iowa, is now running night and day, and furnishes power as well as light.

William H. Brown, an electrician of the Mason City (Iowa) Electric company, was crushed to death by a falling motor, which he was aiding in getting into place.

The mayor of Council Bluffs, Iowa, vetoed the franchise recently granted the Bluff City Gas and Electric Light company by the council. The latter thereupon passed it over the veto. An election is called for October 16th for the voters of the city to pass on the award of the franchise.

The Sherburn Electric Light and Power company of Sherburn, Minn., has been incorporated, with a capital stock of $15,000.

The council of Everett, Wash., pigeon-holed the application of the Snoqualmie Power company for admission to that city. The citizens do not regard the action favorably, and it is probable that the council will be induced to consider the application.

It is stated that John M. Roach, president of the Union Traction company of Chicago, contemplates building a trolley line from Red Wing, Minn., to Frontenac.

The Fargo Gas and Electric company of Fargo, N. D., has lost its case in the District Court, against the Fargo-Edison company. The former claimed an exclusive franchise, and also charged that its service suffered from induction in having the wires of the Fargo-Edison company set near its own. If its contention had been supported, the Fargo-Edison company would have been shut out of the important streets of Fargo, for the Gas and Electric company had already occupied them. The District Court holds that the council has no right to grant an exclusive franchise and that the evidence shows that two different systems of lighting can be in proximity without damage to either. The case will be appealed to the Supreme Court. R.

Gleanings From Colorado.

Denver, September 14.—John D. Mason, manager of the Boulder Electric Light company of Boulder, Colo., was struck by lightning on September 9th and was instantly killed. He was standing in the doorway of a barn about two miles from the city, and by his side were a friend and his son. When the flash came all three were knocked down. Two of them soon recovered and they found that the stroke had been fatal to Mr. Mason. The deceased started the electric-light plant in Boulder and took charge of it. An electric company was organized by bank officials of the city and acquired the plant but Mr. Mason was retained as manager and additions and improvements were made. He had held his position 15 years.

The Leadville Gas and Electric company, which has recently been formed to take over the business of the consolidated illuminating interests in Leadville, Colo., has elected the following-named officers: President, John F. Campion; vice-president, Robert B. Sullivan; secretary and treasurer, C. K. Boettcher. The management of the plant, which is to be enlarged so as to furnish power to mines in the vicinity will be vested in the firm of Gilbert Wilkes & Co., electrical contractors of Denver. Twenty thousand dollars will be expended in the extension. The work will be done by the firm mentioned, which will also purchase the supplies. The directors of the company consist of the officers mentioned and Charles Cavender and Gilbert Wilkes.

John Brisben Walker of the Cosmopolitan is credited by Denver papers with a project of constructing an electric railway from Boulder to Denver. A company was organized to undertake an enterprise of this kind early in the year, but though it had gone so far as to open offices in Denver it abandoned the undertaking when trouble arose over the franchise. Mr. Walker was recently in Denver and did not deny that he had considered the railway project, but he did not make any definite promises. Should a railway be built the power house would doubtless be located at the coal mines a few miles distant from Boulder. The length of the line would be about 29 miles.

The electric line of the Colorado Springs and Cripple Creek railroad, running from Cripple Creek to Victor, has been formally opened to the public. The rolling stock consists of three trains, each composed of a motor car and a trailer. The trains are equipped with air brakes.

Mr. Charles F. Lacombe, president of the Lacombe Electric company and the Rocky Mountain Electric company, and identified with a large number of electrical enterprises in Colorado, was married to Miss Nancy Edrington at Memphis, Tenn., on September 12th. Dr. William Bagot, who is also connected with the Lacombe Electric company, was best man. Mr. and Mrs. Lacombe made a trip to New York and will reach Denver in October.

The Denver City Council has granted a franchise to the University Park Street Railway company for an electric line from the corner of Pearl and Jewell streets to University Park. The line is to be operated by the Denver City Tramway company.

According to the report of the La Bella Electric plant of Goldfield, in the Cripple Creek district, current is now supplied to 25 electric hoists in mines. The plant furnishes 375 arc lights and 7,200 incandescent lights, the latter for residences, business places and mines.

The Lacombe Electric company, which has the contract for supplying municipal lighting and building a plant which will eventually be acquired by the city of Denver, has not yet acquired a site for its station, but the location will be determined upon in a few days. The electrical machinery, which will be of the Western Electric and the Westinghouse types, was ordered a considerable time ago and will be on hand when required. Work on the line construction has been pushed and great progress has been made as the weather has been entirely favorable. J. W. D.

PERSONAL.

John F. Hill, the governor-elect of Maine, is interested in several electric-railway enterprises.

The many friends of C. W. Price, so long identified with the Montauk Multiphase Cable company of New York, will be pleased to learn that he has recovered sufficiently from his long illness to be about again.

W. L. Hedenberg, editor of Electricity, denies the accuracy of an interview in the San Juan (Puerto Rico) News, relative to the lighting of that city, attributed to him. He says that he has neither opposed nor recommended any system of lighting for San Juan.

Benjamin B. Odell, Jr., the Republican candidate for governor of the state of New York, is president of the Newburg (N. Y.) Consolidated Gas, Electric Light, Heat and Power company, and, although an active politician, devotes much of his time to the business of his company.

Rev. Dr. Frank W. Gunsaulus, for eight years president of the Armour Institute of Technology of Chicago, has resigned to give his time entirely to church work. He is reported as having said that he has done all for the school that a man of his training could do. He thinks that the time has come for the engagement of a man of technical ability. Dr. Gunsaulus' resignation is to take effect on February 1st.

Victor Emmanuel III., the new king of Italy, is said to be something of an electrician. Indeed, he has been called "the only real electrician among all the present princes of Europe." He is fairly well versed in all that concerns the application of electricity to light, motive power and sound, and he was one of the earliest experimenters with the X-rays. Soon after that famous discovery he turned his apartments in the Quirinal into something very like a chemical laboratory, much to the disgust of the other members of the royal family.

Mr. Bruno Abdank-Abakanowicz, a prominent European electrical engineer, recently met with sudden death by heart disease at his villa near Paris. He was born in Poland about 45 years ago. He served at the Paris Exposition of 1889 as one of the United States jurors of award and was well known in this country. At one time he was a director of the original French Thomson-Houston company and was instrumental in introducing considerable American electrical apparatus in Europe. He was engaged in experimental work at the time of his death.

Frederick S. Kent, one of the oldest and best-known telegraph operators in the country, died suddenly on September 9th at his home in Chicago at the age of 63 years. He was one of the pioneer operators in the country and was the first man in Chicago to be detailed by the Western Union company to a regular newspaper telegraph desk. During the war Mr. Kent did valuable service as an operator for the Chicago and Alton railroad. He had been doing newspaper telegraphic work for 18 years, and at the time of his death was chief operator for the Chicago Chronicle.

ELECTRIC LIGHTING.

The Ava (Ill.) electric-light plant was totally destroyed by fire recently. The loss was $3,000.

The Iowa Falls Electric Light and Power company will reorganize, with a capital stock of $40,000.

The City Electric Railway company of Port Huron, Mich., will erect an electric-light plant in that city.

The Bluff City Electric Light and Gas company of Council Bluffs, Iowa, has been incorporated, with

a capital stock of $150,000, by T. Bowman and J. P. Greenshields.

The town of Barton Heights, Va., will call for bids from electric companies in the vicinity for lighting the town.

Mendon, Mich., decided at a recent special election, to own its electric-light plant. The town will be bonded in the sum of $8,000.

Halletsville, Texas, has awarded a contract to the Dallas Electric Light company to install an electric-light plant in Halletsville.

The Home Heating and Lighting company of Indianapolis, Ind., has been incorporated, with $250,000 capital stock, by S. E. Rauh, C. Fairbanks and E. C. Hawkins.

The Henderson (N. C.) Lighting company has been chartered, with a capital stock of $10,000. The incorporators are S. H. Pullian, E. V. Williams and J. H. Bridgers.

The proposition to issue $20,000 bonds for the construction of an electric-light and power plant at Coffeyville, Kan., was voted September 4th, by a majority of three to one.

The new machinery for the Greentown (Ind.) municipal electric-light plant, recently destroyed by fire, is being placed in position. When completed the plant will cost $15,000.

The Corning Light, Heat and Power company of Corning, N. Y., was recently incorporated for $50,000, by W. K. Archibald, F. N. Waterman of New York city and P. T. Brady of Syracuse.

The General Light and Power company, capitalized at $5,000,000, has been incorporated, under West Virginia laws, by Philadelphia men, its franchise covering a general electric-light and railroad business.

In a certificate of condition of July 20th, filed by the United Electric Light company of Springfield, Mass., with the state commissioner of corporations, the total assets of the company were given as $937,095, capital stock at $500,000 and debts at $264,529.

The Village Board of Harlem, near Chicago, has voted to advertise for bids for the construction of an electric-light plant to furnish 2,500 incandescent lights to private consumers. The village already owns its own waterworks and electric-light plant for street lighting.

The Westmoreland Light, Heat and Power company of Greensburg, Pa., was recently incorporated, with $50,000 capital stock. The incorporators are Edward E. Robbins, Morris L. Painter, Winfield S. Lane, Edward H. Blair, Greensburg, and Gardner W. Kimball, Wilmington, Del. The company will produce electricity, steam and gas for heating and lighting purposes.

ELECTRIC RAILWAYS.

An electric railway from Charleroi, Pa., to Washington, Pa., is projected.

A franchise has been granted by Junction City, Kan., to F. V. Crouch, Carrollton, Mo., for a street railway.

The Smethport Electric Street Railway company of Smethoprt, Pa., has been incorporated, with a capital stock of $12,000.

A franchise has been granted the Yardley, Morrisville and Trenton Street Railway company to build a street railway in Yardley, Pa.

An ordinance granting a 30-year franchise to the Lansing, St. Johns and St. Louis Railway company has been passed by the City Council of Lansing, Mich.

Surveys are being made to extend the Leechburg, Vandergrif and Apollo electric line to Jeannette, Pa. The route from Apollo will be through North Washington, Markle, Lamont and Delmont to Jeannette.

The City Council of Peru, Ind., has passed an ordinance granting a franchise to the Wabash River Traction company for an interurban line between Wabash and Peru. It is said that work will begin at once.

The Township Board at Lexington, Mich., has granted a franchise to the Detroit, Lexington and Lake Huron Electric Railway company, through the township. The road is to be completed by December 31, 1901.

The construction survey of the route of the proposed Grand Rapids and Holland Electric Railroad company of Grand Rapids, Mich., has just been completed, and it is expected that construction work will begin very soon.

The Whitehall and Granville Railroad company of Washington County, N. Y., was incorporated recently, to operate an electric railway, with a capital of $750,000. The road will run from Whitehall to Granville, a distance of 14½ miles.

The City Council of Jackson, Mich., has granted a franchise to F. N. Rowley of Kalamazoo for an interurban electric road between Battle Creek and Jackson. This is to be part of a line which is projected to run from Kalamazoo to Ann Arbor, a distance of 106 miles. It is stated the right-of-way has been secured for the entire route. The road has already been built from Kalamazoo to Battle Creek. From Jackson east the road will pass through Michigan Center and Grass Lake, with a spur extending to Wolf Lake.

The Susquehanna Valley Electric company has been organized, with $200,000 capital stock, to build a trolley line between Sidney and Franklin, N. Y. H. B. Oakham, C. F. Lehman and Ed H. Tucker, New York, are interested in the project.

The Rockland County (N. Y.) Traction company has been incorporated, with $300,000 capital stock, to operate a street railway, to be operated by electricity. The length of the road is to be 30 miles. The directors are C. W. Reeve, F. H. Reeve, G. F. Carpenter and G. M. Carpenter.

The daily returns of the railway traffic in Sydney, N. S. W., show an average of 219,000 passengers carried daily. Nearly half of these are carried by the new electric line, recently opened. The rest of the traffic is furnished by steam railroads, a cable system and an older electric line.

The Lynn and Boston electric-railway management seeks authority from the Massachusetts railroad commissioners for an additional issue of stock to the amount of $1,500,000. The Holyoke Street Railway company also seeks authority for an increase, desiring to issue $200,000 more stock and $250,000 coupon bonds.

The property of the Jackson Street Railway company of Jackson, Mich., was sold September 13th, under foreclosure proceedings, to W. A. Boland of New York for $153,500. The amount of the bonds it was sold to secure was $150,000. The road, which is seven miles long, has been in the hands of a receiver for some time.

Another effort is being made to construct an interurban traction line between Muncie and Dunkirk and Hartford City, in Indiana. A. L. Johnson, W. E. Hitchcock and other capitalists of Muncie are interested. Most of the right-of-way has been secured, and it is estimated that it will take about $800,000 to construct and equip the road fully.

A petition for a new electric road has been filed with the officials of the various towns interested, the line being planned to cover a route from Belmont, Mass., at the terminus of the Boston Elevated company's line, through Woburn, Burlington, Lexington, Lincoln, Concord, Billerica and Chelmsford to Lowell, Mass., the mill city, on the Merrimac River.

Articles of incorporation have been filed at South McAlester, I. T., by the Union Electric Railway company. The company is capitalized at $122,000 and the directors are A. H. Howe, New York city; E. E. White, W. G. Weimer, W. F. Browne and R. E. Wood. The company contemplates the construction of an electric street railway in South McAlester.

It is expected that in a short time plans will be completed for the construction and consolidation of a system of 120 miles of suburban lines in England, connecting Manchester, Liverpool, Bolton and a number of smaller towns in the most populous district of northern England. The project is said to be in the hands of Tom and Albert Johnson of New York.

A special election has been called, to be held on October 10th, at La Porte, Ind., to vote on the proposition to grant an appropriation of $20,000 to aid in the construction of the electric railway projected to be built from Angola, Ind., across the Michigan line, with Coldwater as the terminal point. Eastern capitalists are said to be interested in building the line.

Maurice Ahern of Chatham, England, owner of 30 shares of stock of the Newton and Boston railroad, has filed a petition in the United States Circuit Court, in Boston, asking for an injunction restraining the company from complying with the provisions of the act requiring street railroads to carry public-school children at half-rates. The petition claims that the act is class legislation as affecting public-school children, and not others. The petition also states that the road has never paid a dividend and that the carrying out of the provisions of the act would prevent any such payment in the future.

Arrangements have been completed by which the mails between Jersey City, Hoboken, Union Hill and Bayonne, N. J., will be carried by the trolley cars of the North Jersey street railway and the Jersey City, Hoboken and Patterson Street Railway companies. The new system will effect a great saving of time, as all mail matter now sent from one of the towns named to any of the others must first go to New York. This involves two trips across the river, the time required for the transfer of a letter being from 12 to 18 hours, while the trip from Union Hill to Bayonne, the two points most widely separated on the route, can be made in about two hours.

AUTOMOBILES.

John L. French and H. Edgar French of St. Louis arrived in Chicago September 17th, after an automobile trip across the country from St. Louis. They reported the roads bad in most parts.

In the recent Newport automobile races one of the most interesting features was the speed developed by Kenneth A. Skinner on his motor tricycle. He won the race of five miles in 10 minutes 30½ seconds. The vehicle used was a De Dion-Bouton motor cycle.

The Electric Storage Battery company of Philadelphia announces that it has sold the use of its patents for automobile purposes to the Columbia Automobile company, receiving $1,000,000 of the latter's $3,000,000 of capital stock. The Electric Storage Battery company says it has booked orders so far this year amounting to $2,000,000, and on September 1st had unfilled orders for $200,000.

Chicago claims the youngest licensed automobile driver in the world in the person of Miss Jeannette W. Lindstrom of 2816 North Ashland avenue, who was examined and granted license No. 322 on September 14th. Miss Lindstrom, who is but 13 years old, was given power to operate vehicles propelled by electricity. She is a daughter of C. A. Lindstrom of the Hewitt-Lindstrom Motor company of Chicago.

During the maneuvers of the French army which took place last week at La Beauce, France, a striking feature was the introduction on an extensive scale of automobiles, in order to secure a practical test of their military utility. Several of the generals and many of the members of their staffs were furnished with fast, light vehicles which proved of great value. One of the general's orderlies covered 170 kilometers (105.5 miles) in a morning, making a complete circuit of the two contending armies and furnishing his superior with full particulars by noon. Heavy forage and provision automobiles also did valuable work. One "voiturette" of four horsepower, it is said, carried an "aluminum searchlight," the motor being powerful enough to cover great distances and at the same time project a light for four miles.

PUBLICATIONS.

A card containing a combined poetical and prose statement entitled "Useful Light," and stating a few advantages of the Shelby lamp, has been issued by the Shelby Electric company, Shelby, Ohio.

The esteemed Electrical Review of New York has improved its appearance, typographically, and removed to larger offices in the Park Row building. The first issue from the new office is an attractive one, and the Western Electrician extends its congratulations.

The Phosphor-Bronze Smelting company, 2200 Washington avenue, Philadelphia, is sending to the trade its revised price-list No. 17. Phosphor-bronze wire, metal, rods, wire ropes, sheets, etc., are quoted and the pamphlet also contains a few tables of weights, etc.

The Cutler-Hammer Manufacturing company, Milwaukee, Wis., is distributing to the trade copies of bulletins recently issued on new apparatus, such as rheostats, controllers, etc. The bulletins are on loose sheets, and are intended to be inserted in the company's perpetual catalogue, which was distributed several weeks ago.

In its August 9th issue the Tramway and Railway World of London devotes over 30 pages to the International Tramways and Light Railways Exhibition which was held in London under its auspices from June 23d to July 4th. A complete illustrated description of the exhibition is given, including a large number of very clear illustrations of the exhibits.

The International Traction company of Buffalo, N. Y., has published an attractive folder descriptive of its lines in and about Niagara Falls and Buffalo. One side contains a complete guide to Niagara Falls and other points of interest in the vicinity, with detailed information about the different routes to be taken and the rates of fare. On the opposite side is a colored birdseye view of the lines of the company, extending from Buffalo to Niagara Falls, Lewiston, Youngstown, Lockport, etc.

The Kentucky Electrical company, Owensboro, Ky., has issued a bulletin pertaining to the Kentucky incandescent lamp. The glass of the bulbs and tubing used in these lamps is the Libbey product, which is noted for its clear, crystal appearance. The filament is made by a special process which is said to give the exact voltage required at the desired candlepower and efficiency, and each lamp is individually exhausted. The manufacturer guarantees the lamp to have a maintained candlepower and efficiency, to be non-blackening, and to give a pure white light throughout its useful life. An illustration shows the style of filament used for all voltages from 45 to 125 and for all candlepowers from eight to 50.

The Simplex Electrical company, Cambridgeport, Mass., has just issued its sixth catalogue, descriptive of miscellaneous heating apparatus, which indicates, by comparison with previous issues, the steady growth of the company's electric-heating business. The catalogue, which contains nearly 60 pages, covers a great variety of apparatus. "Many successful kitchen outfits," says the Simplex company, "have demonstrated that in the very near future all good apartment houses will be provided only with electricity for cooking and ironing. Many hotels, hospitals, sanitariums and steamships use electric flatirons, griddles, broilers, toasters, hot-water urns and other items to a considerable ex-

tent. Tailors, clothing manufacturers, laundries, etc., use thousands of irons, making necessary the large variety listed. Electric heaters for street cars are now the only kind considered, and we make 14 styles to meet the requirements in this line."

Brown, Boveri & Co., manufacturing electrical engineers of Baden, Switzerland, have issued a fine illustrated catalogue (in English) of some of the more important installations carried out by the firm during the last few years. All but two of the illustrations are full-page views and represent installations of large alternating-current plants. An account of the firm's growth and the part it has taken in the development of electrical engineering makes very interesting reading. A long list of the more important plants the firm has installed during the eight years of its existence covers Germany, Luxemburg, Switzerland, Austria, France, Belgium, Holland, Italy, England, Russia, Spain, Sweden and Norway, Egypt and the Transvaal.

POWER TRANSMISSION.

It is announced that W. W. Vaughn will construct a dam and erect an electric power plant at West Branch, Mich., to furnish power to manufacturing plants in the vicinity.

The Roanoke Navigation and Waterpower company will develop 1,000 horsepower on Roanoke River and establish a large electric plant near Roanoke Rapids, N. C.

The dam on Seneca River, where electric power is furnished for the town of Anderson, S. C., is now receiving additions, which will make the total horsepower 5,000 and the cost $500,000.

A 50-year franchise to conduct an electrical power plant and furnish power and light to mines and the incorporated towns of Shasta County, Cal., has been granted by the county supervisors to A. H. Davidson of San Mateo County.

The Niskayuna Power company of Niskayuna, N. Y., has been incorporated, with a capital stock of $100,000, to develop electricity hydraulically and to operate in Schenectady and New York city. The directors of the company are E. C. Brown and L. J. Montgomery of New York city and W. A. Graves of Rexford Flats.

Local capitalists at Hanford, Cal., have organized the Mammoth Electric company, which proposes to develop electricity to furnish light and power to the entire San Joaquin Valley. The organizers are H. G. Lacey, R. C. Lacey, O. M. Lacey, S. E. Biddle, J. E. Rawlins and others, and a large sum of money is said to have been subscribed to carry the enterprise through.

The York Furnace Electric company of Berlin, Pa., has been granted a charter, which permits the company to own and control waterpower from the Susquehanna River and develop and distribute electric current for heat, light and power. The concern is capitalized at $1,200, and the directors are F. S. Shoff, Colemanville; John W. Holman, Newton; J. Miller, G. B. Wilson and W. F. Beyer, of Lancaster.

ELECTRICAL SECURITIES.

The General Electric company has declared a dividend of two per cent. on its common stock, an advance of one-half of one per cent. from the last previous payment. The dividend is payable October 15th to stock of record September 25th.

A dividend of two per cent., payable October 1st to stockholders of record that day, has been declared by the directors of the Union Elevated Railroad company, which operates the Union Loop in Chicago. The transfer books closed September 20th and reopen October 2d. This is the second dividend this year, making four per cent. in all. The last payment was two per cent. on March 26th. While this dividend is not named to cover any particular period, it really puts the stock on a four per cent. basis. In 1899 the road paid a lump dividend of four per cent.

MISCELLANEOUS.

The Crôtte electrical method of treating consumption, described in the Western Electrician a few months ago, is now said to be exciting attention in Paris. It is said that the results have been highly satisfactory.

The members of the local union of electrical workers at Indianapolis, Ind., went on a strike September 14th. The strikers' demand is for an eight-hour day in place of a nine-hour day and for 32½ cents an hour in place of the present scale of 25 cents an hour.

Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until two o'clock p. m., on October 17th, and then opened, for the low-pressure, steam-heating and mechanical-ventilating apparatus, etc., for the United States custom-house building at Portland, Ore., in accordance with the drawings and specifications, which will be furnished at the discretion of James Knox Taylor, the supervising architect, on application at his office, or at the office of the superintendent of the building, at Portland, Ore.

An electric arc was recently utilized to effect an opening to a large safe at the general postoffice in Chicago. The safe had not been used for some time and the combination had been lost. An expert was sent on by the Treasury Department at Washington, but his efforts were futile. W. A. Richardson, electrician at the postoffice, then accomplished the work by means of an electric current. An ordinary carbon was attached to one wire of the city incandescent-light service, the other wire being connected with an open outer iron door of the safe. A water rheostat was placed in the circuit. The door was 2½ inches thick and was constructed of six plates of different compositions.

TRADE NEWS.

J. Hicks Bunting of Wilmington, N. C., wishes to communicate with manufacturers of combination gas and electric fixtures.

The Sunbeam Incandescent Lamp company of Glen Ridge, N. J., capitalized at $150,000, has been licensed to carry on business in Illinois, with a capital stock of $38,000.

The Chicago Fuse Wire and Manufacturing company, Chicago, has been awarded a medal by the international jury of award for its exhibit at the Paris Exposition. This exhibit consists of a complete assortment of the company's "trademark" line of tested fuse wire and fuse links.

Under date of August 28th, the United States commissioners at the Paris Exposition informed the Incandescent Electric Light Manipulator company of Boston, Mass., that the international jury of award had granted the company a bronze medal for its excellent exhibit at the exposition.

It is stated that the firm of Siemens & Halske of Berlin, with branches at Vienna and St. Petersburg, received more prizes at the Paris Exposition than any other single company in the world. The awards granted to the company comprised 12 grand prizes, 11 gold, 21 silver and seven bronze medals.

Beecher Ogden, advertising manager of the International Correspondence Schools, Scranton, Pa., was a recent New York visitor. Mr. Ogden has had charge of the advertising department of these very successful schools for several years, and their large increase in educational business is largely due to his systematic and modern method of advertising.

The Alden Electric company of Chicago was recently incorporated, with a capital stock of $12,000, for general manufacturing and mercantile purposes. The incorporators were Fred H. Alden, J. Schlessinger and Jacob Geiserowich. The new company has secured ample quarters at 52 and 54 West Van Buren street and will do a general electric-supply business.

The American Electric Fuse company, Chicago, announces that it has opened offices and stockrooms at 116 Nassau street, New York city. This branch will be under the charge of W. B. McCurdy, who has been connected with the company for several years, and who is thoroughly versed in everything pertaining to the business. A full and complete stock of all goods manufactured or handled by the American company will be carried at the New York office and shipments will be made direct from there to customers giving orders to that office, thus saving time and money to the customers. Mr. McCurdy will be pleased to see any of the trade at the new offices.

In a recent communication to the Bullock Electric Manufacturing company, the George A. Fuller company, contractor for the Broadway Chambers building, New York city, a model of which is exhibited at the Paris Exposition, states: "Your dynamo forms a prominent feature in our exhibit, and helped to obtain the grand prize and gold medals which have been awarded to this exhibit." Prospective purchasers are asked to investigate the Bullock dynamos and motors before placing their orders. Descriptive and illustrated bulletins are furnished free upon request to the Bullock Electric Manufacturing company, St. Paul building, New York city.

BUSINESS.

Managers of alternating-current lighting plants who desire information regarding the Gutmann wattmeter should apply directly to the selling agent, the Electric Appliance company of Chicago.

The Jeffrey Manufacturing company, Columbus, Ohio, manufacturer of chain belting, mining machinery, etc., announces that its complete elevating and conveying-machinery and chain catalogue is now ready for distribution.

Charles H. Besly & Co., Chicago, for some years have been sending metal-working tools to India. They began by sending a few tools, and those small ones. Last year they sent to Bombay a 20-inch lathe, and it is said that native mechanics, for more than 100 miles around Bombay, came to see the lathe on account of its size and the work it does. The lathe was made by Mr. Porter of Massachusetts. During the past month Besly & Co. have sold outfits for three shops to go to India. American tools seem to be preferred in that country, and the demand seems to be increasing.

J. Holt Gates & Co., 15 Monadnock block, Chicago, have been awarded the contract for a new addition to the electric-light plant at Naperville, Ill. There will be installed one 120-kilowatt Warren alternator, a handsome marble switchboard and a 300-horsepower cross-compound Corliss engine. The entire plant will be run from this engine by belts running to a countershaft. Additional apparatus to be installed will result in a complete overhauling of the entire outfit. The same firm has been awarded the contract for a new addition to the electric-light plant at Whitewater, Wis., which includes a 90-kilowatt, slow-speed Warren alternator.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 11, 1900.

657,510. Perforator Keyboard. Charles L. Buckingham and Emil Germann, New York, N. Y. Application filed January 13, 1898.

In the perforating system are combined a keyboard having a series of key levers, a series of contact arms actuated thereby, a common closing and breaking apparatus in the common return circuit of the perforator and, a circuit-breaking contact in one branch which is actuated by the space key to break the branch as the common return circuit is closed.

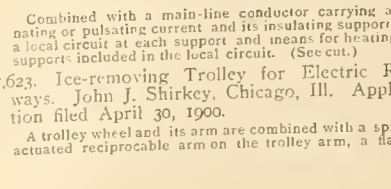
657,516. Motor Vehicle. Clyde J. Coleman, Chicago, Ill., assignor to the General Automobile company of New Jersey. Application filed October 27, 1899.

In a system of electrical propulsion for motor vehicles are combined a circuit controller, a current-reversing switch, a motor, a variable-speed mechanism, intermediate connections between the same and the actuating means of the controller, means capable of independent actuation carried by the movable member of the controller within easy reach of the operator's hand and having operative connection with the switch, and means for locking the switch against movement except when the controller mechanism is in its starting position.

657,541. Device for Fixing Incandescent Electric Lamps. Louis J. P. Hollub and Henri Mignal, Paris, France. Application filed May 29, 1900.

The device has a T-shaped part formed upon or applied to the head of the lamp bulb, in combination with a socket provided with a diaphragm in which is formed an oblong apertore, in such a manner that upon engaging the T-piece in the aperture and turning the lamp through 90 degrees this latter is fixed by the arms of the T-shaped piece, which engage in the recesses in the diaphragm, the extremity of the socket comprising slits in such a manner as to exert a spring action upon the conical portion of the head of the lamp and thus constantly maintain the arms of the T-piece engaged in the recesses.

657,574. High-voltage Insulator. Alf Sinding-Larsen, Frederiksvaern, Norway. Application filed December 11, 1899.



NO. 657,574.

Combined with a main-line conductor carrying alternating or pulsating current and its insulating supports are a local circuit at each support and means for heating the supports included in the local circuit. (See cut.)

657,623. Ice-removing Trolley for Electric Railways. John J. Shirkey, Chicago, Ill. Application filed April 30, 1900.

A trolley wheel and its arm are combined with a spring-actuated reciprocable arm on the trolley arm, a flanged spool on the reciprocable arm, axially parallel cutters on the body of the spool and cylindrical teeth projecting from the opposite inner faces of the flanges, the teeth having points passing closely by the trolley wire.

657,637. Trolley Head. Stanislas Bourgeois, Manchester, N. H. Application filed April 10, 1900.

An electric trolley pole is provided with a trolley head disposed at an angle with the pole and substantially upon a horizontal plane, an oscillatory yoke pivotally attached to the head and a trolley wheel mounted in the yoke.

657,638. Secondary-battery Plate. William Bowker, Sr., Waltham, Mass. Application filed January 19, 1900.

The plate consists of the lead or conducting plate provided with lips or ears, and the sheets of natural vegetable fibrous network secured to opposite sides of the conducting plate by the ears or lips and having a filling of lead oxide or active material.

657,646. Apparatus for Reclaiming Tin and Zinc from Tinned and Zinc Scrap. George B. Cruickshank, Birmingham, Herbert R. S. Coleman, Smethwick, and Percival Cruickshank, Birmingham, England. Application filed May 23, 1900.

In apparatus for reclaiming tin or zinc from tinned or zinc scrap by the use of a chemical solution and electricity are combined a vat having suspended therein a revoluble reel with flanges with circumferential revoluble perforated anode drums, such drums and their interiors

being connected to the positive pole of a battery or dynamo, and the cathode plates connected to the negative pole of a battery or dynamo.

657,659. Secondary Battery. Augustus Jamieson, Elizabeth, N. J., assignor of three-fifths to Sydney H. Carney, Henry E. Knox and William Watt, New York, N. Y. Application filed November 18, 1897.

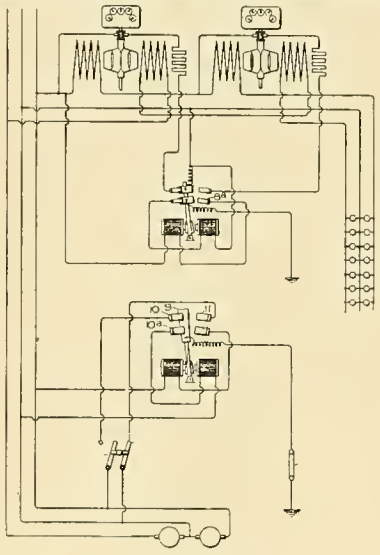
The process of producing electrodes for electric accumulators is described. It consists in applying a plastic mixture consistiog of lead carbonate and water only to a supporting plate then drying, and with a suitable electrode treating the same, as a cathode by an electric current in a solution of carbonate of soda, whereby the carbonic acid is eliminated and a spongy but non-disintegrating metallic lead is produced ready for use without compressing.

657,662. Controlling Means for Explosive Engines. Frederick A. La Roche, New York, N. Y. Application filed March 14, 1900.

In an electric controlling and starting device for gas engines combined with suitable igniting circuits, a storage battery charged by the engine and means for applying the power thereof to the engine shaft, are a three-directional controlling lever and connections whereby upon a movement thereof in one direction power is accumulated for starting the engine, by movement in another direction the ignition circuits are thrown in, and upon movement in an opposite direction to the first movement the power accumulated in the storage battery will be applied to the engine shaft for starting.

657,672. Protective Device Against Burglary. August Petternel, Siebenhirten, Austria-Hungary. Application filed November 7, 1899.

The device has an electric alarm circuit, plates or frames for covering the space to be protected and provided with two separate and independent sets of grooves, the air contained in one set differing in deosity from that contained in the other set and also from the outer air, a U-shaped mercury tube, terminals of the alarm circuit extending into the arms of the mercury tube, each set of grooves communicating with an arm of the tube, the mercury level of which when the grooves are broken into will change and close the alarm circuit and actuate the alarm.



NO. 657,829.

657,678. Secondary Electric Clock. George P. Rose, Jr., Dubuque, Iowa, assignor to Barnim L. Behrendt, New York, N. Y. Application filed October 30, 1899.

The device described consists of a minute wheel, a pawl in engagement with the wheel, a lever for operating the pawl, means for operating the lever, a second pawl with spring acting thereon to engage with the minute wheel, an armature, a pin attached to the armature and engaging the second pawl to hold the pawl out of engagement with the minute wheel, when the electric current is off.

657,694. Electric Clock. George Fichter, Lynn, Mass. Application filed January 10, 1900.

The clock comprises an oscillating shaft and balance wheel, a hairspring, an arm carried by the shaft, a swinging pendant suspended thereon, two springs having ends which are supported adjacent to each other but out of contact and which are insulated from each other, a battery which is connected to the springs, an electromagnet in its circuit, a flat surface adjacent to the end of one of the springs and arranged in the path of the pendant, the parts being arranged so that the pendant may be drawn over the ends of the springs in turn, and will simultaneously engage the ends, when the oscillations of the balance wheel become too short and complete the circuit, and means actuated by the magnet for giving an impulse to the shaft.

657,703. Electrical Rheostat. Harry W. Leonard, New York, N. Y. Application filed February 11, 1899.

A motor-starting or equivalent rheostat is described. It is composed of a shallow box, one side of which is made wholly or partially of insulating material and carries the resistance and contact plates, the resistance being inside of the box arranged in steps connected with the contact plates and lying in a plane parallel to the top and bottom of the box, and embedded in a mineral insulating material, which insulates the sections of the resistance from each other and prevents overheating of the resistance by absorbing the heat developed therein.

657,722. Means for Controlling Excitation of Boosters or Generator Fields. Joseph Appleton, Philadelphia, Pa., assignor to the Electric Storage Battery company, Gloucester City, N. J. Application filed March 30, 1899.

Means for controlling the excitation of the field coil of a dynamo-electric machine or booster comprise a source of current other than the dynamo or booster, a pair of resistances connected across the source of current and means for connecting the terminals of the field coil to various points of the same, to vary both potential and polarity of the field.

657,730. Electric-railway Signal. George H. Dunham, Quincy, Mass., assignor of one-half to Elmer H. Heath, Boston, Mass. Application filed November 11, 1899.

The system is so constructed and arranged that a trolley wheel carried by a moving car will act upon the lower end of a lever and impel a sphere along a raceway into contact with the metal plates on the raceway to close the side circuit and light the signal lamp, and means to be operated by the trolley wheel at or near the second turnout for breaking the side circuit and extinguishing the signal lights.

657,732. Coupling for Electric Conduits. Edward S. Francis, Hartford, Conn. Application filed July 6, 1900.

A coupling for connection boxes combines a main section tubular in form and threaded on the inner surface at one end and having a removable section less in length than the coupling and partible on about the central plane lengthwise of the coupling, and means for securing the two sections together and clamping them upon the end of the conduit.

657,736. Electric Furnace. William S. Horry, Sault Ste. Marie, Mich., assignor to the Union Carbide company, Chicago, Ill. Application filed November 23, 1897.

An electric furnace constructed for the continuous delivery of carbide has pointed clamp screws mounted outside of the furnace and movable inward to nip off the finished product as it is delivered from the furnace and a movable furnace bottom constructed and arranged to support the weight of the contents of the furnace and of the product from underneath and to carry the product and present it between the points of the screws.

657,757. Electric Bond for Railway Rails. Harold P. Brown, Montclair, N. J. Application filed February 18, 1899.

Combined with adjacent rails is a bond plate arranged to overlap the meeting ends of the rails, the bond plate and the rails being provided, the one with electric conducting plugs fixed thereto and the other with bodies of plastic alloy in position to permanently engage the plugs.

657,760. Electric Igniter for Explosive Engines. Isaac H. Davis, Boston, Mass., assignor of one-half to E. D. Mellen, Cambridge, Mass. Application filed November 18, 1899.

The igniter combines an engine-revolved contact and a co-operating stationary contact, means to effect a relative concentric adjustment of the contacts to vary the occurrence of ignition with respect to the power stroke of the engine and means operated by the adjusting movement for throwing the contacts into and out of coacting relation.

657,782. Electric Elevator. John W. Mabbs, Chicago, Ill. Application filed July 26, 1897.

The elevator comprises a car, a hoisting cable therefor, guides in which the car operates, independent guides arranged to form a guideway, a frame arranged between the independent guides and engaged on opposite sides thereof with the guides, the frame connected to the hoisting cable and forming a counterweight for the car, a rack carried by each independent guide, a shaft arranged in suitable bearings in the frame and disposed transversely thereof, pinions carried at each end of the shaft and respectively arranged to engage the racks, and a motor carried by the frame for rotating the shaft, whereby the counterweight frame is caused to travel to raise or lower the car.

657,795. Electric Circuit-closer for Looms. Harry W. Smith and William H. Redding, Worcester, Mass. Application filed July 13, 1898.

The device combines a shuttle provided with an opening to receive the bobbin and a chamber or recess for a pair of contact surfaces, a pair of contact surfaces inclosed in the chamber, a bar extending into the bobbin opening and arranged to bear against the weft thread on the bobbin and connecting mechanism between the bar and the contact surfaces in the chamber, whereby they are brought into contact as the weft is removed from the bobbin.

657,804. Tip for Commutator Segments. Anton R. Westerdahl, New York, N. Y., assignor to the General Electric company of New York. Application filed May 31, 1900.

A commutator segment is composed of insulating material, with a metal tip secured thereto, comprising a rectangular block with a pin formed on the under side and integral therewith, which pin is employed for clamping the tip in place.

657,824. Conveying Apparatus. Robert T. Jenney, London, England. Application filed June 25, 1900.

The apparatus comprises an electric motor, a holder for each carrier of the apparatus, a contact plate in each holder which, when the carrier is placed in the holder, are separated, a circuit in which such contacts are situated, and means in such circuit for controlling the motor circuit so that it is opened or closed as the carriers are in or out of the holders.

657,828. System of Multiple-rate Metering. Eustace Oxley, Lynn, Mass., assignor to the General Electric company of New York. Application filed July 31, 1899.

The system comprises a supply circuit, current-consuming devices and a multirate metering device at the consumer's station, a control circuit extending to the station from a distant point, electromagnetic devices operated by the control circuit for changing the rate of meter registration and an electromagnetic device at the control station responsive to a change of the meter connections and adapted to restore them if changed independently of the control station.

657,829. Multirate Meter. Eustace Oxley, Lynn, Mass., assignor to the General Electric company of New York. Application filed August 7, 1899.

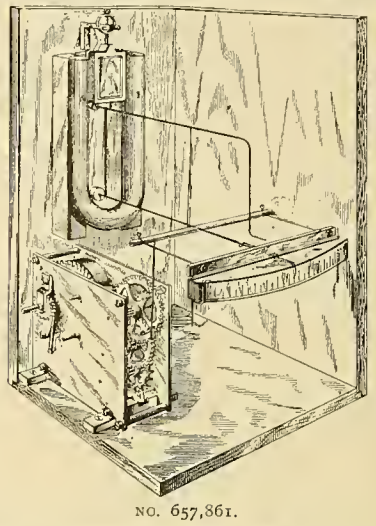
A multirate metering system is described which comprises a control circuit connecting the consumer's station and a control station, a magnetically controlled meter-rate-changing switch at the former, a magnetically controlled rate-maintaining switch at the latter, contacts for the control circuit governed by the several switches for rendering their movements conjoint on a change of the control circuit and circuit connections for effecting a restoration of the maintaining switch if disturbed by independent operation of the rate-changing switch. (See cut.)

657,830. Conductor and Collector for Electric Railways. Arthur Petzenbürger, Berlin, Germany. Application filed December 8, 1899.

The inventor describes a current collector comprising an angular support mounted to rock and to have longitudinal movement, the vertical member of the support being provided with a horizontally projecting pivot at its lower end, a contact shoe mounted on the pivot, and means passing through the support for operating the shoe.

657,853. Electric Lock. Henry G. Carleton, New York, N. Y., assignor to the Carleton Electric company, New York, N. Y. Application filed January 13, 1900.

The lock combines a movable engaging part, a withdrawing mechanism, a controller which moves with the withdrawing mechanism when the lock is to be opened, and electrically controlled means for giving the controller a movement independent of the movement which it has under the influence of the withdrawing mechanism to cause it to engage the movable part.



NO. 657,861.

657,854. Combined Telephone Signal and Jack. Oren R. Cline, Eldorado, Kan. Application filed February 6, 1900.

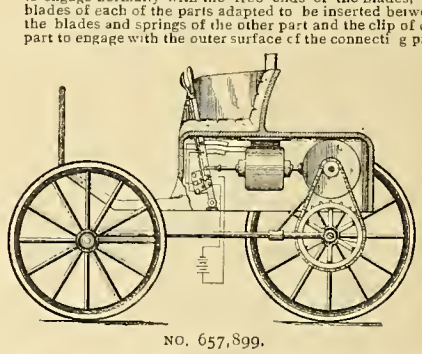
Combined with a switchboard having a jack socket and an inclined guideway leading to the socket are a rotatable indicator element in the guideway and adapted to roll therethrough into the jack socket, a latch for holding the indicator element normally retracted, electrical terminals, and a plug having its body formed to enter the socket and passage or guideway leading thereto, to move the indicator element into engagement with the latch and to engage a contact, the latch having electrically operated means for releasing it from the indicator element.

657,861. Electric Measuring and Indicating Apparatus. Horace Darwin, Ernest H. Griffiths and William C. D. Whetham, Cambridge, England. Application filed May 29, 1900.

The apparatus combines an electric circuit as used in a null method, a movable conductor connected between two points of the circuit, means whereby the conductor automatically alters its point of connection with the circuit until the balancing point is reached and means for making an intermittent contact between the circuit and the conductor and for arresting the motion of the conductor when such contact is broken. (See cut.)

657,887. Electric Train-signal Device. James F. Scullen, Chicago, Ill. Application filed January 26, 1900.

Comprised in the device are a train of individual parts, an equipment of parallel insulated wires for the train composed of individual sections corresponding with the individual parts, an electric connection at each terminal of the train-wire equipment, a separable coupling for each of the individual sections consisting of two similar parts, parallel blades in each part, each blade connected with one of the parallel wires, springs on the sides of each of the blades, an insulating material between the blades, a wrap of insulating material inclosing the blades and springs except the free ends which protrude, a spring-actuated clip on each of the parts of the coupling adapted to engage normally with the free ends of the blades, the blades of each of the parts adapted to be inserted between the blades and springs of the other part and the clip of one part to engage with the outer surface of the connecting part.



NO. 657,899.

657,892. Electrically Actuated Safety Device for Elevators. Nelson B. Keyser, Philadelphia, Pa., assignor to Marcus B. May, Winchester, Mass. Original application filed October 17, 1893. Divided and this application filed October 29, 1897.

The invention consists of a motor-controlling device, a door, and mechanism operable only when the car is opposite the door and the door is open, for actuating the device to automatically stop the travel of the car, the mechanism including a source of power, and also including door-controlled means for conveying power from the source to cause the actuation of the motor-controlling device.

657,899. Motor Vehicle. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed December 8, 1899.

In a system of propulsion for motor vehicles are combined an electric motor, a friction pulley having operative engagement with the armature of the motor and adapted to have longitudinal movement with relation to such motor, a shaft adapted to operate the driving wheels of the vehicle, a friction disk carried by the shaft, means for maintaining frictional engagement between the friction pulley and disk, an operating lever for imparting movement to the friction pulley, and a current controller for the electric motor carried by the lever. (See cut.)

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, SEPTEMBER 29, 1900. No. 13

Chicago Automobile Exhibition and Race Meet.

The International Automobile Exhibition and Race Meet given under the auspices of the Chicago Inter Ocean from September 18th to 25th was for the most part a success. The show and races were held at the grounds of the Washington Park Club, and the managers were favored with good weather on all the days except the 19th and 24th, when it rained considerably. The attendance each day varied between 1,000 and 4,000. The races were begun on Tuesday and continued on all the other days, except Wednesday and Sunday. On the first two or three days the different events were not "pulled off" with remarkable celerity or frequency, but the last few days were marked by many lively and exciting contests. The most interesting events narrowed down to contests between a very few contestants.

Alexander Winton, in his four-wheeled gasoline racer, was one of the most prominent figures on the track, and it is said that his 50-mile record on Saturday of one hour 17 minutes and 50 seconds stands without a parallel for four-wheeled vehicles. Better time, however, for 50 miles was made by Albert Champion of France on a gasoline motor tricycle. Mr. Champion covered the distance in one hour 15 minutes and 57⅖ seconds. Other prominent racers on machines similar to Champion's were Kennett A. Skinner and C. S. Wridgway. Messrs. Champion, Skinner and Wridgway gave several spirited and close contests. Probably the most daring and skillful operator seen about the track was T. E. Griffin, who handled a racer of the locomobile (steam) type with great skill. His exhibition mile race against time, in which he covered the mile in the fast time of one minute and six seconds, is claimed to be the fastest time for that distance ever made by a four-wheeled vehicle, excepting only railway trains. Although generally credited with no exceptional speed, the electric vehicle showed up remarkably well at the meet. A light runabout, built by the Hewitt-Lindstrom Motor company, made a mile in 2:34, under the guidance of Charles A. Lindstrom, and this company's vehicles also figured prominently in several other contests. Mr. Lindstrom's 13-year-old daughter, Miss Jeanette, showed considerable skill in handling electric vehicles in several different races.

As far as the exhibition itself went, the expectations of the promoters were probably not fully realized. The vehicles were shown under the east end of the large grand stand, the different manufacturers occupying space according to their requirements. There were less than a hundred vehicles shown for exhibition purposes solely. Three of the largest exhibitors showed electric vehicles, the total number of electric machines exhibited being 34. There were 23 gasoline and 35 steam vehicles on exhibition. The different types of gearing, engine construction, etc., were subjects of careful examination by many people. One noticeable feature of the exhibition that was conspicuous by its absence was the large pneumatic tire. None of these large tires were to be seen. The majority of the vehicles were equipped with solid-rubber tires, although a few were provided with pneumatic tires of small diameter.

Some of the most interesting events from the viewpoint of the general public were afforded by John Worth with a gasoline delivery wagon of the Chicago Motor Vehicle company's manufacture. The wagon was run up a specially constructed see-saw arrangement or "teeter" in front of the grand stand, and the operator exhibited perfect control of the vehicle by balancing it over the center of the teeter and by teetering it back and forth. The operator also gave an exhibition of running over an obstacle with one rear wheel. The fine control he had over the mechanism of the vehicle was demonstrated by letting the wheel roll slowly off of an obstacle until it just cracked an egg, and then running the wheel back over the obstacle. An illustration on the next page shows the wagon mounting the teeter platform.

CHICAGO AUTOMOBILE EXHIBITION.—GASOLINE VEHICLE ON 35 PER CENT. GRADE.

Another exhibition given with the same vehicle was that of mounting the successive sections of an incline increasing in grade from 10 to 40 per cent. The above picture shows the wagon stopped on the 35 per cent. grade.

One of the most practical results of the automobile show will be the compilation and publication of the data collected from the scientific tests. A testing platform, shown in the larger illustration on page 196, was built under the west end of the grand stand. The vehicles to be tested were run up the incline backward on to the platform. The rear or driving wheels rested on split-wood pulleys which were mounted on a shaft beneath. A pulley on one end of this shaft, shown at the left of the picture, was belted to a five-horsepower Wagner motor, a suitable sliding-wire resistance being connected in the motor circuit to vary the speed. A complete test of the vehicles was made. The brake horsepower, the draw-bar pull, efficiency of batteries, friction of gearing, etc., were some of the points determined. The draw-bar pull was measured by means of a lever arrangement bearing on a platform scales. During the tests of an electric vehicle some of the points noted were the revolutions of the brake pulley, revolutions of the driving wheels, draw-bar pull, voltage and amount of current consumed. Standard Weston instruments were used for the electrical measurements. The committee in charge of the tests comprised Leland L. Summers, Cleveland; Professor John E. Sweet, Syracuse, N. Y.; Professor Henry Crew, Northwestern University; H. M. Brinckerhoff, general manager Metropolitan West Side Elevated Railroad company; Professor P. M. Chamberlain, Lewis Institute; Professor C. V. Kerr, Armour Institute, and R. H. Pierce. The data will be tabulated and published.

The start for the race between Miss Jeanette Lindstrom and Miss M. A. Ryan in electric vehicles is shown in the illustration at the left.

CHICAGO AUTOMOBILE EXHIBITION AND RACE MEET.—MISS RYAN AND MISS LINDSTROM AWAITING THE WORD IN ELECTRIC-VEHICLE RACE.

Summaries of Races.

The summaries of the different events as run off are as follows:

Tuesday, September 18th.

Event No. 1—Grand automobile parade for manufacturers. First prize, gold medal, for greatest number of practical designs; second prize, gold medal, for greatest number of automobiles in line; third prize, gold medal, for most practical design. Hewitt-Lindstrom Motor company, first and second prizes; Woods Motor Vehicle company, third prize.

Event No. 2 One-mile race, flying start, free for all,

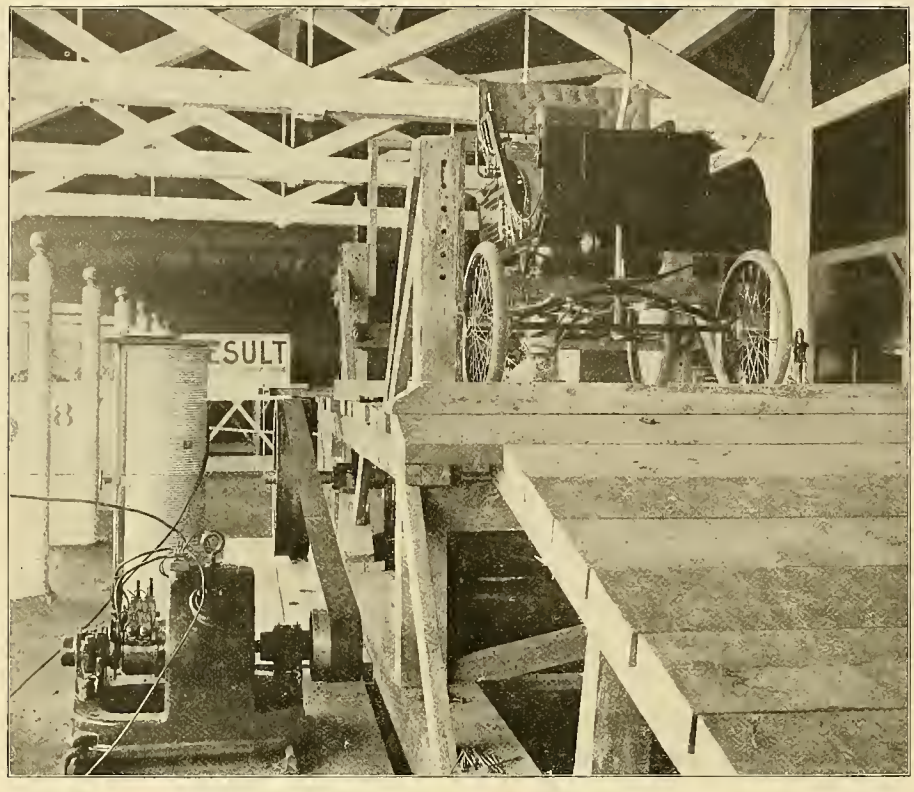
for steam automobile. First prize, gold medal; second prize, silver medal. T. E. Griffin, first; H. C. Eisselstyn, second. Time, 1:39.

Event No. 3—One-mile race, flying start, free for all, for gasoline automobile. First prize, gold medal; second prize, silver medal. Arthur J. Eddy, walk-over. Time, 2:09.

Event No. 4—One-mile race, flying start, free for all, for electric automobile. First prize, gold medal; second prize, silver medal. Charles A. Lindstrom, walk-over. Time, 2:34.

Event No. 5—Obstacle race. Prize of gold medal for greatest dexterity in passing through obstacles. T. E. Griffin, first.

Event No. 6—Grand automobile parade for private owners. Gold medal prize for most elegant turnout; gold medal prize for carriage carrying greatest number of



CHICAGO AUTOMOBILE EXHIBITION.—PLATFORM FOR TESTING.

seated passengers. J. Wesley Allison, first; Charles A. Lindstrom, second, carrying twenty-two persons.

Event No. 7—Ten-mile race, free for all. First prize, gold medal, to winner; second prize, silver medal, to most dexterous operator; third prize, gold medal, to best-appearing vehicle. Alexander Winton, first; Kennett A. Skinner, second; Arthur J. Eddy, third. Time, 16:00 2-5; best mile, 1:08.

Event No. 8—Five-mile race for motor tricycles. First prize, $150; second prize, $50. Kennett A Skinner, first; Albert Champion, second. Time, 7:33½; best mile, 1:06.

Exhibition mile by T. E. Griffin in locomobile in 1:05.

Thursday, September 20th.

Event No. 1—Mail race (five miles). First prize, gold medal to manufacturer of mail wagon for best time in finishing and making twenty mailbox collections; second prize, $25 in gold, to driver of prize-winning wagon; third prize, gold medal for most practical and best adapted wagon. Siegel, Cooper & Co., first.

Event No. 2—Exhibition on teeter board by John Worth with a delivery wagon of the Chicago Motor Vehicle company's manufacture.

Event No. 3—One-mile race, flying start, free for all, of steam locomobiles (private owners). First prize, gold medal; second prize, silver medal. Dr. L. D. Shepard, first; H. C. Eisselstyn, second. Time, 2:55.

Event No. 4—Exhibition of grade climbing by John Worth with Chicago Motor Vehicle company's delivery wagon. Wagon was driven up to 35 per cent grade.

Event No. 5—Fifteen-mile race, flying start between motor tricycles. First prize, $150; second prize, $50. Albert Champion, France, first; Kennett A. Skinner, second. Time, 24:47 3-5.

Friday, September 21st

Demonstration of perfect control of automobile on seesaw or teeter.

Event No. 1—Ten-mile road race for vehicles carrying four people. Silver cup won by T. E. Griffin in a walk-over.

Event No. 2—Five-mile road race for vehicles carrying two people. Silver medal. Milwaukee automobile made first four miles in 2:52½, 2:34¼, 2:00 2-5 and 2:31 3-5. Locomobile made last mile in 2:37 3-5 and won race in 11:38 1-5.

Event No. 3—Two-mile ladies' race for silver medal. Won by Miss Jeannette Lindstrom in a Hewitt-Lindstrom runabout. Miss M. A. Ryan, in Woods stanhope, second. Time, first mile, 3:32½; second mile, 3:39½; total, 7:12.

Event No. 4—One-mile novelty race, vehicles running backward. First prize, silver cup; second prize, silver medal. Two entries, T. E. Griffin and H. C. Eisselstyn. On first trial Griffin ran into fence and Eisselstyn won in 4:16. Race run over, Griffin winning in 2:56 3-5.

Event No. 5—Handicap race for silver cup for high-speed four-wheel vehicles, between Alexander Winton and Arthur J. Eddy, Winton to go twenty miles to Eddy's sixteen. Winton's twenty miles: 2:01½, 1:37, 1:36 1-5, 1:37½, 1:38½, 1:35½, 1:34, 1:34¼, 1:35¾, 1:36, 1:36¾, 1:36, 1:35, 1:36, 1:35, 1:30½, 1:38, 1:33½, 1:36 1-5, 1:38. Winton made the twenty miles while Eddy went thirteen. Time for Winton's twenty miles, 30:31¼.

Event No. 6—Twenty-mile race between Winton, Champion and Skinner. First prize, $150; second prize, $50. Winton declined and as a substitute Skinner and Champion raced, giving C. G. Wridgway handicap of one mile. Wridgway won in 15:19 1-5; Skinner, second, 15:48 3-5; Champion, third, 15:55. Motor tricycles used.

Event No. 7—Exhibition mile by Champion on motor bicycle. Time, 1:31 4-5.

Event No. 8—Grand five-mile free-for-all race, especially arranged for members of the Chicago Automobile Club. Standard vehicles as used by the club members only ad

mitted. First prize, gold medal; second prize, silver medal. J. W. Bate (steam) won in 14:32 1-5; Charles A. Lindstrom (electric), second, in 14:35 2-5; Charles T. Jeffery (gasoline), third; Arthur J. Eddy (gasoline), fourth.

Saturday, September 22d.

Event No. 1—Grand sweepstakes event for Inter Ocean challenge cup. Fifty miles. Alexander Winton, four-wheel gasoline—5 miles, 8:44; 10, 16:09; 15, 23:52; 20, 31:35; 25, 39:25; 30, 47:12; 35, 54:49; 40, 1:02:25; 45, 1:10:36; 50, 1:17:50. Fastest miles were made in the thirty-sixth and fortieth, in 1:30; average, 1:33 2-5. In one hour covered 38 miles, 3½ furlongs.

Judges later opened race to Albert Champion and Kennett A. Skinner on motor tricycles. Champion—5 miles, 7:31; 10, 14:54 2-5; 15, 22:27 1-5; 20, 30:04 3-5; 25, 37:40 4-5; 30, 45:04 3-5; 35, 52:28 4-5; 40, 59:53 2-5; 45, 1:08:11 3-5; 50, 1:15:57 2-5. Fastest mile, second, 1:20 1-5. In one hour covered 40 miles, 3-5 furlong.

Event No. 2—Ten-mile race for steam vehicles, manufacturers; first prize, silver cup; second prize, silver medal; first, Locomobile, Griffin driving; Milwaukee, Dousman driving, dropped out at eighth mile. Time, 21:13.

Event No. 3—Ten-mile race for gasoline vehicles. Winton, in racing machine, 16:17 3-5; Champion, on tricycle, 14:21 1-5; Skinner, on tricycle, 14:21 2-5.

Event No. 4—Five-mile juvenile race for electric vehicles. First prize, silver cup; second prize, silver medal. Hewitt-Lindstrom only entry. To furnish race, placed Master W. S. Millen (fifteen years old) on two-seated brake and Miss Lindstrom (thirteen years old) on runabout, giving Master Millen half-mile handicap. Miss Lindstrom made five miles in 15:50 4-5; Millen, four miles, in 17:22 4-5.

Event No. 5—Five-mile combination race to winner of above manufacturers' races. Electric did not compete. First prize, gold medal to Champion in 7:36. Griffin dropped out.

Special race, one mile (club men's race), in electric stanhope, between Bruce Clark and Alfred T. Leopold. Leopold won in 3:22 1-5.

Special two-mile race in electric vehicles between Miss Lindstrom and Miss Ryan, for silver medal. Miss Ryan won in 6:43 2-5; Miss Lindstrom, close second.

Monday, September 24th.

Event No. 1—Grade-climbing contest. Prizes, gold and silver medals. First prize to Chicago Motor Vehicle company. First trial, from position 50 feet from base of incline; machine, commercial delivery wagon. Ascended to 37 per cent. point of grade. Second trial, vehicle ascended to top of incline, completing entire 42 per cent. grade. Second prize to St. Louis Motor Carriage company, making 35 per cent. on fixed position, and 36 per cent. on second trial.

Event No. 4—Pioneer contest. Prize, gold medal for oldest automobile entered. Won by Columbia Perambulator company, only exhibitor.

Event No. 5—Fancy and trick driving contest. Open to all types of motor vehicles. First prize, gold medal for most difficult tests and practical demonstrations; second prize, silver medal. First prize won by Chicago Motor Vehicle company; second prize, St. Louis Motor Carriage company.

Event No. 6—Two-mile merchant delivery race. Won by Hewitt-Lindstrom Motor company in walk-over.

Tuesday, September 25th.

Event No. 1—T. E. Griffin, in one-mile race against world's track record for automobiles. Prize, silver cup. First mile, 1:34; second attempt, 1:31 3-5.

Event No. 2—Five-mile ladies' race, free for all. Prize, silver medal. Won by Miss Jeannette Lindstrom, with Hewitt-Lindstrom Motor company road wagon. Time, 12:41 3-5.

Event No. 3—Challenge grade-climbing contest for gold medal. Won by Chicago Motor Vehicle company. No other contestant.

Event No. 4—Three-mile race for motor vehicles carrying four people. Won by Chicago Motor Vehicle company. Time, 10:31. St. Louis Motor Carriage company vehicle entered, but disqualified because rig was not according to specifications.

Extra—Five miles for motor tricycles; $100 to winner. Won by Albert Champion.

Event No. 5—Ten-mile race for private automobiles seating two people; first prize, gold medal; second prize, silver medal. F. W. Brinckerhoff, first; Charles T. Jeffery, second. Time, 30:55 2-5.

Event No. 6—Ten-mile ladies' race; prize, gold medal. Not filled.

Special rough-riding contest, to include running over timbers and four-feet-high piles of logs and lumber; prize, $150 in gold. Won by Chicago Motor Vehicle company. No other contestant.

Event No. 9—Five-mile race for motor tricycles; $100 to winner. Won by Albert Champion. Time, 6:49 1-5.

Extra—Exhibition trial for best time of American and world's record; prize, gold medal. Time, 1:19 1-5. Won by Albert Champion.

Special—A gold medal was awarded to C. G. Wridgway, the English champion, for long-distance trip on motor vehicle, the trip being from Albany, N. Y., to Toledo, Ohio.

EXHIBITS AND EXHIBITORS.

A sample of transmission gearing was exhibited by the Empire Motor Works of Buffalo, N. Y.

The Baldwin Cycle Chain company, Worcester, Mass., was on hand with a line of its detachable chains, suitable for automobile use.

The Avery acetylene searchlight, especially constructed for automobile uses, was exhibited by its manufacturer, the Carse Brothers company of Chicago.

The Jesse O. Wells company of Des Moines, Iowa, represented by Jesse O. Wells and Webster Bishop, exhibited the Wells patent folding top for buggies and automobiles.

The Baker ball bearings were shown by the United States Ball Bearing company, in the person of K. Franklin Peterson, western sales representative for the company.

C. M. Giddings and R. C. Stevens of Giddings & Stevens, Rockford, Ill., did not exhibit, but were both in attendance to advance their new two-cylinder, two-cycle gasoline engine for automobile uses.

Strong & Rogers of Cleveland showed a single electric vehicle of the stanhope pattern. It was beautifully finished and trimmed and was believed by some to be the handsomest vehicle on the grounds.

Canda Brothers, western agents for the Canda Manufacturing company of Carteret, N. Y., exhibited a gasoline "auto-quadricycle," which has a bicycle seat for the driver and a comfortable seat in front for one passenger.

William P. Miller's Sons of Chicago showed their line of lubricants, especially prepared for automobiles, and in the same space the Nelson Automobile Motor company of Chicago exhibited designs of its new automobile motor and gearing.

The Buffalo Gasoline Motor company of Buffalo, N. Y., manufacturer of motors for vehicles, boats and stationary purposes, had on exhibition a six-horsepower, four-cylinder, upright, non-vibrating gasoline motor, which attracted considerable attention.

The Consolidated Rubber Tire company of Chicago showed its well-known Kelly Springfield solid-rubber tires, with electrically welded retaining wires. It also exhibited roller bearings manufactured by the Grant Manufacturing company of Springfield, Ohio.

An interesting exhibit was that of three old vehicles shown by the Columbia Perambulator company. One of these had a placard stating that it was the first vehicle used in Chicago and that it dated prior to 1890. The vehicles were all equipped with electric motors, but the batteries had long since been removed.

The Milwaukee Automobile company exhibited two steam runabouts and a separate engine. This company sells automobile parts, as well as complete vehicles, and it showed an automobile gear, a seamless steam or air tank and other parts. The exhibit was in charge of J. H Dousman, secretary of the company, and Frank P. Illsley, the Chicago agent.

CHICAGO AUTOMOBILE EXHIBITION —GASOLINE DELIVERY WAGON ON "TEETER."

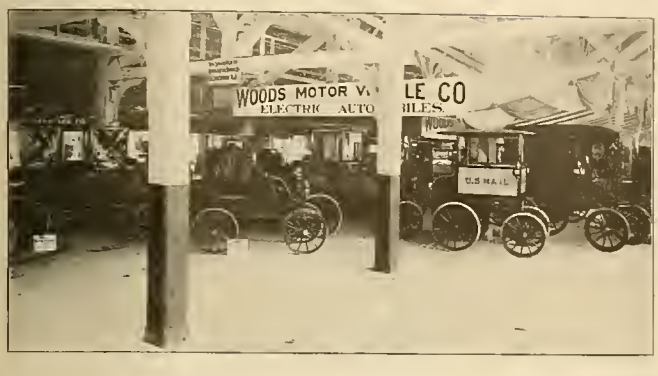
The Mobile company of America, with headquarters at Tarrytown, N. Y., exhibited a victoria, two buggy-top carriages, a Westchester model runabout and nine other runabouts. These vehicles were all of the steam-propelled type. Randolph Walker was in charge of the exhibit, and J. H. McDuffy and L. C. Soule of the company were also in attendance.

The St. Louis Motor Carriage company of St. Louis showed two gasoline vehicles that had been driven over Illinois from St. Louis to Chicago. One vehicle was a spindle-seat road wagon and

the other a stanhope. The representatives of the company, John L. French and H. Edgar French, were kept busy taking visitors for short rides in their vehicles.

Secretary V. G. Apple of the Dayton Electrical Manufacturing company, Dayton, Ohio, was much in evidence, explaining the merits of the Apple gas-engine igniters. A jump-spark outfit was exhibited with an automatic igniting dynamo equipped with a spark coil in its base. Mr. Apple stated that he had taken orders for his outfit from all but one of the gasoline-machine concerns represented at the exhibition.

The Ohio Automobile company of Warren, Ohio, the gasoline-vehicle end of the New York and Ohio company, had on exhibition two of its Packard runabouts, which are adjustable for one or two seats. George L. Weiss had charge of the exhibit and was assisted by William S. Ions and F. Hofste. Mr. Packard and Burt Hatsher, the inventors and designers of the vehicle, were also in attendance.



Woods Motor Vehicle Company.

American Bicycle Company.

EXHIBITS AT THE CHICAGO AUTOMOBILE EXHIBITION.

Always popular at whatever convention he attends, William Hood, general sales agent of the Helios-Upton company, made many friends at the automobile exhibition. His company showed two sets of storage batteries, one of 36 cells, suitable for a runabout, and one of 40 cells, for heavier vehicles. R. C. Gregg, western manager, Thomas Spencer, general superintendent, and King Upton, managing director of the company, were also in attendance.

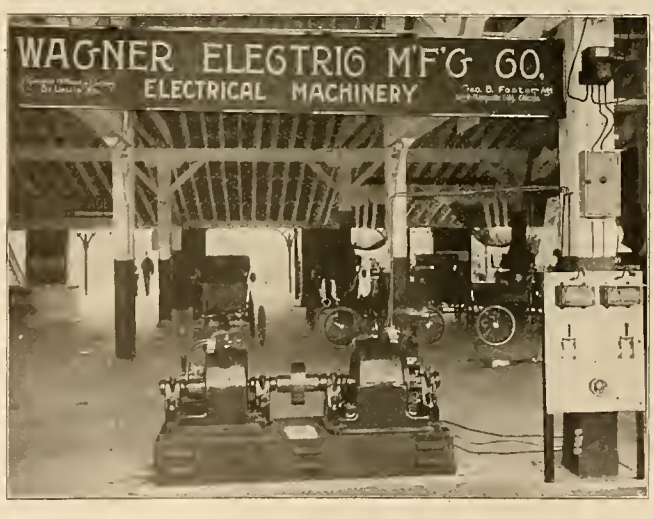
The Eastman Automobile company of Cleveland, Ohio, exhibited a complete steam vehicle and three pressed-steel bodies for runabout styles. The company makes a specialty of its sheet-steel bodies with asbestos lining, which are insulated and incombustible. E. E. Foote, in charge of the exhibit, reported having taken orders for 400 bodies during the week. H. F. Eastman, president, and H. J. Hayes, manager of the company, were in attendance.

called the "auto-sparker." The device consists of a small generator operated by a friction pulley, which bears on the flywheel of the engine. It is claimed to maintain constant speed and therefore regular sparking, regardless of the variations in the speed of the flywheel. It is adaptable for use with gasoline vehicles, and the device was shown as attached to a vehicle that had been run from St. Louis to Chicago for the exposition.

The Locomobile company of America, New York, exhibited four runabouts, one surrey, two stanhopes and two racing machines. These machines were all of the steam type. A. W. Robinson, superintendent of agencies, was in charge of the exhibit, and he was assisted by T. E. Griffin, assistant superintendent of the factory at Bridgeport, Conn., H. C. Eisselstyn and C. H. Tucker. Mr. Griffin early in the meet became a well-known figure upon the racetrack, and was successful in capturing several prizes. It was in one of the locomobile racers that he made a mile in one minute and six seconds on the first day of the meet, the fastest mile ever made by a four-wheeled vehicle, outside of a railway car.

The exhibit of the Chicago Motor Vehicle company, situated near the main entrance, comprised two brakes, a trap, a stanhope and two delivery wagons. This company's machines are all of the gasoline type and their chief selling point is the perfect control the driver has over the operation of the vehicles. This control is accomplished by means of a large friction wheel under the center of the vehicle. One of the delivery wagons was used in the teeter and grade-climbing exhibitions already referred to. The company was represented by President W. O. Worth, General Manager J. E. Keith, Treasurer and Superintendent H. W. Kellogg, Secretary W. R. Donaldson and J. A. Linville, who had charge of the exhibit.

The De Dion-Bonton Motorette company of Brooklyn, the sole agent and licensed manufacturer in the United States for De Dion-Bouton & Co., Puteaux, France, was represented by C. G. Wridgway, who had charge of the exhibit. The vehicles shown were a gasoline motorette with two seats, for either three or four people, and a gasoline tricycle. Both were French machines, as the American factory is not in operation yet. Mr. Wridgway was assisted by G. S. Gelston. The two gentlemen rode the motorette from Albany to Toledo, en route to Chicago, and covered about 1,600 miles in three weeks. The tricycle was ridden by Mr. Wridgway in his races. The racers, Albert Champion, who rode an Orient tricycle, and Kennett A. Skinner, who rode a De Dion tricycle, kept their vehicles in the De Dion-Bouton booth, where they were inspected by many interested persons.



EXHIBITS AT THE CHICAGO AUTOMOBILE EXHIBITION.

Among the concerns exhibiting at the automobile meet that are not mentioned elsewhere were the following-named exhibitors: Porter Battery company, Chicago; B. F. Sweet, Fond du Lac, Wis.; Friedman Automobile company, Chicago; Horseless Age, Chicago; W. C. Houston & Co., Chicago; Kokomo Rubber company, Kokomo, Ind.; The Automobile, New York; W. W. Rathbun, Chicago; Autobain, Chicago; Automobile Review, Chicago; Motor Vehicle Review, Cleveland; Motor Age, Chicago.

The Winton Motor Carriage company of Cleveland, Ohio, showed four vehicles, viz., phaeton, surrey, semi-racer and racer. The racer was the machine used by Alexander Winton in all of his races and with which he made his 50-mile record on Saturday afternoon. President Arthur J. Eddy of the Chicago Automobile Club used the semi-racer in his exhibitions. The Winton machines are of the single-cylinder gasoline type. The company was well represented by President Alexander Winton, Sales Manager C. B. Shanks, who had charge of the exhibit, C. C. Collins and A. D. Shanks.

President N. H. Motsinger and Secretary R. A. Morris of the Motsinger Device Manufacturing company, Pendleton, Ind., were present to extol the merits of their gas-engine sparking device, an interesting exhibit from the electric-vehicle owners' viewpoint was that made by the Wagner Electric Manufacturing company of St. Louis. It consisted of an automobile charging set. The motor end of the outfit was a 20-horsepower, alternating-current machine, operating on a 208-volt, 60-cycle circuit. The generator was capable of delivering 64 amperes at 125 volts. A gray marble switchboard was also shown, on which were mounted an ammeter, voltmeter, two switches and a rheostat. The alternating current was received from a General Electric type H, 15-kilowatt transformer. The primary of the transformer was connected to a 2,080-volt circuit, the secondary delivering current at 230 volts. George B. Foster, the popular Chicago representative of the Wagner company, was on hand to explain the merits of the charging outfit.

The Olds Motor Works of Detroit were represented by R. E. Olds, manager, and M. F. Loomis, who has charge of the electric-vehicle department of the works. The Olds firm has been in the gas-engine business for a number of years. It first produced a steam carriage in 1890, which was sold in India. Then the gasoline vehicle was taken up, and now the firm is devoting part of its attention to the building of electric vehicles. The only vehicle shown was an electric stanhope, which the firm is building to supply the demand for a high-

grade family carriage. All the gearing of the vehicle was enclosed. The booth of the Olds Works had a handsome entrance formed by Corinthian columns, studded with incandescent lamps.

By far the largest exhibit was that of the Woods Motor Vehicle company of Chicago. This company had 21 vehicles in its large booth, and the exhibit made a striking display. The vehicles shown were as follows: Hansom cab, extension brougham, landau, brake, stanhope, three top road wagons, two spindle-seat road wagons, stanhope with rumble, physician's coupé, two victorias, brougham cab, station wagon, small brougham, United States mail picking-up wagon, coach delivery wagon, and two delivery wagons, designed respectively for Marshall Field & Co. and the Pabst Brewing company of Milwaukee. The last-mentioned wagon was greatly admired for its handsome finish and artistic design. The whole collection was for exhibition purposes solely, and not intended for racing contests. The Woods company had two coachmen dressed in fashionable livery in constant attendance at its booth. Bruce Clark had charge of the exhibit, and he was ably assisted by J. Wesley Allison, president and general manager, G. H. Atkins, secretary and treasurer, Samuel Bofkin, general sales agent, and G. H. Petrie and R. B. Leffingwell, sales agents.

The booth of the American Bicycle company attracted many visitors. The main portion of the company's exhibit was taken up with electric vehicles shown by the Waverley factory. The line included a runabout, runabout with top, stanhope, brake, combination delivery vehicle, dos-a-dos, road wagon and road wagon with top. These vehicles, by their noiseless operation and handsome design, attracted much attention. J. S. Connell, sales manager of the Waverley factory, was in charge of the exhibition. Others in attendance were J. E. Bromley, second vice-president, T. T. Marcellus, third vice-president, W. L. Githens, head sales manager, G. A. Duncan of Minneapolis, John E. Roach of Louisville, the inevitable Fred Patee of Peoria, Ill., and Thomas H. B. Varney of San Francisco. The Cleveland factory exhibited a gasoline motor-tricycle, and the Crescent Works, represented by G. W. Hett, showed a gasoline "trimotor" automobile. The Gormully & Jeffery sales department showed a Rambler gasoline runabout and also had a machine on the track to demonstrate its starting and running qualities. Joseph F. Gunther, manager, and Charles T. Jeffery represented the Rambler machines.

Unusual interest was shown by visitors to the exhibit of the Hewitt-Lindstrom Motor company of Chicago, whose line of electric vehicles was very complete. The exhibit consisted of vehicles of the omnibus, delivery-wagon, brake, stanhope and runabout type, and, through courtesy of the management, many visitors enjoyed the pleasure of taking their first ride in an automobile. The handsome design and finish of the vehicles shown were freely commented upon, and courteous attendants were ever ready to explain to those interested the details of mechanical construction. Interest seemed to center in the runabout and omnibus. The former had won numerous prizes in open competition for vehicles of this type. The 'bus is designed for pleasure parties, depot work and use in public parks. It has a comfortable seating capacity for 20 grown persons, and during the show made daily trips over the grounds. Ten first and several second prizes were awarded to vehicles of the Hewitt-Lindstrom Motor company's make, and in the practical utility tests the company's motors, safety devices and style of construction showed a very high average percentage. Messrs. John Hewitt and Charles A. Lindstrom were in constant attendance at the show, ably assisted by the following-named gentlemen: F. E. Rich, John B. Conrad, H. Underwood, N. Vance and E. O'Connell.

Hutin-Leblanc Direct-connected Two-phase Alternator.

Among the most interesting of the large generating sets in the dynamo room allotted to the French section of the Paris Exposition is the direct-connected engine and alternator of 750 kilowatts constructed by the Joseph Farcot company, which has a large establishment near Paris. The designers of the system, Messrs. Hutin and Leblanc, have planned the present arrangement especially with a view of solving the problem of working alternators in parallel. They have chosen a simple condensing engine as presenting certain advantages over the other types. The consumption of steam per indicated horsepower at full load is about the same as for the compound types, they contend, with increased efficiency due to the smaller number of parts. Besides, the consumption of steam per indicated horsepower varies but little for a great variation of power developed; in consequence, the use of these engines is desirable for alternators of central stations, owing to the great variations of load. On the other hand, the governor acts with greater rapidity in this type of engine, as it acts upon the whole of the expansion.

The system of compensating winding adopted by Messrs. Hutin and Leblanc is said to have overcome the only objection to the use of such engines for parallel working. This has been demonstrated, it is thought, by the successful working of one of the large stations of Paris, operated on this system, with seven alternators of 600 kilowatts each, and by another station in the suburbs having four alternators of 350 kilowatts, besides a number of others. The generating set presents the peculiarity that both engine and dynamo have been built by the same firm.

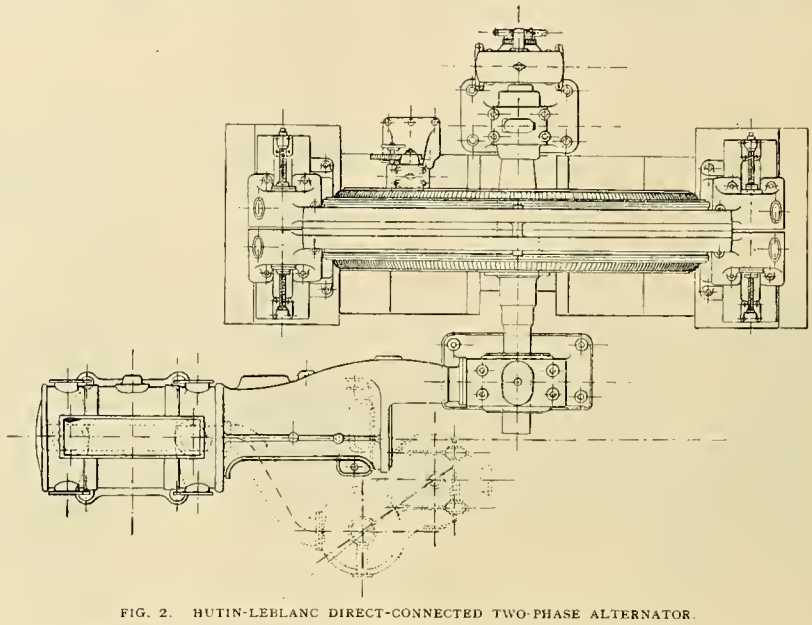


FIG. 2. HUTIN-LEBLANC DIRECT-CONNECTED TWO-PHASE ALTERNATOR.

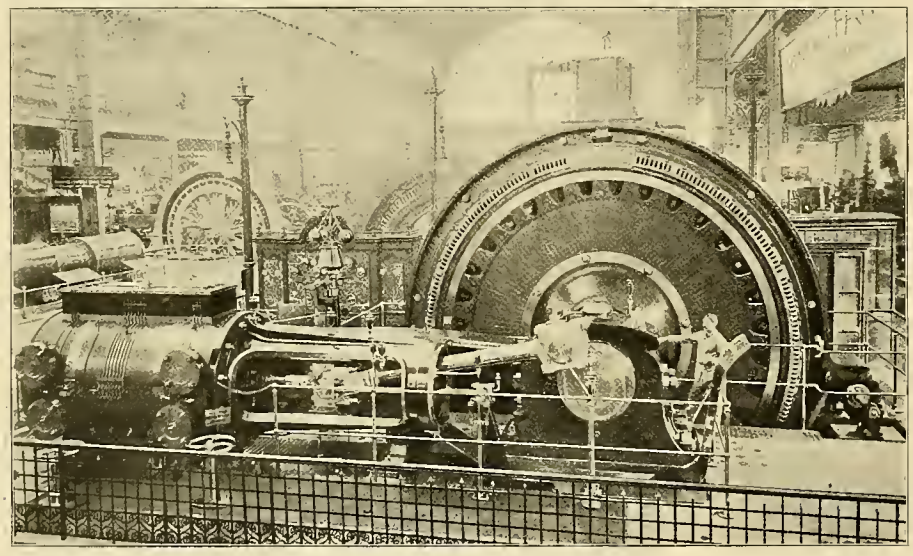


FIG. 1 HUTIN-LEBLANC DIRECT-CONNECTED TWO-PHASE ALTERNATOR.

The engine, shown in Fig. 1 and the plan view (Fig. 2), is non-condensing, of the standard type made by the company, and includes a number of improvements in detail which are the result of several years' study of this form of engine. The cylinder diameter is about 40 inches and the stroke 54 inches. It will give 900 horsepower (indicated) at one-tenth admission, or 1,300 horsepower at two-tenths. By using three-tenths admission it will give as high as 1,600 horsepower. The governor, shown in Fig. 1, has an adjustment which allows it to be regulated either for the putting in synchronism of its alternator with other machines on the circuit or for the regulation after this coupling has been made.

The alternator is of the two-phase type and gives normally 880 to 900 kilowatts at a voltage of 2,000. The current at full load is 200 amperes to each circuit. There are in all 64 poles, or 32 for each of the two exterior armature rings. This, with a speed of 78.5 revolutions per minute, gives a frequency of 42 cycles per second. The disposition of the armature, which is exterior and stationary, will be observed in Fig. 3. Two large rings of cast iron, seen also at the exterior of the alternator in Fig. 1, form the main body of the armature. These rings are placed side by side and carry a series of projections

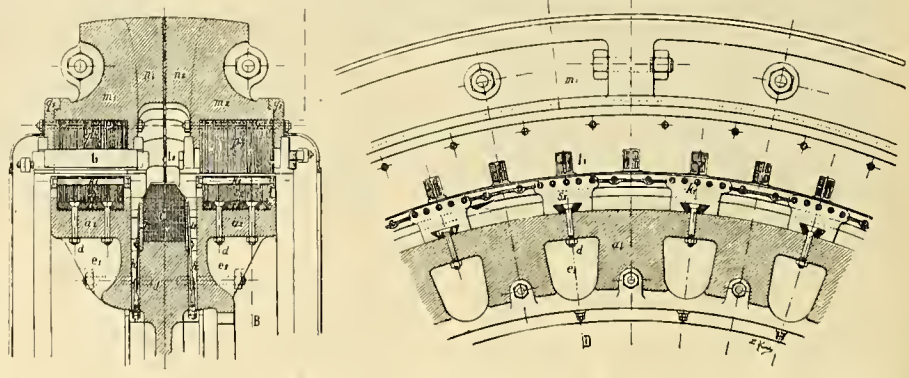


FIG 3 HUTIN LEBLANC DIRECT CONNECTED TWO-PHASE ALTERNATOR,— DETAILS OF STATIONARY ARMATURE AND REVOLVING FIELD

(n_1) (n_2), Fig. 3, by which they almost touch in the center. There are 64 of these projections, corresponding to the number of armature coils. Each of the rings carries on the interior the laminated portion (p_1) (p_2), which is built up of iron plate; this is held in place by the end plates (q_1) (q_2). The

winding (I_1) passes in slots in the armature. Each of the two armatures is wound for simple alternating current, with 64 coils of 10 turns each. The coils are divided into two series of five turns each, and superposed, being placed in 64 slots. The insulation is made of micanite tubes. The two coils in each slot are separated by a triangular strip of paraffined wood. The coils are wound with copper bands 0.14 inch by 0.15 inch in section. The resistance of each of the armatures is 0.113 ohm, measured hot. The armature coils are connected at the exterior by strips bolted together, the joints being protected by ebonite boxes. The winding is protected by a circular bronze end plate, with openings, which is bolted to the main ring.

The two halves of the stationary armature may be moved laterally and thus made to uncover the revolving field. The projecting base of the armature ring slides upon its support, being moved by a screw. The polar projections are not in actual contact, but about one-eighth-inch space is left between them, to avoid the effects of residual magnetism, which would make them difficult to separate. The exterior diameter of the armature is 234 inches and the interior 220 inches. The width of active iron in each ring is 12 inches and the total width of the armature, not counting the bronze

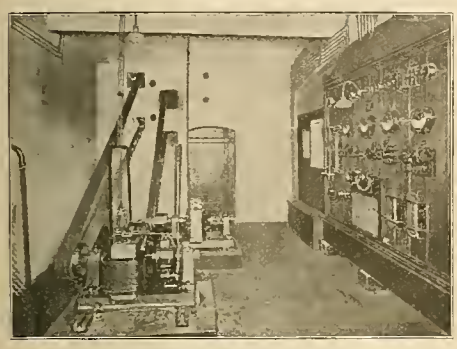


FIG. 1. ELECTRICITY IN AGRICULTURE —GENERATING PLANT.

end plates, is three feet. The total weight of the fixed portion reaches 132,000 pounds.

The revolving field is composed of a central portion (j), forming the rim of the flywheel proper, and two cast-iron rings, which are bolted to each side. Each of these is made in four pieces. The rings carry the laminated portions (s_1) (s_2), forming the field projections; they are held on by bolts (d), which pass into the keys (c) (c), previously wedged into the mass. The pole-pieces are enlarged at the ends and carry circular grooves, slightly open, in which is placed a series of copper bars, which forms the compensating winding. The field is excited by a single coil, which passes around the periphery of the flywheel, between the laminated portions. This coil, seen in section at (i), is held on by the straps (h) to the main body, between the rings (l_1) (l_2); the latter are provided with wings, which serve to increase the ventilation. This is also assured by the fact that the openings between the external armature projections have a considerable width, allowing a good circulation of air. The field winding has 460 turns of wire 0.3 inch in diameter; its resistance is 3.5 ohms and the exciting current at full load is about 50 amperes. The air gap is 0.26 inch and the diameter of the field, 214.5 inches. The total weight of the revolving field, without the shaft, is 110,000 pounds, of which the winding represents 6,600 pounds.

An original feature of this machine is the arrangement for compensating for the armature reaction. This is carried out by an auxiliary winding composed of the copper bars previously mentioned; these have a circular section and pass through the slots on the ends of the pole-pieces, being joined at their extremities by copper segments. Each pole-piece carries five bars and there are, besides, two similar bars riveted to the segments in the spaces between the poles. This disposition will be seen at the right in Fig. 3. Messrs. Hutin and Leblanc, who have been among the foremost of the European engineers in the study of alternators and rotary converters, give the following explanation of the system adopted in this machine. The dynamo, although two-phase, has but one winding upon each armature. This arrangement has been adopted in order to obtain the full effect of the compensating winding. The latter is used to diminish the armature reaction and also to keep the alternators in synchronism when worked in parallel. In polyphase machines having a polyphase winding on each armature the flux due to the armature currents is a constant flux, turning in space with the same speed and in the same direction as the field flux; it is thus fixed with relation to the compensating bars, and these have no action upon it. On the contrary, in armatures of single phase the flux is alternating and may, as the inventors have shown, be separated into two components, turning in opposite directions at a speed corresponding to synchronism. The first will remain fixed with relation to the field, without effect upon the compensating bars, but the second will be displaced with reference to the bars at double speed; it induces in the bars an electromotive force at a frequency double that of the alternator, whose currents give a number of ampere-turns equal and opposite to the ampere-turns of the second component. In fact, this component is practically annulled. The first component is, therefore, the only one left to be balanced by the field winding. The second advantage of the compensating winding is that it enables the coupling of alternators in parallel to be carried out easily. The compensating winding forms, in fact, the armature of a non-synchronous generator or motor. When the machines tend to fall out of phase, the compensating circuit gives a strong reaction, permitting the machines to fall in step. When a number of machines are working in parallel the regularity of the system is greatly increased by the compensating system on account of the powerful couples which it opposes to momentary changes of speed during each revolution.

The machine carries an exciter upon the outer extremity of the shaft. The exciter has a capacity of 60 amperes at 220 volts. This machine has six poles with series winding.

Electricity in Agriculture.

According to Paul Renaud, it is only a comparatively short time when animal power will be largely displaced on the farm by electrical energy. In a series of articles in l'Electricien, he has shown, partially from actual working apparatus, various applications of electrical energy in farm life. Mr. Renaud says, among other things, that he has calculated the comparative cost of electrical and animal energy (horses) for the transportation of 10,000 cubic meters of material over a road one kilometer in length, having a width of 50 centimeters, the grades in some cases rising as high as 10 per cent., with results showing an advantage in favor of electricity of 31 per cent. The details of these experiments are published in the Bulletin of the (French) Society of Encouragement.

The writer proposes a small station, as shown in Fig. 1, from which he would utilize power for nearly every variety of labor accomplished by animals. In one of his articles he illustrates a trainload of beets drawn by a trolley line (Fig. 2). This is from the sugar works of Goenendyck, Holland.

Among the illustrations given are many of considerable ingenuity as well as interest—threshing grain afield, transporting it to the barn, pressing and baling hay, grinding mills, etc. In Fig. 3 is shown a German exhibition of sheep-shearing by electric power.

The principal advantages of electric power in agriculture, according to Mr. Renaud, are:

First—Hydraulic or steam power pre-existing, ordinarily in use for distilling, sugar refining or starch manufacture, may thus be employed temporarily, as occasion requires, to drive the plow, actuate a centrifugal pump, etc., and thus materially reduce the interest on invested capital.

Second—The electrical apparatus may be placed in any convenient place without detriment to its usefulness, the power being readily carried to its destination, with minimum loss, by wire.

Third—Any motor may be readily moved from point to point to meet the local demands of the various agricultural machines.

Fourth—The current may be readily divided so as to permit the actuating of more than one motor at the same instant.

Fifth—Motive power, light and heat may be utilized from the same plant.

Sixth—Properly installed, such a plant would give

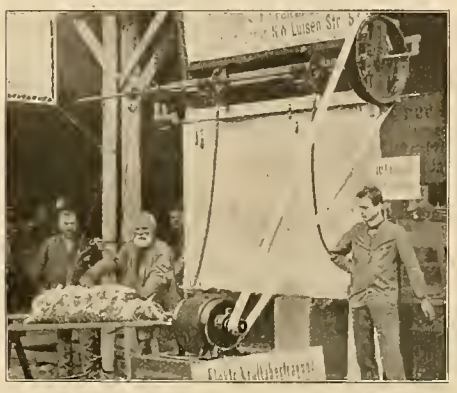


FIG 3. ELECTRICITY IN AGRICULTURE —SHEEP-SHEARING BY ELECTRIC POWER

almost absolute security against fire or danger to persons.

Seventh—The handling and care of such an installation could be readily learned, and would then be easy and simple.

Eighth—In case of conflagration it would form a better fire apparatus, properly arranged, than could be hoped for, except in towns of considerable importance.

Ninth—The removal of beasts of burden would inure to the health of communities; would relieve the fluctuating annoyances in the prices of food products, which sometimes result disastrously to the producer.

Mr. Renaud cites individual instances of the beneficial results which have resulted from experiments with electricity in deep plowing, among which are the products of the premises of Mr. Prat, an increase of 33 per cent.; at Grochoff, Prussia, of 25 per cent.; in Hungary, premises of the Archduke Albrecht, 35 per cent. in his barley crop.

Of course, it is to be remembered that these observations (pre-existing power, etc.) apply to European conditions. With a grounded return system it would be interesting, also, to note if the stray currents did or did not increase vegetation.

FIG 2. ELECTRICITY IN AGRICULTURE.—A TROLLEY TRAIN OF BEETS AT THE SUGAR FACTORY.

Bids will be received, until September 25th, by the Board of Trustees of the village of Neoga, Ill., for constructing an electric-light plant.

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CONVENTIONS AND EXPOSITIONS.

American Street Railway association, Kansas City, Mo., October 16th to 19th.
Automobile Show, New York, N. Y., November 10th to 24th.
Illinois State Electric association, Peoria, November 27th.

Forty-cent gas in a few competitive districts of Chicago has stirred up some of the aldermen to such an extent that a municipal gas plant is proposed, because "the reduction now in force shows that the prices heretofore charged were excessive." Philadelphia's experience with a municipal gas undertaking was so unfortunate that any other city should deliberate well before engaging in the business. In electric-lighting circles the most enlightened central-station men propose a uniform system of accounts, with books open to the public. In this way it can be determined whether the public is overcharged and whether better results could be obtained from a municipally managed plant. The gas industry ought to be willing to place itself in a similar position. With all elements of cost properly taken into account, the lighting interests should be satisfied with only a fair commercial profit in addition. If the people were once convinced that the lighting companies were not taking advantage of their public privileges to make an undue profit, the municipal-ownership agitation would cease.

The paper of Mr. Etienne de Fodor of Budapest on a "Proposed Method of Charging for Electric Current," read before the recent Electrical Congress at Paris, is more interesting than valuable to American central-station men, because it takes no account of motor load or the variation in load at different times in the day. The writer proposes a discount according to the season of the year, based on proportionate lamp-hour consumption; but in this country something more than that is needed. However, Mr. de Fodor's paper is of considerable interest; it is presented on another page.

Despite its manifest advantages and the fact that for years it has been legally recognized by the United States government, the metric system of weights and measures seems to make way but slowly in this country. Doubtless there is some progress, and a constantly increasing proportion of the people is familiar with the decimal system, but the process of assimilation is a very deliberate one. The subject is recalled by a recent statement of Consul Thackera of Havre, who, in calling attention to an opportunity for the introduction of American steel measuring tapes, caliper gauges and the like, says: "Of course, the scales must in every case be metrical, as no other system of measurement is used in France. In this respect, at least, the French lead the way; and it is to be hoped that America will not be long in following suit, as no one can dispute the fact that the metric system excels all others in simplicity and practical usefulness. Its general adoption by all countries is to be greatly desired by those who wish to foster and extend the commercial and industrial intercourse between the various nations." The truth of this is generally recognized, but the fact seems to avail little for the every-day employment of the improved system.

The situation in China again calls attention to the necessity of a transpacific cable. In fact, the need is such an obvious one that there can be no question that one or more cables across the Pacific will soon be laid. Japan, China, Australia and the Philippines are assuming such importance in the diplomacy and trade of the world that the circuitous methods of telegraphic communication now existing must be supplemented by other and more direct routes, not alone for the benefit of the United States, but also for Great Britain and other European countries. There are no insuperable engineering objections to a Pacific cable, and the twentieth century will not long be marred by the omission of such an important link in the world's telegraphs as a submarine line from Asia to North America would prove to be. Unquestionably it will be to the advantage of the United States to possess a Pacific cable, and that the first one. The subject has been before Congress several times, but none of the plans proposed has been carried out, owing to conflict between advocates of a private cable subsidized by the government and a straight-out government cable. It is to be hoped that at the coming session of Congress some definite arrangement will be made. Certainly if government ownership is ever justified it will be in this case.

Under President Cahoon's direction the National Electric Light association is making a vigorous effort to enlarge its membership and thus enhance its usefulness, both by the force of greater numbers and the possession of more funds. Lieutenant Cahoon points out that the work of the committee on the photometric value of arc lamps has been of a high order, and that to carry it to its logical conclusion will require increased resources. The association has taken an aggressive stand against municipal ownership and is daily helping companies, particularly small ones, in their fight for existence. Companies not members of the association do not hesitate to appeal to the National association for help when attacked, yet sometimes seem to think that the organization should go to the expense of collecting and preparing data for their use without expecting them to help foot the bills. The association has now in hand the preparation of a complete and uniform system of accounting; it is preparing to fight the present unjust freight classification of electrical apparatus, and is engaged in the collection of other data of interest and importance. The president calls the attention of central-station companies not members of the association to these facts and solicits their support in the practical form of applications for membership. The effort is a well-deserving one, and the Western Electrician hopes that it will meet with success.

In electrical and other forms of competition between Englishmen and Americans national characteristics are, of course, continually cropping out. Sober-minded men on both sides of the Atlantic ask themselves, temperately and judicially, "What manner of men are these, my brothers?" An answer to this question is found in a recently published book, the memorials of Charles Henry Pearson. Mr. Pearson was an Englishman of high character and keen intellect, a fellow of Oriel College at Oxford and later an Australian cabinet minister. He compares Englishmen and Americans in the following terms:

The American has less stiffness of manner, and, I think, more good nature. With respect to national character, I agree in an observation made to me by an Englishman who knew the States well, that the American's great advantage over the Englishman is his greater modesty. The Englishman is impatient of new inventions and new ideas, because he believes that nothing more can possibly be needed than is already to be found in England. The American, on the other hand, believes the society he lives in to be susceptible of improvement, and inclines to give everything a fair trial.

This seems to be a just characterization, and, coming from an Englishman, is particularly graceful. It is pleasant to have our progressiveness conceded by a foreigner; we know our faults ourselves.

If the refuse or garbage of a large city could be burned in a "destructor" in such a way that the heat could be economically applied to some useful industrial purpose, such as the generation of electricity for light and power, the result would be such a satisfactory killing of two birds with one stone that everyone would rejoice. But those who have had most experience with experimental plants of this character are of the opinion that the practicability of the plan is very dubious. At the recent session of the British Association in Bradford, England, Mr. J. McTaggart, the "cleansing superintendent" of that city, read a paper on "The Disposal of House Refuse in Bradford." This is, perhaps, the latest contribution of importance on the subject, although it must be borne in mind that the writer treats of the disposal of "ashpit refuse," and not of the miscellaneous kitchen refuse known in this country as garbage. The Bradford plant, or a part of it, has been in operation since 1880, and Mr. McTaggart's conclusion is that as an economical destructor of refuse it is a success, but that as a practical power-raising apparatus it is available only to a very limited extent. In the discussion of the paper this point was brought up. Answering a question, Mr. McTaggart said that the subject of generating electricity from refuse was one which had received the consideration of the cleansing committee of Bradford, but so far it had not yet seen its way to go any further into the matter than simply to light its own works and the limited area adjoining them. The calorific value of the refuse was found to vary so much from day to day that the committee hesitated to place itself in any position where it might be expected to deliver a certain amount of power which it would find it would be unable to do without using coal. In his opinion the committee should not try to have a duplicate plant at all. If it wished to have an electric-lighting works, let it have one, and thoroughly up to date; if it wanted a destructor, let it have it as a destructor, and make that thoroughly up to date, and let it utilize every atom of power in some other useful work.

These conclusions are the result of years of practical experience. Inasmuch as the mayor of Chicago has been directed by the City Council to appoint a committee of five aldermen to investigate the feasibility of utilizing heat from garbage crematories for the production of electricity, the experience of Bradford should be of some value to the municipal authorities of this city.

Old-time and Military Telegraphers.

[Special correspondence of the Western Electrician.]

St. Paul, Minn., September 21.—The annual meeting of the Old-time Telegraphers' association and of the Society of the United States Military Telegraph Corps, which closed in this city to-day, was one long to be remembered in the minds of those present. The attendance was fully as large as could be expected, and many members expressed themselves as being surprised at the large number present. While there was not a great amount of business to come before the two associations, and most of that which did come up was of a routine nature, those present expressed themselves as being well satisfied with the work accomplished. The social features of the meeting were numerous and afforded no small amount of pleasure to the visiting members.

The list of those present includes some of the most prominent men in the telegraphic affairs of the United States and Canada. All the larger cities in Canada were well represented, and nearly every city in the eastern part of the United States sent delegations or representatives. Aside from these, members were present from all over the country, and by their attention to matters before the association showed that they were fully alive to the benefit to be derived from such meetings.

One feature of the meeting which was particularly gratifying was the large number of women who were present. Nearly one-half the entire number were women, and they took a prominent part in the deliberations of the convention. Special preparations for their entertainment had been made by the committees in charge, and all comments expressed by them show that they were greatly pleased at the courtesies extended to them.

Owing to the cloudy and stormy weather which predominated on the days of the meeting, a few of the pleasure features of the programme were omitted, but the enjoyment thus lost was fully recompensed by the keen pleasure which was taken in those events which could be given without the consent of the Weather Bureau.

The meeting was held in Elks' Hall, St. Paul, and at the business session of the Old Timers, which was held on Tuesday morning, upward of 300 members were in their seats. When President H. C. Hope took the chair to open the meeting for business, he was heartily cheered. He expressed great pride in being called upon to preside at such a representative meeting of the association, and declared that he was extremely gratified at the outlook for a successful meeting, as depicted by the large number present. Mayor Smith of St. Paul was introduced to the meeting, and in his jolly, whole-souled manner, presented a large key, which he declared was the official key of the city of St. Paul. James D. Reid, the father of the association and one of the best-known of the veteran telegraphers, was called upon to receive the key by the members of the association, and as he thanked the mayor for the courtesy, he was warmly applauded. Senator C. K. Davis of Minnesota was then introduced to the convention, and in a few remarks told of his experience with the telegraph key when he was a young man. He related several incidents which had happened many years ago, when the art was in its infancy.

After the customary opening remarks, the regular order of business was taken up. Routine matters were disposed of and such new business as came before the meeting was discussed and acted upon. The election of officers resulted as follows: President, J. B. McFarland of the Bell Telephone company, Montreal; vice-president, J. E. Hutchinson, of the Ottawa Street Railway company, Ottawa; secretary and treasurer, John Brant, manager of the Western Union Telegraph company, New York. The committee having the nominations in charge was composed of W. C. Burton, New York; H. A. Tuttle, Minneapolis; G. H. Yetman, Boston; J. F. Petit, Chicago; Colonel J. Winthrop, Philadelphia. It was decided to hold the next regular meeting of the association at Montreal, Canada, on the third Tuesday in September.

At the close of the session invitations were received from several of the prominent St. Paul clubs, inviting the members to participate in the hospitalities of the club rooms. These invitations were quite generally accepted, and an effort put forth by the clubs to make the delegates feel at home. An invitation was also received by the members inviting them to take a trolley ride about the city on Tuesday afternoon. This invitation was also generally accepted, and a large number were on the cars in the afternoon and rode to various points of interest about the city. Fort Snelling was visited and the party was entertained at the buildings on the grounds. The members of the Military Telegraph Corps were greatly interested in the many new inventions which were seen about the fort and which were not a part of the equipment when they were in service.

One incident which was of more than ordinary interest to the Old Timers was the presentation, by Mr. Reid, of the medallion of Samuel F. B. Morse. This medallion was made from the inventor's picture at the age of 20 years, and is highly valued by the members of the association. It was turned over to the president for safe keeping, and will be given to each succeeding president of the association in order that it may not be lost or misplaced.

A business meeting of the Society of the United States Military Corps was also held on Tuesday. The annual address of the president, William B. Wilson, who was absent on account of a recent death in his family, was presented. The address recommended that a committee be appointed to confer with Senator Davis in regard to the introduction into Congress of a bill that will give to former military operators the recognition now awarded to other veterans of the Civil War. The committee appointed was as follows: Colonel Bliss, Chicago; Colonel Winthrop, Philadelphia; W. R. Plum, Chicago. The election of officers resulted in the re-election of Mr. Wilson and his associates.

Wednesday was "Minneapolis Day" with the delegates. Special interurban cars were chartered, and a ride to Minneapolis was first enjoyed. This was followed by a ride to several points of interest about the city, and at about noon the street cars drew up at the railroad station, where a special train was waiting to convey the party to Lake Minnetonka. The afternoon was spent on the lake and at the Ice Yacht clubhouse, where a luncheon had been prepared. After spending a short time at the clubhouse in the enjoyment of the luncheon and an informal hop, which followed, the party again took the train for Minneapolis.

Wednesday evening was spent at the Masonic Temple in Minneapolis, where a banquet had been prepared. Dancing was the order of the evening for the younger members, and those who were not desirous of entering into this form of amusement spent the evening in telling past experiences at the business ends of the wires.

Thursday morning again found the delegates on chartered cars. A ride was taken to various points in St. Paul and Minneapolis. Lake Harriet, Lake Como, Minnehaha, Mound Park and various other interesting points were visited. A carriage drive about the city of St. Paul was scheduled for the afternoon, but owing to the inclement weather this feature of the programme had to be omitted.

The banquet at the Hotel Ryan, in St. Paul, was the crowning feature of the meeting. Every preparation had been made for this event, and it was participated in by over 400 guests. Mr. Hope, the retiring president, introduced H. P. Hall, who acted as toastmaster. As Mr. Hall took his seat a ticker was heard, and as the last letter of "What Hath God Wrought?" was ticked, the banqueters broke into tumultuous applause. Governor Lind of Minnesota was introduced, and in a few well-worded remarks spoke of the art of telegraphy and its growth in the United States. James D. Reid was the next speaker, and, despite his four score of years and two, he held the attention of the entire assembly. He expressed his pleasure at the growth of the association, and although his remarks were mostly of a congratulatory vein, he said: "I take great interest in the proceedings here to-night, but, nevertheless, I am here somewhat in a different spirit than most of you. Most of you are young. All of you are good-looking. I am among you with a sort of feeling that it may probably be for the last time. I feel that it is a farewell for me, and it makes the occasion somewhat sad." Mayor Gray of Minneapolis was then called upon and gave a short address on the relation of the art of telegraphy to the modern newspaper. Robert C. Harper of Minneapolis, who is now 101 years of age, also spoke a few words, and was vigorously applauded. Others who responded to toasts were Mrs. John C. Costello, New York; W. L. Ives, New York; W. H. Eustis, Minneapolis; J. McMichael, H. A. Tuttle, J. H. Skinner, George R. Finch, I. J. Dicks, A. C. Thomas, Mr. Wenter, W. C. Burton, Dr. Monro, Charles Seldon, W. R. Plum, A. C. Terry, M. J. O'Leary. A number of others prominent in telegraphic affairs also spoke in response to toasts.

National Municipal League.

About 100 delegates attended the sixth annual convention of the National Municipal League in Milwaukee last week. This convention was the starting point of active work in the adoption of the so-called municipal programme adopted at the Columbus convention last year. The programme, as adopted, recommends three branches of activity—enlarging the power of cities by providing, so far as possible, for home rule; enforcing carefully devised restrictions against the abuses of municipal powers, and regulating the granting of franchises.

New officers were elected as follows: President, James C. Carter, New York; first vice-president, Charles Richardson, Philadelphia; second vice-president, Samuel B. Capen, Boston; third vice-president, Thomas M. Strong, Portland, Ore.; fourth vice-president, H. Dickson Bruens, New Orleans; fifth vice-president, Edmund J. James, Chicago; secretary, Clinton Rogers Woodruff, Philadelphia; treasurer, George Burnham, Jr., Philadelphia; executive committee, Charles J. Bonaparte, chairman, Baltimore; George W. Guthrie, Pittsburg; William G. Low, Brooklyn; Joseph A. Miller, Providence; Harry A. Garfield, Cleveland; Oliver McClintock, Pittsburg; Dudley Tibbitts, Troy; George W. Ochs, Chattanooga; John A. Butler, Milwaukee; Hector McIntosh, Philadelphia; Frank N. Hartwell, Louisville, and the previously-named officers.

Among the papers was one by George E. Hooker of Chicago on "Local Transportation and Its Relation to the Welfare of the Municipality." Mr. Hooker advocated the idea of grading fares according to the distance traveled. He is opposed to selling franchises to street-railway companies, holding that the money thus obtained comes from the poor, who are forced to patronize street railways, and goes into the pockets of boodlers in the City Councils. Another paper of unusual interest was contributed by Bird S. Coler, comptroller of the city of New York, whose subject was "Danger of the Commercial Spirit in Politics."

The meeting closed with the reading of a paper by M. N. Baker of New York on "Municipal Accounting," which was discussed by James B. Cahoon of Syracuse, N. Y., the president of the National Electric Light association. The place of next meeting will not be chosen for several months.

British Association Meeting.

[Special correspondence of the Western Electrician.]

London, September 11.—The members of the British Association are holding their annual meeting this year at Bradford. Women have gained a footing now on the committees. The learned men who have hitherto monopolized these bodies have had the advice given to Ida in "The Princess" retorted upon them: "Work no more alone." They have heard the inverted argument, "The man's cause is the woman's," and have given in. Professor Hartog, to prove it, cited the work of the late Miss Mary Kingsley, and Professor Silvanus Thompson told how a woman—Mrs. Ayrton—had made the most interesting contribution to the Congress on Electricity in Paris. The voting in women's favor was more than two to one.

There were a good many papers in the mechanical-science section of exceptional interest. The address of the president is almost inevitably difficult, but it is often suggestive. That of Dr. J. Larmor, the president of this section at this meeting, was the latter quite as much as the former. He grapples with a group of problems, the rise of which is largely due to the exceptional advances made during the last quarter of a century in the manipulation of electric power. The study of its transmission, now even across space for long distances, and of electric discharges in rarefied media, suggest that in the abstract region of this science the physicist must deal with two subjects of thought, viz., the molecules, which constitute what is called matter, and the ether, or medium pervading them. But when any attempt is made to determine what either of these really is, difficulties at once arise. Physicists, as Dr. Larmor showed in his historical and critical sketch, though they had but little real knowledge of the essential nature of matter, have been able to divine precisely the mode of operation of the intangible ether, and to get some idea of the physical action of the molecules. But it is as yet an unsettled question whether the former be the very essence of physical actions or whether it is an impalpable material atmosphere of exceeding tenuity, though with properties of a solid, as Lord Kelvin maintains, which serves for the transference of energy by radiation, at extremely small densities, but at a very great speed. If the second view be correct, then ordinary matter would be the seat of all this energy, a hypothesis seemingly difficult to reconcile with certain recent discoveries about the electric fields around currents and magnets. Dr. Larmor's critical discussion of electrical power led him to the conclusion that in regard to the uniform phenomena of activity in finite regions of the ether, science can build up a definite scheme, but in the domain of matter it cannot say what that is, but can only, accepting the existence of permanent molecular systems, fit together an outline plan of the more general and universal features of their activity. In other words, the secret of the universe has not yet been discovered, though many erroneous conceptions have been cleared away and progress made, both directly and indirectly, toward solving the problem. At present, we may be said to be brought down to an ultimate dualism in the beginning of things, but in the journey thither many apparent diversities become only different modes of a real unity, so that this dualism at last may be found in like matter to exist in thought rather than in fact.

Mr. J. G. W. Aldridge read a very interesting paper on "The Automobile for Electric Traction." Since we can have telegraphy without wires, why cannot we have tramways without lines, argues Mr. Aldridge.

Parliament threw out the Manchester and Liverpool electric-railway proposal, which was to develop a normal running speed of something like 120 miles an hour. The electricians, under the guidance of Sir William Preece, discussed the feasibility of such a venture, after listening to an instructive paper on "Resistance Acceleration of Trains." Sir William Preece read a paper on "Wireless Telegraphy and Telephony," an abstract of which the Western Electrician correspondent presents elsewhere.

DEVELOPMENT OF THE TELEPHONE FIELD.

Notes from Ohio and the Ohio Valley.

Dr. L. E. Niles of Springfield has gone to New York, where he will open offices for the Electro-magnetic Telegraph company, of which he is president. The company will place upon the market a police and fire-alarm system.

The town of Alliance, after a long delay, has granted the Columbiana County Telephone company a franchise to build an exchange. President S. C. Thayer states that work will be begun on the new system at once.

The Warren-Niles Telephone company will give free service to its subscribers in Warren and Niles on its new lines to Leavittsburg, Mineral Ridge and Vienna.

The Columbiana County Telephone company will be able to connect its line with the Independent system at Pittsburg the latter part of November.

The Marietta Telephone company, Marietta, Ohio, opened its office for business two weeks ago with 600 subscribers. The system was built by W. J. Dusenberry and others of Columbus. The Bell people are said to be cutting rates to meet competition.

The Central Union Telephone company has been granted an injunction against the Home Telephone company of Greenville, Ohio, stopping the latter from building a system in the town. The Central Union people asserted that the Independent company had cut its main lines and lines running to its subscribers, thus greatly impairing the service. There is probably another side to the question, which Judge Elam Fisher of Eaton, who granted the injunction, will be asked to hear later on.

The United States Telephone company has begun the construction of a line from Toledo to Saginaw, Mich., connecting also with the towns of Adrian, Jackson, Lansing and Owosso, as well as a number of smaller ones. The entire line will be about 160 miles in length. This company will within a short time be able to make connection with the large cities of the East also.

A new Independent exchange is to be built at Lexington, Ky., within a short time, and it is stated that activity in this line of improvement will soon be quite marked in that state.

The officials of the new Citizens' Telephone company at Circleville, Ohio, have been meeting with success in soliciting subscriptions. Already over 100 have been secured, with only two weeks of work.

The Newark (Ohio) council has passed a resolution prohibiting the United States Long-distance Telephone company from building through the town without a franchise. The members were somewhat disconcerted when told that the company only intended to build to the corporation line, and that the Newark Telephone company would build out and connect with it.

The Massillon Telephone company of Massillon, Ohio, was incorporated a few days ago, with a capital stock of $75,000, the incorporators being E. E. Fox, J. W. McClymonds, Frank Stroebel, J. H. Hunt, O. E. Young, J. C. Putman and H. A. Croxton. The new company has purchased the plant of the Farmers' Telephone company, which is now undergoing great improvements. The new company will complete these and extend the service in every way possible. E. E. Fox was president of the old company, and is a leading spirit in the new one.

The line of the United States Telephone company from Columbus to Newark has been finished as far as Granville, and the poles have been erected almost the entire distance.

The Cuyahoga Telephone company's cable employes held a very enjoyable outing at Geauga Lake recently. A number of very laughable athletic contests were held, and in all but one the telephone boys won over the outsiders.

A telephone war is on in Canton between the Stark Telephone company, which has asked for a franchise, and the Bell people, who are opposing it. The Independent company will likely secure the right to construct a plant, as there are some influential men behind it.

The Citizens' Telephone company of Columbus sustained a loss of several hundred dollars on North High street, through a fire which occurred there a few days ago.

The Albany and Vales Mill Telephone company, with main office at Albany, Athens County, was incorporated a few days ago, with a capital stock of $10,000, by J. Q. A. Vale, L. P. Vale, W. Y. Castor, Emeline Castor, D. L. Webb, Elizabeth Webb, S. D. Webb and Elizabeth V. Webb. The company will build exchanges at Albany and Vales Mills.

The Athens County Telephone company has been incorporated by C. L. Jones, Y. W. Durfee, W. E. Moler, A. F. Holmes and E. J. Holmes. The capital stock is placed at $15,000. An exchange will be built at Athens by the new company.

W. B. Seaton, J. L. Anderson, Hugh Russell, Thomas L. Collett and F. E. Hayward are the incorporators of the Lawrence Telephone company of Ironton, Ohio, which has a capital stock of $24,000. The company proposes to build an exchange at Ironton, and has authority to build lines through the country and plants in any other cities or towns which the board of directors may designate. The incorporators are all prominent men of Ironton.

The Ottawa County Telephone company, with a capital stock of $30,000, has been incorporated. The office will be at Oak Harbor, and the men interested are Homer Metzger, E. D. Harkness, J. G. Steinkamp, Taylor Fuller and F. W. Grandolph. It is the intention to build plants at Oak Harbor, Elmore, Geneva and Woodville, and toll lines throughout Ottawa, Wood, Lucas and Sandusky counties.

Frederick T. Masters has brought suit against the Central Union Telephone company in the courts at Columbus for $10,000 damages alleged to have been sustained through the breaking of a signal apparatus in the company's exchange. He was employed by the company, and while examining the apparatus, under orders of the superintendent, the contact brush on the generator which operates the ringing system broke and the pieces flew into his face, tearing out the cornea of one eye and otherwise injuring him.

The Massillon Telephone company, which was incorporated recently, has made arrangements to take over the entire system of the Farmers' Telephone company of that place and will within a few weeks have the lines throughout Stark County in good working order. The capital of the new company is placed at $75,000.

The Progress Telephone and Telegraph company of West Milton has applied to the Board of Public Works in that city for a franchise to operate a toll station in that city. The company proposes to erect its line along the Dayton and Covington pike.

The Central District and Printing Telegraph company has its new plant at Salem completed, and the old instruments are being torn out of the business houses and residences. They are being supplanted by new Blake telephones. The offices of the company are at the corner of Main street and Lincoln avenue, and are well equipped for the business. At the head of the stairs, as one goes up, is the office of the manager, J. K. Stitt, and to the left of this is the waiting room, which also contains the long-distance booths. The operating room occupies the entire northeast part of the floor. It is large and well lighted, affording the operators every convenience for their work.

The preliminary steps have been taken by the Columbiana County Telephone company for installing a plant at Alliance. President S. C. Thayer and Chief Engineer J. B. Price were in that city recently, making plans and establishing routes for the lines. Work will be begun on this plant at the earliest possible moment.

The Albany and Vales Mills Telephone company of Albany, Meigs County, has elected J. Q. A. Vale president and S. D. Webb secretary.

The Belmont Telephone company will shortly begin the construction of its line in Bridgeport. It is the intention of the company to extend its service to Martins Ferry and St. Clairsville, but this cannot be done this fall on account of the scarcity of poles. All the poles for the entire system have been purchased, but only enough can be delivered this fall to complete the system in Bridgeport.

Clarence Houk, manager of the People's Telephone company at Shelby, Ohio, and Miss Jessie McDonald of the same place were married a few days ago.

It is said that the Citizens' Telephone company of Columbus may escape taxation altogether this year, as it was not in operation on May 1st, when property is listed for that purpose. O. M. C.

Mississippi Independent Telephone Association.

An interesting meeting of the Independent telephone companies of Mississippi was held at Aberdeen, Miss., on September 19th and 20th, when the Mississippi Independent Telephone Association was organized. The following-named officers were elected: President, Hugh Campbell, Aberdeen; vice-president, L. B. Camp, Amory; secretary and treasurer, A. W. Kearley, Boonville; assistant secretary and treasurer, C. W. Bolton, Pontotoc. The officers also constitute the executive board of the association.

The Maltese-cross sign was adopted as the emblem of the association, and the members of the association are requested to have it printed on their telephone stationery. The members of the association are to report quarterly to the secretary all changes and improvements in their business and all matters of special interest to the telephone people, that may take place in their section of country. The secretary is to make a report of all such items of interest to the members of the association at the close of each quarter. A membership fee of one dollar will be charged annually to each member actually engaged in, or interested in, the Independent telephone business in Mississippi. A membership fee of five dollars will be charged to any manufacturer or dealer in telephones and material. The time and place of holding the next meeting will be decided later by the executive board of the association.

Mr. La Bourveau, representing the Sumter Telephone Manufacturing company, attended the meeting with an exhibit of telephones and switchboards.

Reports showed rapid advancement in the Independent telephone business in Mississippi. There are 26 Independent exchanges in Mississippi and many hundreds of miles of good toll lines. These lines and exchanges are being rapidly extended and connected. The Independents are also equipping their lines and exchanges, in many instances, with new and improved material. The public appreciates the efforts of the Independents to give it good service at low rates, and is sustaining and encouraging their companies in every way possible. The day is not far distant when the Independents in Mississippi will rival those of some of the older states in advancement in the telephone business.

Telephone News from the Northwest.

The Greene and Western Telephone company has connected its exchange at Shakopee, Minn., with Minneapolis and St. Paul, over the lines of the Mississippi Valley Telephone company.

The Southern Electric Telephone company is rebuilding its exchange at New Ulm, Minn., and equipping the system with Bell instruments.

A manhole of the conduit system of the Northwestern Telephone Exchange company at St. Paul recently filled with water and grounded 108 lines. Repairs were made as soon as possible.

C. L. Grandin has completed a local exchange at Mayville, N. D., which opens with 60 subscribers.

The Almond (Wis.) Telephone company is seeking stock subscriptions in Waupaca, Wis. If successful, the company plans to extend toll wires to Waupaca, and to establish a local exchange there.

The Mississippi Valley Telephone company is waiting in Minneapolis for a shipment of wire ordered six weeks ago. When it is received 3,000 new connections will be made. The company expects to have that number of new subscribers talking within 60 days.

The new electric-light company at Dickinson, N. D., will wire the city and install a local telephone system also within a short time.

The stockholders of the Minnesota Central Telephone company held their annual meeting in Minneapolis recently and elected directors for the ensuing year. The company operates about 800 miles of lines. Dr. O'Hare of Waverly, Minn., one of the stockholders, wants an investigation into the sale of certain lines between Dassel and Kingston, occurring two years ago.

The directors of the Mutual Telephone company of Des Moines, Iowa, will ask the stockholders to raise the rates to a figure which will equal the cost of operation. The capital stock will be increased to $90,000 from $24,000. The increase will take care of floating indebtedness and provide for the necessary improvements.

The Stevens Point (Wis.) Telephone company is being organized to establish a local exchange. The company will have $15,000 capital stock.

A franchise for a local exchange was voted at Columbus Junction, Iowa.

Work will shortly be begun at Tacoma, Wash., on a $20,000 central-office building for the Sunset Telephone company.

Efforts are being made at Montezuma, Iowa, to form a local telephone company.

Residents of Highland, near Tama, Iowa, are raising funds for the construction of a telephone line into Tama.

The Sioux Rapids (Iowa) Telephone company has been organized, and will install a local exchange within 60 days.

Two non-union employes of the Rocky Mountain Bell Telephone company, at Butte, Mont., were set upon by a gang and severely beaten. There is a strike on at Butte, and these men had been put to work.

Mrs. Grace Porter of Fort Dodge, Iowa, operator for the Iowa Telephone company, is the probable heir to a fortune of $1,000,000, through the death of her aunt, Mrs. Mary Adams, of South Bend, Ind. She is the principal heir of the estate.

The Western Minnesota Telephone company plans to build a toll line between Glencoe, Minn., and Minneapolis. This company is Independent, but will connect with the Bell system in Minneapolis.

The village of Two Harbors, Minn., has granted a franchise to Thomas Owens for a telephone system.

The Greene and Western Telephone company has connected East Union, Minn., with Minneapolis and St. Paul, where connection is made with the Mississippi Valley Telephone company. R.

An Old Story Revived.

Eastern newspapers have revived the rumor of a great consolidation of the Western Union Telegraph company, the Postal Telegraph company, the American Telephone and Telegraph company and the National Telegraph and Telephone company. Diligent inquiry has not confirmed the story, however, and it is hinted that it was set afloat for stock-jobbing purposes. To a representative of the Western Electrician in New York, Mr. W. H. Baker, vice-president and general manager of the Postal company, denied any knowledge of a foundation for such rumors. Other officers of the companies mentioned have returned similar answers to the questions of the reporters for the daily press.

New York Street-railway Association.

The eighteenth annual meeting of the Street Railway Association of the State of New York was held in the Iroquois Hotel, Buffalo, on September 18th and 19th. President G. Tracy Rogers of Binghamton presided and delivered a long address, an abstract of which is given on page 204. The executive committee made a report, and the treasurer stated that the total receipts for the year were $7,050.64, with expenditures of $4,948.15, leaving a balance on hand of $2,102.49.

J. H. Armstrong of the General Electric company, Schenectady, N. Y., read a paper on "Railway Power Transmission," in which it was shown that the electric-railway field has become so broad and so complex in its engineering problems that no one system of distribution is adapted for all classes of service. A small congested system demands a 500-volt, direct-current system; larger systems present the dividing line between the 500-volt, direct-current system and the alternating-current, sub-station system. Suburban roads, with considerable length of track, heavy cars and high speeds, usually find the alternating system cheaper both as to operation and first cost.

"Accidents on Street Railroads" were treated in a paper read by Mr. Patterson of the Metropolitan street railway of New York. Mr. Vreeland of the Metropolitan system of New York, President Charles F. Schoepflin of the Buffalo, Gardenville and Ebenezer railroad, G. Tracy Rogers, W. W. Cole of Elmira, Mr. Hasbrouck of the Metropolitan Street Railway company of New York and Ira McCormack of Cleveland participated in the discussion.

"How Can We Increase the Efficiency of Employes?" was the title of a paper read by E. G. Connette, vice-president and general manager of the Syracuse Rapid Transit company. Mr. Connette advised kind treatment, praise and encouragement as well as reproof, the reward of merit, and that bulletins to employes should set forth their contents concisely, simply, comprehensively and in doses that could be digested.

The president was authorized to appoint a new committee of five, to consist of representatives from roads in large and small cities and suburban roads, to report to the next convention on the standardization of rules and regulations.

B. B. Nostrand, Jr., of the Peekskill Electric Light and Power company described a storage-battery auxiliary in the plant of a small road. The results obtained are said to be remarkable constancy of load, increased economy, simplicity of operation, permitting the shutting down of the small engine suddenly from some mishap, the battery carrying the entire load for the eight or 10 minutes necessary to get the other unit into operation, and running a car for some special occasion late at night with the generator shut down and the battery thrown across the line. The battery has given no trouble since its installation, and the daily labor for its care does not average more than one-half hour. In fact, about all the work required is that of taking voltmeter and hydrometer readings upon the individual cells once each week.

At the afternoon session of Tuesday, the 19th, papers and addresses were delivered as follows: "Storage Battery," by Thomas Henning, superintendent of the power house of the Buffalo Railway company; "Description of the Rochester and Sodus Bay Railroad," T. J. Nicholl, vice-president Rochester Railway company; "Tests in the Buffalo Railway Power House," Professor Norris, Cornell University, Ithaca, N. Y.

At 4 p. m. an adjournment was taken and the delegates and guests were taken in special cars of the Buffalo Railway company to the Pan-American Exposition grounds, after which a visit was made to the transforming stations and storage-battery plants of the Buffalo Railway company, where alternating current at 11,000 volts is stepped down and transformed to 550 volts, direct current. At 8 p. m. the annual dinner was held at the Ellicott Club.

On Wednesday morning a paper on "Precision of Steam Power Making," by A. S. Mann of the engineering department of the Metropolitan Street Railway company of New York was read by the secretary, in the absence of the author. The point was that definite results in the making of steam power could be attained only by actual measurement of the several factors involved, thus reducing operation to a mechanical certainty and eliminating from the problem the errors of what was known as "best judgment," and which varied as much as 10 per cent.

A paper on "Compressed-air Motors," by H. H. Cook of New York, was, in the absence of the author, read by H. E. Himely. This paper referred to the rapid progress made in the application of compressed air, which was made possible by the similarity of its application to that of steam. It was stated that 2.8 cents would compress 1,000 cubic feet of free air to 2,000 pounds' pressure. Mr. Himely was asked by one of the delegates whether the reciprocating action of the motors in question did not introduce one of the evils which steam-railroad men were hoping to obviate in changing from steam to electricity, and as to whether any attempt had been made to apply compressed air to rotary motors, to do away with the reciprocating action. Mr. Himely replied that up to the present time rotary engines had not been perfected so as to be operated successfully where economy was the desideratum.

"Practical Experience in the Operation of Combined Public Franchises by One Company," was the subject of C. E. Ueberlacker of the Elmira Municipal Improvement company, Elmira, N. Y. In the absence of the writer of this paper, it was read by the secretary. The conclusion reached by the author was that when companies previously well managed were combined, the advantages of economy lay not so much in broad sweeping reductions as in attention to the smaller details of combined organization; not so much in actually reducing the whole amount of labor required to accomplish the combined result as in the economical division of that labor, the use of the whole instead of a part of each employe's time, and assigning similar work in different departments to the same employe.

The order of "Topics for General Discussion" was then taken up, and Mr. Nicholl of Rochester explained the repair-shop methods adopted in the plant there. One of the features was an inventory book placed in the hands of all employes, giving a specific number to every part in use, to the number of about 2,500. All purchases, without exception, were made on written order entered with the purchasing agent, and a daily report was made out showing in detail every article bought or sold. Mr. Tully, purchasing agent of the Metropolitan Street Railway company, New York, stated that several years ago they had adopted the system of numbering each requisition consecutively.

Under the head of "Selection and Management of Employes, and Methods for Increasing Their Efficiency by Benefit Associations and Other Means," the discussion was deviated somewhat to the more particular consideration of standard rules. The president asked Mr. Vreeland of the Metropolitan Street Railway company to discuss the latter phase of the subject. Mr. Vreeland thought it would be useless to attempt in the few minutes remaining to consider the question intelligently. He criticized the state association for not giving more attention to the business coming before its conventions and urged that a standing committee be appointed on the question of uniform rules. Such a committee had existed since 1870 in the Railway Superintendents' association. The executive committee of the state association worked hard and faithfully, and it was unfair that effort of this kind should be met by a beggarly array of empty chairs in the conventions. The executive committee had never had a meeting but that Mr. Nicholl of Rochester, Mr. Ely of Buffalo, Mr. Rogers of Binghamton and the other members had come to New York to attend it, even when they were engaged in large construction work at home, and could barely afford the time. J. P. E. Clark, general manager of the Binghamton Street Railway company, moved that the president divide this topic into subdivisions to be suggested by Mr. Vreeland, and that then the president allot to the presidents of different railroads throughout the state, according to geographical location, etc., such divisions as he thought most applicable, and that these be discussed under their respective heads at the next meeting. This motion was carried.

In a discussion on snow plows, the practices of the Buffalo Railway company and the Metropolitan Railway company of New York were outlined. One of the delegates called attention to the trouble met with in snow plows because the angle of the shear interfered, when there was ice and snow on the track, with keeping the front wheels on the rails. He had received a pamphlet describing a 1⅜-inch flange with a groove cut in it, which groove, it was claimed, in running over the rail, cut out the ice in sections. He asked whether anyone had had experience with such a device, but no one present could offer any information on the subject.

The nominating committee, consisting of W. W. Cole, J. C. Brackenridge and H. S. Cooper, presented the following report:

President—G. Tracy Rogers, Binghamton.

First vice-president—John Boyle, Utica.

Second vice-president—Edward G. Connette, Syracuse.

Secretary-treasurer—Henry A. Robinson, New York.

Executive committee—G. Tracy Rogers, Binghamton; Clinton L. Rossiter, Brooklyn; W. Caryl Ely, Buffalo; H. H. Vreeland, New York; T. J. Nicholl, Rochester.

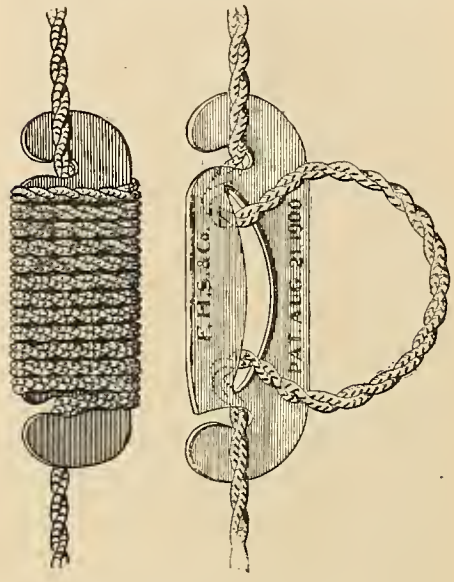
On motion, the secretary cast the ballot of the convention for the gentlemen named, and they were declared duly elected. Mr. Nicholl invited the association to meet at Rochester in 1901, and, on motion, the invitation was accepted. The association then adjourned.

Mr. Yerkes' London Project.

The London Times of September 20th confirms the report that Charles T. Yerkes of Chicago has purchased the parliamentary charter of the Charing Cross, Euston and Hempstead underground railroad. It is said that construction of the line will be begun almost immediately. The Times says that this is the first time such a European enterprise has passed entirely into the hands of American capitalists. The authorized capital of the company which Mr. Yerkes has bought out is $8,880,000, in shares of $50 each, and $2,960,000 in loans. The share capital was offered for subscription in April, 1894. The old board of directors has been retired and a new board is to be appointed by Mr. Yerkes. It is expected that an electric line will be constructed and put in operation in two years, 1902 being the time limit of the parliamentary grant. The total length of the projected line is 6½ miles, the total cost being estimated from $15,000,000 to $20,000,000. The engineers are Sir Douglas Fox and W. R. Gailbraith.

Stewart Patent Cord Adjuster.

Considerable trouble has been experienced with the various kinds of cord adjusters for incandescent lamps. The chief difficulty has been that the adjusters would take but one size of cord. It is said that this difficulty is entirely overcome in the Stewart patent cord adjuster by using a slot converging at both ends, which permits the use of any size of lamp cord and securely locks itself by means of the throat at each end. The adjuster is one that can be used after the lamp is suspended, thus saving the time and annoyance of disconnecting the cord. It is made of fiber. The cuts illustrate two methods of adjustment, and, as will be seen, the application of the adjuster is very simple. Frank H. Stewart & Co. of Philadelphia make the device.



STEWART PATENT CORD ADJUSTER.

Lead Colic of Electrical Workers.

With the increasing demand for storage batteries, says a foreign contemporary, there has developed among the workers in that department of electrical manufacture the peculiar lead poisoning known popularly as painters', or sometimes, erroneously, as bilious colic. This manifestation is especially manifest among those whose duties require the handling of the lead paste for the grids, particularly the mixers, who knead the paste, and those who fill the grids with the mixture containing litharge or minium.

Ordinarily, this operation is conducted with the hand, without the precaution of wearing rubber gloves. In spite of frequent washing of the hands, the friction necessary to mix and apply the paste properly eventually fills the pores and carries into the system of the workman a sufficient amount of the poisonous lead to provoke the disease.

This particular manifestation of lead poisoning among electrical workers is marked by its precocity, its intensity and its frequency of critical periods. While with painters the disease is years in making itself manifest, with storage-battery makers it often occurs after a few weeks of exposure. This is explainable readily enough if it is remembered that in the former case the victim has only occasionally come in personal contact with the cause; in the latter the workman is in physical proximity to it at all times when at work.

The "chargers" form a second category, and do not succumb as readily as those who mix the paste. Their work is more intermittent, and the hands are not as constantly in contact, nor as intimately, as are those of the former class. The effect is longer in reaching a climax, as is the case with printers, plumbers, tin workers, and the like.

The prophylactic measures proper are those of the olden days, which have even been employed by establishments where powders are manufactured, where salts of lead (fulminates) and other detrimental chemical compounds are capable of producing disease through inhalation or outer physical contract. These are rubber gloves, where the hands are employed, masks, where the substances are floating in the air, sponge respirators, frequent, thorough baths and general cleanliness of clothing. When a crisis does arrive, a physician should be summoned at once, as the symptoms are both dangerous and painful and should be checked immediately.

The Atlanta Railway and Power company of Atlanta, Ga. (Joel B. Hurt, president), has been granted a franchise for the construction of an electric-lighting and power plant.

Street-railway Affairs in the State of New York.[1]

By G. Tracy Rogers.

During the last year we have enjoyed the fruits of the good times, and the close of the convention year finds us in a more prosperous and healthy condition. While there have been no startling developments, we have all advanced in the line of improvement in every direction, in construction, equipment, and, I believe, also, in our relations to the municipalities and to our employes. The consolidation of the street railroads throughout our state is still the order of the day, and, in some instances, consolidation with other electric interests has been effected.

The railroad commissioners' report of 1899 shows that there are 94 electric roads in this state, and 41 show a deficit, while only 14 declared a dividend. Of the latter, four were in the smaller cities, being operated partly as interurban roads. This report also shows a gain in the receipts of the surface roads over the previous year in this state of 7.1 per cent.; also that the lines of Greater New York carried 55 per cent. of all the passengers in the state, and their increase was 74 per cent. of the total increase of the state.

It is a recognized fact that there is nothing that will more rapidly and permanently develop smaller cities than rapid transit, especially interurban service. Oftentimes, the value of real estate in certain districts will advance upon the mention of an extension of a road in that direction. The people of provincial cities stand in their own light in not taking measures to have the existing law changed. I am satisfied that the public is each year realizing more and more the benefits accruing from a well-constructed, well-equipped and carefully managed street railroad in its midst.

The management of roads in the smaller cities make no mistake in taking the city authorities and the public into their confidence, appealing to their sense of justice and fairness. This course, if conscientiously and consistently followed, will result in much good. The sympathy and good will of the people is necessary to the success of a street railroad, and without it, especially in small cities, it is next to impossible to succeed.

Foreign street railways seem to be more fortunate than those of the United States in the matter of tax upon gross earnings. As an illustration, the British tramway is paying into the public treasury less than $600,000 annually in a formal tax on gross receipts of $25,000,000. The street railroads of New York and Massachusetts alone are paying nearly $2,500,000 on gross receipts of $50,000,000.

The municipal-ownership agitator is still active, but I think the fever has abated; at least it is working westward. No doubt some of these agitators are sincere and honest in their advocacy of the theory. If the craze is allowed to run its course, public opinion will, in time, desert it, especially after a few more illustrations of the impracticability of the theory in America under American politics. Under municipal ownership, the agitator claims, the wages of the men will be increased. Incidentally, perhaps, the vote of the political party then in power will also be strengthened as well as the taxpayers' bill of expenses. This is a phase of the question which every American taxpayer should study.

Municipal accounts should be kept by a uniform system, all prescribed and audited by the authority of the state. All accounts for revenue-producing property should be kept as individual accounts, each of such properties having its own account, in order to show the true and entire cost of ownership and operation. A correct system of public regulation, as well as a standard system of accounts, is as necessary for the safeguard of the interests of the user and the taxpayer as it is to the private ownership and operation.

In financiering a street railway, as large a portion of the bonds and stocks as possible should be disposed of to local investors, thereby insuring a local co-operation and interest that cannot fail to redound to the benefit of all concerned. It is very important for street railroads to have as large a number of local stockholders as possible, thereby creating a common interest with the citizens in our properties. We must be frank and open with investors, which will result in securing and retaining the confidence and increasing the holdings and the numbers of holders.

Street railroads have not, in my opinion, anything to fear from the competition of the horseless carriage. This vehicle may be used for carriage and cab purposes to some extent. The "loco" or "auto" is still the fad, however. We hope that the many inventors now working on the various vapor motors for the "auto" may produce something that will prove practicable and economical for street-railway operation.

Much has been accomplished in the standardization of our accounts which will work out untold benefit to the roads. Besides strengthening our securities, it will give confidence to the public, and afford us material for comparison. Our track system is also working out its own standard.

It is to be hoped that we will soon reach a standard in a permanent type of mechanical power, and it will be no longer necessary to discard costly apparatus because improvements have displaced them. As to equipment and rolling stock, we do not seem to accomplish much in standardization, except on the larger roads. This result is due to a combination of circumstances which I will not attempt to enumerate. If we could standardize our equipment it would be a saving in many directions.

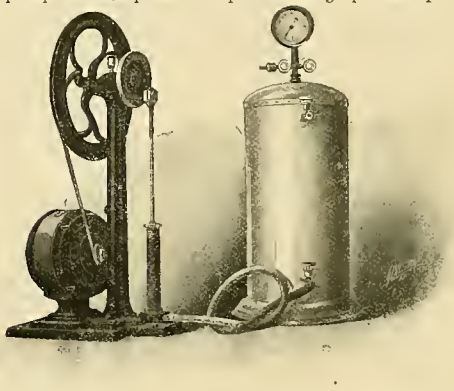
With the extension of railroad systems in the city of New York necessarily follows the greater increase in travel. For the last fiscal year the returns of the Metropolitan company show that 452,761,158 passengers have availed themselves of the right to ride on the company's lines, of which 297,254,580 were cash passengers, with 155,506,578 transfer passengers. These returns show an increase over the preceding years of 61,000,000 passengers carried, of which 34,000,000 were cash passengers and 27,000,000 were transfers.

In the improvement of the railroad situation in the city of New York is to be noticed the active construction of the rapid-transit tunnel. The citizen realizes from active operations now carried on in the streets the dreams of rapid transportation which he has nourished for 20 years past. There is a great enthusiasm and hopefulness for the early completion of this road, but with the difficulties attending the acquisition of material and the character of the construction, it is manifest that a period of many years must elapse before the benefits of the system, if any there may be, can be realized by the contributing taxpayers.

1. Abstract of the presidential address at the eighteenth annual meeting of the Street Railway Association of the State of New York, at Buffalo, September 18, 1900. Mr. Rogers is president of the Binghamton Railroad company.

Emerson Electric Air Pump.

The accompanying illustration shows an electrically operated air-compressing outfit for physicians' use with atomizing tubes in treating mouth, throat and lung diseases, and which is also adapted for dental purposes, such as cleaning cavities in teeth. The outfit as shown consists of a single-action-piston air pump with metallic ball valves operated by an alternating-current motor, connected by two feet of pressure hose to a six-gallon nickel-plated tank, which is supplied with a gauge to show the pressure, and stop-cocks and hose connections for leading off to the atomizing tubes, etc. It is asserted that this pump will compress air up to about 30 pounds' pressure, but that it is more efficient up to about 20 pounds' pressure, which is understood to be about the right amount for this class of work. The pump has a capacity of about 1½ gallons of free air a minute, and will pump the six-gallon tank, it is claimed, up to ten pounds' pressure in 2½ minutes, 15 pounds in 4½ minutes, 20 pounds in 6½ minutes, 30 pounds in about 14 minutes.



EMERSON ELECTRIC AIR PUMP.

The manufacturer says that this style of outfit is not only much more convenient than any water-pressure air pump, but in most cases will cost much less to operate, and has the additional great advantage of being able to get the pressure anywhere that it is desirable. No permanent fixtures are necessary for fitting up this outfit, as all that is necessary to start it in operation is to plug in the lamp socket the same as an electric lamp or an electric fan motor. The expense of operating the pump is said to be very small, as at the ordinary rates charged for an electric-light current of 20 cents for 1,000 watts it would cost less than one-fourth of a cent to pump this tank of air up to 20 pounds' pressure. All of the parts of this outfit are extremely simple and durable, the pump having long, heavy bearings, and the valves being metallic, the only part of the pump which might require renewal after a considerable length of time being the leather packing of the piston, but this can be replaced by anyone in a very few minutes and at a cost of a few cents. The outfit is placed on the market by the Emerson Electric Manufacturing company of St. Louis, Mo.

Automobile Races at Guttenburg.

A series of automobile races was run off on the one-mile track at Guttenburg, N. J., on September 18th. The occasion was the first day of a tri-state fair. The time of one minute 27⅘ seconds was made for the last mile of a 10-mile race by the gasoline racer of A. C. Bostwick. A record for five miles was made by Mr. Bostwick in a five-mile race—seven minutes and 43⅗ seconds. The races were run under the rules and auspices of the Automobile Club of America. In a 10-mile "championship" race, which was won by Mr. Bostwick, A. L. Riker started in his electric vehicle and passed the other contestants at the first mile, but had to withdraw soon after, as his batteries became short-circuited. Preliminary to the races there was a parade, in which about 30 vehicles of all kinds participated. The prize for the best-appearing machine was won by R. M. Barwise of New York, and the prize for the best decoration was awarded to D. C. Goodwin and Miss Menken.

Proposed Method of Charging for Electric Current.[1]

By Etienne de Fodor.

The keen competition which the electric light has met in these days has led most stations to reduce the price charged for current, or to allow considerable discounts on the normal price. But in spite of all such concessions we have not been able to lessen the competition, and the result is that many customers who had previously introduced the electric light into their homes have abandoned it for other means of lighting. Neither the most generous reductions nor other offers on our part have persuaded these customers to remain loyal to the electric light, since they have found one much cheaper, and at a figure almost impossible for us to meet.

I have come to the conclusion that it is inevitable that we should lose such customers, and that the electric light is not made to keep up an unrestricted competition with other modes of lighting, but made rather for those who can appreciate its value and who will use it regardless of cost. Those who regard price of light only we will let go. On the other hand, we should aid the customer who wishes the electric light, by establishing a moderate rate of charging, and seek to extend this clientele, slowly but surely.

If there is to be a reduction in price it must be on a just and equitable basis. If we give, for example, a discount on consumption above a certain number of lamp-hours per year, it might be likely that this number would be reached in the winter, in our busiest season, while that during the summer this same customer would use no current. There should be, then, a reduction only after a certain consumption which will take place anyway, and because the electric light is then a necessity whether a discount be given or not.

It is the same with a consumer who prefers to burn gas in winter, using electricity in summer only. To such a one there will be no reduction, because with his limited consumption the necessary number of annual lamp-hours will not be attained. Yet this last consumer is rendering a service to the company in taking current at a period when the power house is run at a loss. To be just, then, it is necessary to regulate the discount, not on a number determined by annual consumption, but the discount should depend on the period of the year during which the consumption takes place.

In comparing the results of six years we have found, for example, for our station in Budapest, that the averages were: In 1894, 440 hours per year per each lamp installed; in 1895, 454; in 1896, 462; in 1897, 420; in 1898, 418, and in 1899, 448. I may then reckon, almost with certainty, that each lamp added to our system will furnish me about 440 hours of consumption per year, and upon this mean I should base my charge price for current. I can call this mean the assured mean of performance.

If now we subdivide this mean into 12 parts, according to the months, we find that the consumption is apportioned among the several months, as follows:

In January	13.6 per cent. of the total mean.
In February	11.4 per cent. of the total mean.
In March	8.2 per cent. of the total mean.
In April	6.6 per cent. of the total mean.
In May	4.3 per cent. of the total mean.
In June	2.8 per cent. of the total mean.
In July	2.2 per cent. of the total mean.
In August	3.2 per cent. of the total mean.
In September	6.6 per cent. of the total mean.
In October	11.4 per cent. of the total mean.
In November	14.5 per cent. of the total mean.
In December	15.2 per cent. of the total mean.

This mean percentage in many cases may differ sensibly from the actual percentage for given consumers or classes of consumers. If one wishes to be very scrupulous he may arrange his customers in different classes—private apartments, shops, restaurants, etc.—and establish for each class a separate monthly percentage. But he will find that this will only complicate the system unnecessarily.

I know, then, that each lamp added to our circuits will be operated 50 hours in January, 50 hours in February, 36 in March, etc. Upon this number of hours I can count my assured revenue, and upon these figures I may base my allowances for discount.

The power plant has little to do in June, July and August; I can then give large discounts during these months, almost cutting down to cost figures. I cannot accord the same figures for April, May and September, for the demands for current then are heavier, and I ought logically to give but slight reductions to ordinary customers during the remaining months, since I can scarcely meet the demands for current made at that time.

I can then establish three classes of discounts for the surplus of consumption over the assured mean. The determination of the figures for these reductions depends naturally upon local circumstances and the cost price. In many stations it would be easy to offer

1. Paper read before the Paris International Congress of August, 18-25, 1900. Mr. de Fodor is director of the Société Générale d' Electricité of Budapest.

in summer a discount upon surplus consumption of 60 per cent. of the normal price; for the months of mean consumption a discount of 40 per cent. and for the winter months a discount of 20 per cent. might be granted. As an example: A customer has 20 lamps installed. Taking 440 lamp-hours for the assured mean, the customer should be granted in

January	20 × 60 = 1200 lamp-hours	A discount on the surplus of 20 per cent.
February	20 × 50 = 1000 " "	
October	20 × 50 = 1000 " "	
November	20 × 64 = 1280 " "	
December	20 × 67 = 1340 " "	
March	20 × 36 = 720 " "	A discount on the surplus of 40 per cent.
April	20 × 29 = 580 " "	
May	20 × 19 = 380 " "	
September	20 × 29 = 580 " "	
June	20 × 12 = 240 " "	A discount on the surplus of 60 per cent.
July	20 × 10 = 200 " "	
August	20 × 14 = 280 " "	

I consider current as a merchandise the price of which ought to vary according to the demand. All beyond the assured mean ought to be sold at a discount, and this discount should vary according to the magnitude of the demands.

In this way we will not be overloading our station during three months to furnish power at a discount to consumers who will desert us altogether through the remainder of the year.

Reports of Chicago Elevated Roads.

The elevated railroad companies of Chicago have made reports on their business for the year ended June 30th, showing, in general, large increases over the figures for the previous year. In condensed form the reports are as follows for the years ended June 30, 1900, and 1899:

GROSS EARNINGS

	1900.	1899.	Gain.
Metropolitan	$1,603,461	$1,336,799	$266,662
South Side	1,258,379	1,061,656	196,723
Lake Street	727,587	653,299	74,288
Northwestern	65,487	.....	65,487
Total	$3,654,914	$3,051,754	$603,160
Gain. excludiog Northwestern			537,673

OPERATING EXPENSES, RENTAL AND TAXES.

Metropolitan	$ 891,978	$ 830,176	$ 61,802
South Side	712,281	631,046	81,235
Lake Street	481,447	386,264	95,183
Northwestern	34,507	.....	34,507
Total	$2,120,213	$1,848,486	$272,727

SURPLUS.†

Metropolitan	$ 711,483	$ 506,623	$204,860
South Side	546,098	432,700	113,398
Lake Street	216,140	267,035	*20,895
Northwestern	30,980	.....	30,980
Total	$1,534,701	$1,206,358	$328,343

*Decrease. †Applicable to fixed charges (other than taxes and rentals) and to dividends.

The following shows the gross earnings (which are also net, the road having no expenses) of the Union Elevated Railroad company for the first six months of 1900:

January	$ 35,700.33
February	33,352.78
March	37,281.70
April	35,537.49
May	35,203.17
June	34,970.43
Six months	$212,045.80
Gross for first half of 1899	188,565.94
Increase	$ 23,479.84
Per cent. of increase	12.6

Siemens & Halske Plant Closed.

On September 22d the General Electric company finally closed its works at Cicero, near Chicago, known as the Siemens & Halske plant. It is said that labor troubles were the chief cause of the shutdown, the determination to close being arrived at six months ago, when a strike occurred that occasioned a large loss to the company. At that time the company had on hand large contracts for castings, which were undertaken because of the finely appointed foundries at the works. With the loss of these contracts, the decision to suspend was made and various departments have been closed from time to time since then. All contracts had been completed by Saturday, with the exception of some work on automobiles, which will be taken to Fort Wayne, Ind.

The Siemens & Halske Electric company was organized in 1895, under the laws of Illinois, with a capital of $1,300,000 common stock and $700,000 preferred stock. Early in the same year the company purchased the Grant locomotive works, which had been closed previously through the failure of the Grant Land association. Later a consolidation was effected with the Pennsylvania Iron Works company. After that the interests of the Siemens & Haiske company were purchased by the Electric Vehicle company, and the last act of the consolidation was the purchase of all the property by the General Electric company.

Franchise for construction of electric-light plant for Marion, Va., has been granted to Palmer & Groscup of Washington, D. C. The company has been granted charter, and A. C. Sprinkle of Marion is general manager.

Development of Electric Lamps.[1]

By André Blondel.

It would be useless to-day to recall the beginnings of electric lighting and its prodigious development. True, from a practical point of view, the art dates back only 20 years; yet its origin seems already distant, and it is the future that should occupy the electrical congress rather than the past. Since the exposition of 1889 few important changes in the technic of lamps have been made, but the situation as regards electric lighting is far different. The increased demand for light has become enormous. Precisely on account of the market thus created the art of production and distribution of electric energy is considerably perfected by incessant improvements of construction and efficiency of machines, by the employment of powerful units direct-driven by economical motors, by increase of potentials of distribution, etc. At the same time all details of appendage—interrupters, circuit-breakers, rheostats and meters—as well as lamp attachments of artistic bronze and devices to add beauty and luster, have been objects of continual improvement. Thanks to the specialties of style, a new art has been developed, permitting us to use the electric light for new and captivating effects impossible to obtain with other illuminants. The elegance, convenience and hygiene of this light are to-day recognized and each year win to it new enthusiasts.

Yet, on the other hand, the electric lamp has seen arrayed against it new and redoubtable modes of lighting, very economical and very brilliant—incandescence by gas and acetylene, which has been known since 1889. The invention of Aüer von Welsbach has completely changed the base of comparison between gas and electricity and has produced, as is useless to deny, if not a stop, at least a diminution, in the advance of electric lighting. Yet the difference in net cost will doubtless decrease, thanks to such new inventions as the Nernst lamp; and the advantages of the electric light are such that the question of economy is only secondary.

The object of this report is to review the actual progress and the improvements desirable in arc and incandescent lamps.

PROGRESS OF ARC LAMPS.

Progress of the Theory of the Electric Arc.—The beautiful work of Mr. Violle has given, with sufficient accuracy, the maximum temperatures attained in the arc, 3,500° for the positive, 2,700° for the negative, and has shown that in a closed globe the brightness and the temperature of the crater are constants.

After a discussion of many years, in which have taken part, Edlund, V. Lang, Arous, Stenger, Luggin, Blondel, etc., it seems settled that there does not exist in the arc a counter electromotive force, but only a resistance to passage, which can be considerably modified by substances added in the manufacture of the carbon.

Numerous authors have sought in vain a simple law to reconcile the different phenomena of the behavior of the arc. In a series of admirable investigations Mrs. Ayrton has solved, for the first time, this problem completely. She has shown in particular, that the energy consumed is a linear function for each diameter of the carbon. The curves drawn show the conditions of production of the long and short arcs, and of the unstable region separating these.

As to the phenomena of the alternating arc, it seems established that the shape of the electromotive-force curve and the self-induction can modify, to a small extent, the performance, but that the effect of the latter preponderates; this increases the stability. In practice all curves are rounded through the influence of the conducting core of the carbons, which permits obtaining power factors of nearly unity.

Stability of the Arc and Mode of Regulating Lamps.—From the point of view of regulation, all to-day agree in recognizing the superiority of the differential system, which regulates with constant resistance. While a lamp in simple derivation has a supplementary loss of 30 per cent. of its tension in a stability resistance, the differential lamp suffers only 15 per cent. For example, a 30-volt lamp requires 39 volts in simple derivation and 34.5 volts in differential. These figures depend also on the number of lamps in series.

The alternating-current arc requires less stability resistance because of the greater sensibility of its mechanism under influence of vibrations. We may admit as minimum supplementary drops 10 per cent. for direct, 5 per cent. for alternating current, and as minimum voltage, 30 volts for alternating, with 1.5 volts more in resistance, and 33 volts for continuous, with 3.5 to four volts supplementary.

Construction of Arc Lamps.—The arc lamp offers serious difficulties of construction, for it should be at once exact and as simple as possible. It is exposed to all variations of temperature and humidity, to oxidization, often to corrosive vapors. It must be placed in unskilled hands, and its repairs ought to be easy and rapid. In the United States these qualities have hitherto seemed sufficient. In Europe we demand in addition an absolute fixity of light, through perfection of mechanism and excellent quality of carbons. It is thus that we have attained such completeness of construction.

The mechanism of alternating-current lamps presents one special difficulty. Not only does the self-induction reduce the current intensity in the shunt coils, making it difficult to obtain the same number of ampere-turns with the same current intensity, but this self-induction varies with the approach of the armature in such a fashion as to compensate in great part the variation of current, which tends to produce a variation of tension at the terminals. Mr. Claude has advanced the ingenious idea of correcting this effect by use of condensers in series, annulling the self-induction of the fine-wire bobbin, but this has not yet been practically applied.

Grouping of Arc Lamps.—Of late years two opposite tendencies have been manifested: The one, after that of Marks, in simplifying the installations and insuring complete independence of all lamps, has been to employ the high-voltage enclosed arc, working directly at 110 volts. The other, on the contrary, persevering in the original way, has sought to increase the efficiency by grouping the lamps, three in series, each absorbing from 30 to 35 volts.

Low-voltage Lamps.—Several methods have been advocated concurrently. Some manufacturers, like Siemens & Halske, or Körting and Mathiesen, have added to differential lamps an adjustable rheostat. A second arrangement invented by Mr. Henger, and much lauded under the name of the Volta lamp, presents no peculiarity of mechanism, but each series of three is supplied with a four-point automatic rheostat, all of whose sections are thrown in to light, and successively cut out in operation. Finally, Messrs. Vigreux and Brillé have invented a special mechanism which allows them to suppress the rheostat altogether, fixed or automatic.

The advantages of low-voltage lamps are the increase of the number of units, assuring a better division of the light, and, to a certain extent, an increase of luminous efficiency or economy of consumption. The disadvantages are increase of first cost, complication of mechanism and necessity for special carbons of very best quality.

Enclosed-arc Lamps.—The idea of the enclosed arc is old, having been first tried in 1846 by Staite and later by Varley and André. The lack of success of these experimenters was due to the fact that they sought merely to shield an ordinary arc from the air. The globe was rapidly clouded by an opaque film of powdered carbon. In 1894 appeared the modern type, characterized by a long arc under a voltage of 75 to 80 volts. Patents on this form were taken out almost simultaneously by Marks and Jandus, but Americans have conceded priority to the former. The use of enclosed arcs has spread rapidly in the United States, on account of their simplicity, and also of the small demands on the part of the public as to the fixity and efficiency of the light. In certain cities, such as Hartford, are employed circuits containing from 25 to 100 lamps of this sort, fed in series by constant-current transformers, analogous to those of Ferranti. Unfortunately, the efficiency of these arcs, at the present, at least, does not justify such a solution.

Carbons.—The essential base of European carbons is graphite, from gas retorts, carefully picked, separated by hand from silicious gangue, and mixed with variable proportions of lampblack, tar and certain chemical substances added to increase the durability or luminous power. All European manufacturers add to the carbon a mixture of silicates or borates, which give off conducting vapors. These European carbons have an extended use in the United States, but for the American trade alone an inferior grade is also produced. For low-tension lamps these must be made very soft and be copper-plated. This plating is abandoned in Europe save for lamps of projectors, for the globules of melted copper cause derangement and extinction of the lamp.

Reflectors and Globes.—The reflector invented by Cörper is employed to-day in all alternating-current lamps. The increase in the mean hemispherical intensity amounts to 10 per cent. for direct current and almost 50 per cent for the alternating current. Unhappily, the opaline globe absorbs a large proportion of the light, formerly 50 per cent. to 60 per cent., but now reduced to 15 per cent. or 25 per cent. Another more perfect method, combining great diffusion with the most favorable partitioning of the light, is that of the holophane globes, invented by Psaroudaki in 1893, after interesting experiments of Raffard and Trotter, and brought to great perfection by the American Holophane Glass company. These globes, with double prismatic flutings, so direct the light as to appear uniformly brilliant in all directions.

Luminous Output of Arc Lamps.—To avoid confusion, it is well to specify whether this output is spherical or hemispherical, i. e., whether it represents the quotient of the total luminous flux by the consumption in watts, or only that of the lower hemispherical flux by this quantity. For the lighting of open spaces the second alone is of interest, but in interiors having white walls it is the spherical efficiency which is to be sought.

In a series of experiments not yet published the author has compared the two classes of arcs under practical conditions and has found the following values (calling I the mean spherical intensity in Hefner candles and W the watts) between 300 and 1,500 watts:

Continuous currents.....I = 1.75 W.
Alternating currents.....I = 0.90 W.

These figures show well the inferiority of alternating currents, as has been already pointed out by other experimenters, notably Fleming and Pétavel.

The photometric study of the enclosed arc has

1. Abstract of paper read before the International Electrical Congress at Paris, August 18-25, 1900. Mr. Blondel is professor of applied electricity in the French National School of Bridges and Causeways.

been pursued by many experimenters. In these lamps the luminous intensity varies incessantly, but the total luminous flux changes little. The diffusing globe employed to give uniformity absorbs 30 per cent. to 40 per cent., and thus the final efficiency is moderate. The output of the enclosed arc is about two-thirds that of a good lamp with open arc of the same power, or almost that of two open-arc lamps of 4.5 amperes mounted in series.

According to the recent experiments of Matthiews, Thompson and Hilbish, upon the alternating enclosed-arc lamp, its efficiency is less than that of the ordinary incandescent lamp; the consumption reaches three to 4.35 watts per Hefner candle, compared to two watts for the direct-current enclosed arc similarly tested.

Progress of Incandescent Lamps.

According to Professor Weber, the temperature reached in incandescent lamps is from 1,565° to 1,588°, and it attains 40° more in large-filament lamps. Mr. Le Chatelier, by aid of his optic pyrometer, has found still higher figures (1,800°). Mr. Janet, from very accurate measurements made with the aid of an ingenious method based upon the cooling of the filament, has found figures from 1,610° to 1,720°, for 16-candlepower lamps at 65 volts.

Another point upon which we have somewhat definite ideas is the variation of the resistance of the filaments as a function of the temperature. In 1887 Mr. Anthony had observed in certain lamps a change in sign of the coefficient of temperature; later Mr. Howell has shown that the core of a filament decreases its resistance as the temperature rises, but that the carbon, loosened by the heating, behaves rather as a pure graphite and increases the resistance.

The two phenomena just mentioned present immediate interest in the choice of filaments for incandescent lamps.

Progress of the Manufacture.—As a whole, the methods of manufacture of incandescent lamps have not suffered any essential change within six years, though details have been considerably improved.

To-day very fine filaments are made, perfectly homogeneous and uniform, by the employment of cellulose, dissolved and formed under pressure. These methods, analogous to those for artificial silk, though having numerous variations, according to the solvent employed for the cellulose (chloride of zinc, ether-alcohol, sulphuric acid, etc.), and the mode of solidification, have to-day almost completely replaced all the others, even those of Edison and Swan, for ordinary filaments. However, they are ill-suited to the manufacture of filaments of large diameter. These are obtained more free from imperfections and more dense by squirting a carbon mass agglomerated under pressure, as for arc-lamp carbons. These modern filaments require no further padding by deposit of carbon, as was once necessary.

The art of obtaining a vacuum in the lamps has been much improved by the employment of very powerful mercury pumps, after a first vacuum (up to 0.5 millimeter of mercury) rapidly made by mechanical pumps. Certain manufacturers replace this second vacuum by a chemical vacuum (the Malignani process, etc.) obtained by previously introducing into the bulbs a secret chemical substance, which is heated in a second vacuum effected after the introduction of a hydrocarbon gas. The vapors produced are precipitated, removing every trace of air, and the vacuum is at once more perfect and quickly obtained (two minutes instead of 10 or 15) than is possible with mercury pumps.

The soldering of filament to leading-in wires, hitherto obtained by precipitation of carbon in a hydrocarbon liquid, is more often performed to-day by the aid of a dough of carbon and tar heated to a high temperature. The leading-in wires may be nickel or ferro-nickel, enamel conductors, or some substitute for platinum; but, in general, it has seemed best to merely reduce this length of platinum to a minimum (12 millimeters).

Luminous Efficiency.—The point where least progress has been made is in luminous efficiency, generally referred to the maximum horizontal intensity. Some excellent results have been announced by makers, but they are obtained generally on accumulator batteries. In practice the consumption is rarely less than 3.5 watts a decimal candle (1.14 Hefner candles), for in these conditions a variation of 10 per cent. in the voltage may change the intensity of a 16-candlepower lamp from 10 to 20 candlepower, and the efficiency from four to 2.6; a lamp forced further is rapidly destroyed.

In spite of the efforts of numerous producers and the experiments made with the view of reducing the disintegration of the coating, or even to suppress it altogether, the 220-volt lamps are inferior, as to life and efficiency, to lamps of the same power of 110 volts; moreover, the specific consumption increases very rapidly with the time; finally, it is difficult to make 220-volt lamps of small intensity—scarcely those of 16 candlepower. The true solution of the problem of making such lamps, and, a fortiori, of 500-volt lamps, seems then to be sought in the employment of a higher resistance filament than that of ordinary carbon.

Filaments of Other Materials.—The inconveniences of carbon filaments are their easy volatilization and their too great specific conductivity. Numerous investigators have tried other refractory substances, notably the carbides of borium, aluminum, silicon (carborundum), etc. Carborundum can be made into elastic and homogeneous filaments, but the blackening of the bulbs is very rapid and frequently accompanied by rupture of the attachments. Carbide of calcium gives slightly better results. These carbides seem more volatile than carbon.

Langhaus has tried, unsuccessfully, to cover a core of oxides with a deposition of borium or silicon. The only two proceedings of this sort which seem to be actually employed in the industry are due to Langhaus and to Maxim. The Maxim filament is formed from a carbide in crystallized powder, very hard, refractory, and of a high electrical resistance, obtained by a special process of precipitation, mixed with tar, and then shaped under pressure. According to these manufacturers, these lamps blacken less rapidly and give an increase of efficiency of about 25 per cent. They are still too novel to allow us to speak more exactly concerning them.

The same is true of the osmium filaments of Welsbach, concerning which much has been said in recent months, but which have not yet been presented to the public. These filaments are obtained in a number of ways, notably by heating a platinum wire in a hydrocarbon vapor, with steam and osmic anhydride. The filament of osmium, previously freed from its platinum core by exposure to a flame, is placed in the vacuum and submitted to a temperature higher than that of carbon filaments, and gives, it appears, twice the output. The disadvantages of this product seem to be the high cost of its manufacture and the too great conductivity of the substance employed, which does not permit a higher voltage than 20 or 30 volts. It is the same with filaments with base of tungsten, chromium, etc., proposed by others.

Filaments with Base of Oxides of Rare Earths.—A second, and entirely different, method to better the efficiency is to employ as incandescent bodies those presenting a more favorable law of radiation than carbon, in particular the oxides of rare earths already employed in incandescent-gas mantels, thanks to the beautiful discovery of Welsbach. It is important alike to electricians and gas dealers to understand the true causes of the remarkable efficiency of these burners. Certain authors (Nichol and Snow) have attributed this to a luminescent effect; to an exceptional emissive power (John); others (Bunte) to the very high temperature of 2,000° and a catalytic effect due to the presence of a small quantity of oxide of cerium (one-half to one per cent.), distributed on the surface of the body of thorium oxide. But in reality, and following the law of Kirchhoff, the beautiful experiments of Le Chatelier and Boudouard have discounted all these hypotheses and determined that the increased efficiency results simply from colored bodies having a more favorable law of radiation than black bodies at the same temperature (which does not exceed 1,650°). Thanks to an emissive power nearly unity for blue, green and yellow radiations, and a less one for the red and heat rays, the energy radiated per unit of surface is less than with carbon, but its composition is better. It is sufficient then to carry these oxides to the same temperature as the actual filaments to realize a large improvement in light efficiency. Thus numerous inventors have sought to apply a coat of these oxides to carbon cores, either by application of a paste, or by electrolytic deposition (Langhaus), or by an application of an impregnated tissue (Thowley), etc. To obviate the difficulty resulting from differences in the coefficients of expansion, other inventors have replaced the carbon core by a spiral wire of very refractory metal (chromium, tungsten, platinum, iridium, rhodium, etc.).

Jablochkoff, in 1877, and Nernst, in 1897, have suppressed all addition of this sort by utilizing the property which oxides and analogous bodies have of becoming conductors at high temperature. Mr. Nernst has made the lighting automatic by a platinum spiral placed near the filament, and by the employment of oxides which are much better conductors than those known before, through the mixture of two oxides behaving as a base and an acid. By means of these important improvements and those brought out by the Allgemeine Electricitäts Gesellschaft in its manufacture—mounting the filament, etc., the Nernst lamp appears to have reached the commercial stage.

Thanks to its high temperature, and especially to the properties of radiation of oxides, this lamp gives a beautiful white light, with a small consumption (1.75 watts per candle for 25 candlepower, 1.0 watt for 100 candlepower), in spite of the loss resulting from its employment in open air. The presence of an oxygen atmosphere is necessary to retard the decomposition of the filament by electrolysis. The practical life of the lamp is not yet determined, but it is to be feared that the filament forced so continuously will be fragile and very sensitive to variations of voltage. In all cases one must add in series a resistance with high coefficient of temperature to prevent too rapid an increase of current when the voltage rises. Hitherto the makers have been unable to build lamps for less than 25 candlepower, or less than 110 volts; but it is very easy to obtain lamps of 220 volts and even higher, lighted by hand or automatically.

Rating of Incandescent Lamps.—The adoption of different units (in France the decimal candle, in Germany and America the Hefner, which is only 0.88 of the decimal) creates an apparent advantage of foreign lamps over the French lamps. There is like disagreement in the definition of the luminous power of lamps, and the method of measuring it.

Lamps should carry an indication of their power and voltage correct within two per cent. of their performance. In acceptance tests the limit of variation is from six per cent. above to six per cent. below for luminous power and consumption. If more than a quarter of the lamps show greater variations, the consignment should be refused. The life beyond which the luminous intensity will fall off 20 per cent. should be indicated by the maker.

There is in reality but one rational way to measure the light of incandescent lamps, especially now, with all the varied forms, in nowise comparable; that is, to measure the total flux. The author has shown one method of so doing, viz., to rotate the lamp very rapidly about the axis of a lumenmeter. Mr. Ulbrich has indicated another, still more simple, arrangement, using a sphere with perfectly whitened interior. The intrinsic brightness is the same everywhere on its surface and gives by proportionality a measure of the luminous flux.

As to the rule to be adopted for defining the useful life of a lamp, there is general accord in France, as in Germany, to define this upon a basis of 20 per cent. under constant potential. This should be made the base of an international agreement. We desire to see a vote passed by the congress recommending the generalization of direct measurements of total luminous flux, and the provisional adoption of a light standard common to various countries, until a perfectly practical unit can be realized.

Peking-Matchiapu Electric Railway.

The Zeitschrift des Vereins Deutscher Ingenieure published in a recent issue an article on the Peking electric railroad, written by Mr. A. Fischer, an electrical engineer of the firm of Siemens & Halske. Following is an abstract:

"When the railroad from Tientsin to Peking was built the engineers in charge exerted themselves to the utmost to secure a concession from the Chinese Government to build the terminal station of the road in Peking, or at least in the immediate neighborhood of the capital. This terminus was to become a most important railway center, as it was to form at the same time the Peking station of the Peking-Fengtai-Paotingfu-Hankow line, and, later on, the great central depot of the Manchurian railway. But all efforts were entirely in vain. The railroad administration was forced to build the station at Matchiapu, three kilometers (1.86 miles) from the so-called Yungting-Mun, one of the southern gates of the capital. Here it was where the locomotives had to stop.

"But it soon became evident that at least some kind of connection had to be established between the Tientsin railroad terminus and Peking. After many proposals and schemes had been taken into consideration by the administration of the Imperial Railways of Northern China, this honorable body decided upon the construction of an electric railway. Several offers were considered, and finally that of Siemens & Halske of Berlin was accepted.

"The Chinese authorities determined that the road should first be built only from the Matchiapu station to the southern gate of Peking. From that gate to the central parts of the capital there remains still a distance of three kilometers, the line thus constructed reaching its object only partly. But the Chinese government refused permission to extend the electric line to the inner parts of the city, as it was a means of communication for the first time introduced in the Celestial Empire, and one did not know at that time how the population would behave itself with regard to the road. A further hindrance was found in the fact that it would have been very difficult to lay the tracks through the wall, no matter whether through one of the existing, or through a new, gate, as the population would doubtless have opposed this scheme energetically. Furthermore, would it have required a pretty long time until all these difficulties could have been overcome, and the only consequence would have been that the construction of the granted section had been indefinitely delayed.

"It was hoped that all the objections named would be overcome with less difficulty when the Chinese officials could be convinced by the completed part of the line that the people made use of this new means of communication and that they appreciated it. After the line from Matchiapu to the Peking gate had been completed, all expectations of our engineers were surpassed. From the opening day the cars were almost constantly crowded. With the exception of the higher positions, which were held by Europeans, exclusively Chinese help was employed, and the first Chinese electric railway came daily more into favor.

"Before the opening of the road it was, not without reason, feared that the lower part of the population, which up to the present time cannot find an explanation for the electric motive power, would consider electricity as an invention of the devil and would think it best to destroy it—just as they did with the first railroad built in the Celestial Empire. An attack was, I must admit, made upon the cars on the opening day—but only in order to get a seat! Very little can so far be said about the paying prospects of the line, as it was opened only in 1899. But, generally speaking, they seem to be satisfactory, especially when considering that it is only a suburban line.

"Soon after the completion of this section of the electric railway, work on the construction of an electric-light and power plant in Peking was started. For this enterprise the Siemens & Halske company formed a stock company styled Chinese Electrical company. The first purpose of this plant was to

supply the various foreign legation buildings with electric light, and then to extend the same all over the city. As the Imperial Palace at Peking and the Summer Palace at Wanchuchang had been lighted by electricity for several years, the electric light was nothing new to the Chinese. But in spite of this it was very difficult to secure a concession from the Chinese government for the establishment of an overhead line. That the Chinese officials finally granted the concession was chiefly due to the influence of the late German minister to China, Baron von Ketteler."

The outbreak of hostilities in China has naturally stopped all electrical enterprises in the Empire, but there is every reason to suppose that after peace has been restored a steady development in electrical matters will be noticed. It is to be hoped that the various nations whose troops now occupy the Chinese capital will ask and get guarantees that will render a repetition of similar troubles an impossibility. The attention of British manufacturers was, some time ago, especially called to the great possibilities offered to them in China by a speech of Lord Charles Beresford, delivered at a meeting of the Institution of Mechanical Engineers, in which he particularly mentioned the above-described electrical enterprises at Peking. This speech should also be considered as a lesson for all American electrical manufacturers, as it shows that there is a great field for electricity within the vast territories of the Chinese Empire, and that energetic efforts should be made to gain a firm foothold in that market before our great competitors, Germany and Great Britain, get ahead of us. H. L. G.

CORRESPONDENCE.

London Letter.

London, September 11.—Perhaps I cannot do better than to devote this letter to a synopsis of Sir William Preece's recent paper before the British Association on "Wireless Telegraphy and Telephony."

The speaker began by saying that Marconi's system of wireless telegraphy had been a good deal experimented on since 1896, but, unfortunately, had not yet established itself as of commercial value. It was now his privilege to announce a still more wonderful and easily practicable system of communicating across space without the use of communicating wires. The first experiments in this direction were made in February, 1894, across Loch Ness, in the Highlands. On that occasion trials were made to determine the laws governing the transmittance of Morse signals by his electromagnetic method of wireless telegraphy. Two parallel wires, well earthed, were laid one on each side of the lake, and arrangements were made by means of which the wires could be systematically shortened with a view to ascertain the minimum length necessary to record satisfactory signals. It occurred to Mr. Gavey, who was the experimenter, to compare telephonic and telegraphic signals, to ascertain whether articulate speech could be maintained under the same conditions as Morse signaling. The trials showed that it was then possible to exchange speech across the loch, at an average distance of a mile and a half between the parallel wires when the length of the wires themselves was reduced to four miles on each side of the water. The sensation created in 1897 by Mr. Marconi's application of the Hertzian waves distracted attention from the more practical, simpler and older method. Mr. Evershed and Dr. Oliver Lodge had in the meantime much advanced the system by introducing admirable call-methods. In 1899 they conducted some careful experiments on the Menai Straits, and these determined the fact that the maximum effects were produced when the parallel wires were terminated by earth plates to the sea itself. It became quite evident that the ordinary inductive effects were much enhanced by conduction through the water, and that, in consequence, shorter wires were practicable. No special apparatus seemed necessary, and the ordinary telephonic transmitters and receivers were used. It became desirable to establish communication between the islands or rocks known as the Skerries, and the mainland of Anglesey, and it was determined to do this by means of wireless telephony. It was desired to put the lighthouse at the Skerries in communication with the coastguard station at Cemlyn, which was connected with the Post-office system. The bottom of the channel was too rough, and the currents were too violent for a cable, and a wire 750 yards in length was therefore erected along the Skerries, and on the mainland one of 3½ miles was laid from a point opposite the Skerries to Cemlyn, each line terminating by an earth plate in the sea. The average distance between the parallel portions of the two wires was 2.8 miles. Telephonic communication was now readily maintained, and the service was a good one.

Further experiments with wireless telephony had recently been made between Rathlin Island, on the north coast of Ireland, and the mainland. The east and west portions of the island of Rathlin were about eight miles from the mainland, but a tongue of land projected southward to within a distance of four miles. Communication was required between the lighthouse near the northeastern corner of the island and the mainland, and the question for solution was whether an overland line running the whole length of the island from east to west was necessary to obtain good communication, or whether a shorter line across the neck of the southern peninsula would serve. The preliminary experiments proved conclusively that communication, both telegraphic and telephonic, was readily maintainable by means of temporary wires established across the neck of the peninsula along the shorter line. Wireless telephony across the sea was now a practical and commercial system. No experiments had yet been made with ships, but it would appear simple to speak by telephone between ship and ship, or between ship and shore, to considerable distances across space by means of a circuit formed of copper wire terminating at each end of the ship in the sea, passing over the topmast and using simple telephones.

In discussing the paper, Professor Oliver Lodge said that he had always urged that sea conduction was really a more important factor than the induction between the wires, though it might happen, in some cases, that the wire induction was more powerful or yielded stronger current. The simple process described by Sir William Preece had evidently a considerable future before it. Nevertheless, it was possible that there were cases where the Hertzian wave method might seem preferable.

S. F. Walker said he believed there were cases in which the working was better by a purely conductive system. At the same time, the inductive system might probably be considered preferable for communication from ship to ship, or between ships and the shore. Unfortunately, the whole telephonic system of communicating through space, either inductively through the air or conductively through the ground or the sea, was subject to the objection that anybody in the intervening distances who had a pair of conductors could read the message.

Sir William Preece, in reply, said there was no doubt a field for the Hertzian-wave system. It could be used in the navies of the world, and the British Admiralty was quite alive to its advantages. There were upward of 30 British warships already fitted with wireless telegraphy, and probably others would soon be equipped, but not necessarily with Marconi's system, as Captain Jackson, a naval officer in charge of that department, had made confidential reports on the subject to his official superiors before Marconi had announced his results. W. H. B.

New York Notes.

New York, September 22.—The Manhattan Railway company is putting in a moving stairway at the uptown station of the road at the southeast corner of Twenty-third street and Sixth avenue. This "escalator" is not the same as that at Fifty-ninth street and Third avenue, but is the Otis escalator. Instead of being a moving inclined platform, it is a moving stairway, a series of steps moving upward. The moving stairway at Fifty-ninth street and Third avenue is not patronized as much as was anticipated. In 15 minutes the other day five persons ascended by this route. During the same time 11 persons ascended on the old-fashioned half of the same flight of steps. These latter were evidently in a hurry, for those of them who started at the same time as others did by the escalator reached the top first in every instance.

A resolution to compel the Brooklyn Rapid Transit company to put its trolley wires underground was introduced by Alderman Alt at the last meeting of the board. It was referred to the committee on railroads. The resolution sets forth that the overhead wires are a menace to life, and that they interfere with the work of the Fire Department. It requests the corporation counsel to begin legal proceedings to bury the wires.

The rapid-transit commissioners are now contemplating the extension of the rapid-transit tunnel to Brooklyn. The plan now favored by a majority of the commissioners contemplates that the tunnel shall reach Brooklyn at the foot of Joralemon street and run along that street and Fulton to Flatbush avenue, with a station at City Hall. A large part of the preliminary work of removing sewer mains for the subway has been done, and excavation has been begun in every sub-section, except where elevated structures put obstacles in the way.

The Brooklyn Rapid Transit company has not yet begun to operate the motor-car trains on the Brooklyn bridge. This has been due to a misunderstanding between Bridge Commissioner Shea and General Manager Breckinridge of the Transit company. Commissioner Shea will not allow the trains to be operated unless bridge employes are in charge of the motor cars. A delay of some days will result while the bridge employes are being taught how to handle the cars.

Last week the new electric-light and power plant at the Brooklyn navy yard was started, and within a short time it will likely furnish all the electricity that is needed in the local navy yard. It cost about $200,000, and is the finest, as well as the largest, electric plant owned by the United States Navy. Hitherto, nearly every department at the yard has had its own electric plant, but it is claimed that with one central plant to supply the power, better service may be given at a saving of at least $100,000 a year. The installation includes three Standard Ball automatic vertical engines, of 300 horsepower and 250 revolutions per minute. Each engine is direct-connected to two 100-kilowatt generators, one pair being Siemens & Halske generators, the others of the General Electric equipment. Within a short time a condensing apparatus will be added to the plant, and then the engines will be run at low pressure instead of at high pressure, as is the case at present.

The second United States cable ship is now being fitted out at the Morse Iron Works, Brooklyn. This is the former transport Burnside, which will soon sail for the Philippines with 500 miles of deep-sea cable coiled in her three cable tanks. The cable will be laid under the supervision of Captain Squier of the Signal Corps. The copper wire of the cable is sheathed with 16 steel wires covered with jute, and the whole is incased in an outer covering of guttapercha, making the cost of the cable from $800 to $1,000 a mile. M. L. G.

Northwestern Notations.

Minneapolis, September 22.—The Union Electric company of Dubuque, Iowa, has petitioned the council for an extension of the time to 1901 to equip its cars with fenders. The company intends to put a new equipment in service, and will fit the new cars with fenders.

L. C. Spooner of Morris, Minn., contemplates installing a lighting and heating system.

Manchester, Iowa, has voted to grant a franchise for an electric-light system.

The Owatonna (Minn.) Electric company's system changed hands September 1st, and is now owned by Chicago men.

The Seattle Electric company of Seattle, Wash., has moved its general offices to larger quarters in the Holyoke building.

A Montana capitalist contemplates establishing a street-car system in Fargo, N. D.

Local capitalists at Hutchinson, Minn., have formed a stock company and will install an electric-lighting plant.

Suit has been begun in the United States Circuit Court at St. Paul against the Northern Pacific Railway company, to compel that corporation to maintain and operate a telegraph system throughout its entire line. The suit is based on the charter originally granted the old Northern Pacific Railroad company, which required the maintenance of a telegraphic system. The company has entered into an exclusive contract with the Western Union Telegraph company for the operation of the system. The suit demands that the railway company be compelled to operate the telegraph system without favor or discrimination.

The council of Duluth, Minn., unanimously voted to annul the franchise of the Duluth Street Railway company, on the ground that the company had failed to carry out its promise to improve the service. The line was recently consolidated with the Superior system and purchased by an eastern syndicate, in which Thomas Lowry of Minneapolis is largely interested.

The Minnesota Board of Equalization is not satisfied with the returns made on the property of the Twin City Rapid Transit company in Ramsey and Hennepin counties and the Duluth Street Railway company in St. Louis County. A resolution has been passed directing the officers of those companies to show cause why the assessed valuations of their properties should not be increased.

The council of Council Bluffs, Iowa, is considering an ordinance for the creation of the office of city electrician.

The Sioux City Traction company of Sioux City, Iowa, plans to extend its system to a number of points. The line now running to South Sioux City is to be extended to Dakota City and Homer, Neb. Eventually, the Leeds line will be continued on to LeMars, Iowa, the Riverside line to Elk Point and Vermillion, S. D., and the Morningside tracks to Sergeant Bluff, Salix, Sloan, Whiting and Onawa. Of course, the completion of these plans will be a matter of a number of years.

Alexander Hughes, of the Hughes Electric company, Fargo, N. D., contemplates buying the electric plant at Glendive, Mont. If the sale goes through, he will increase the plant and extend it.

The government has contracted for materials for the extension of the electric-light system at the Port Orchard dry dock near Seattle, Wash. When this is completed, it will be possible to work night and day at the dock.

Foreclosure suits have been begun in St. Cloud, Minn., on the property of the Benton Power and Traction company.

It has been reported that the Twin City Rapid Transit company would run its Stillwater interurban cars through St. Paul to Minneapolis. The company denies the rumor.

E. C. Morrow of Wallace, Idaho, has become superintendent of the Gas and Electric Light company's plant at Walla Walla, Wash.

The Butte Consolidated Street Railway company of Butte, Mont., has about completed the rebuilding of its power house and car barns at the lower end of Montana street. The cost was $65,000. The work has progressed slowly, as the old building had to be removed piece by piece and the new one built in its place, with the plant in operation to furnish power. The new plant, as completed, is one of the finest in the Northwest.

The Seattle Electric company of Seattle, Wash., has had four of its employes arrested on a charge of stealing a large amount of copper wire. The company believes there has been a systematic plan whereby the men implicated have taken not far from $1,000 worth of wire.

City Electrician Pinckney of Seattle, Wash., has just resigned his office, to become the manager of the Washington Electric Supply and Mantel com-

pany, of which he has just been elected president and manager. In leaving his office, the fire and police departments presented him a handsome gold watch. R.

From the Buckeye State.

Columbus, Ohio, September 22.—It is hardly probable that the Columbus, Urbana and Mechanicsburg Electric Railway company will get a complete franchise unless it agrees to use the loop now being built by the Columbus, London and Springfield company. In fact, the Board of Public Works has made the announcement that all interurban roads coming into the city must use this loop. The city compelled the company last named to build the loop, with the expectation that all the other roads would use it and pay a reasonable rental or proportion of the fares to the owners. The loop will cost the company about $60,000.

It is the opinion of some legal authorities that a blanket franchise cannot be given the Columbus Street Railway company, unless it forfeits all the rights it now has and abides by those contained in the new franchise. There has been no action taken in this matter yet, but the general opinion prevails that the company will be compelled to grant a reduction in fares before the desired franchise will be granted.

J. R. McComb will represent the Shelby Electric company on the road in Ohio this year. He is a good salesman, and will no doubt give the company satisfactory service.

Long hours were the cause of a short strike of the street-railway employes at Newark this week, but it did not last long, the men going back to work better satisfied than they were before. The lines were crippled slightly for a day or two.

A. G. Grant was granted a franchise for an extension of his Grove City line, from Grove City to Morgan's Station, by the Franklin county commissioners. If other lines wish to use the extension, the question of compensation is to be submitted to the county commissioners as a board of arbitration.

Edward Adams of Toledo has been made general manager of the Sandusky, Milan and Norwalk electric railroad. Mr. Adams is well up in electric railway business, having been connected with various companies about Toledo for the last 10 years.

The directors of the Chillicothe, Mount Sterling and Columbus Electric Railway company held a meeting at Chillicothe a few days ago and accepted a proposition which was made to the company by eastern capitalists. The officers of the company were instructed to sign the contract, which Colonel Field of Columbus, representative of the capitalists, had prepared.

Arrangements have been made to manufacture the Shelby lamp at Hamilton, Ont. This move is made to escape the high duties which have practically prohibited the sale of these lamps in Canada. The factory there will use the same machinery and devices that are used in the Shelby factory, and the filaments will be supplied from Shelby. It is expected that the Canadian trade will add greatly to the business of this company and will not hurt the sale of the Shelby factory's output in the United States.

All arrangements have been made to begin active work on the construction of the Toledo, Findlay and Fostoria electric railway. The contract for the construction and equipment of the road has been awarded the Dover Construction company of Canal Dover, Ohio, and the engineers are now at work locating the line. The power house will be located on the outskirts of Fostoria. The boilers, two in number, will be of 400-horsepower each, and generators of the same capacity will be used. The contractors say that work on the line will be begun within two weeks and that the power house will be built and equipped this fall and winter, so that at least a portion of the line may be put in operation early in the spring.

The power house of the Pomeroy and Racine electric road on the Ohio River has been completed and the machinery is now being installed. The track gang will be at work within another week.

The Sandusky, Bellevue, Monroeville and Norwalk Electric Railway company has given a mortgage of $600,000 to the Commonwealth Title Insurance and Trust company of Philadelphia, as trustee, to enable it to sell bonds for the construction of the road. This insures its completion, and it is expected that cars will be running over the line this fall. O. M. C.

PERSONAL.

The American Bridge company announces that Mr. August Ziesing has been appointed as the general western representative of the company, with headquarters at Chicago.

J. Arthur Jones, a young electrical man well known in Chicago, has joined forces with the Northern Electric Manufacturing company and will be connected with the Chicago office of that company at 939 Monadnock building.

George R. Metcalfe, formerly connected with the Sprague and Edison companies and for five years editor of Electricity, has accepted the position of electrical engineer for the Woods Motor Vehicle company of Chicago. Mr. Metcalfe is a technical man of experience and will no doubt acquit himself worthily in his new relation.

Edward P. Burch, consulting electrical engineer, Minneapolis, Minn., is retained as consulting engineer in the projected Albert Lea (Minn.) and Geneva electric railway and the Decorah and Waupun (Iowa) electric railway. Mr. Burch is also making improvements in the Cedar Rapids and Marion road, with the idea of enabling that road to haul more freight and to increase the economy per car-mile. He is also making tests of Iowa coal for another railway for the purpose of decreasing its operating expenses. Mr. Burch was formerly electrical engineer for the Twin City Rapid Transit company, which controls the Minneapolis, St. Paul, Stillwater and Duluth-West Superior systems. After resigning his position he was retained as consulting engineer of these roads. Mr. Burch has been identified with the development of many of the electric railways in the Northwest.

ELECTRIC LIGHTING.

The new electric-light plant at Tarboro, N. C., has been put into operation and is proving a success.

The Johnstown (Pa.) Steam, Heat and Power company has been incorporated, with $35,000 capital stock.

The new electric-light plant at the North Carolina state penitentiary at Raleigh has been completed.

Edward J. O'Beirne of Birmingham, Ala., has petitioned the City Council of Florence, Ala., for franchise to build an electric-lighting plant.

Arrangements are being made and work will soon commence for the erection of an electric-light plant and waterworks at the town of Clinton, N. C.

The Boston Electric Light company, on June 30th, had total assets of $5,329,648, a capital stock of $3,000,000 and debts of $1,777,156.

Bids will be received at the city clerk's office in the city of Rock Island, Ill., until October 1st, for furnishing the city with power pump and electric motor.

Kingsbury, Samuel & Co. of Baltimore, Md., have submitted the lowest bid ($9,999.45) for the erection of the electric-light plant at Fredericksburg, Va. The council will recommend acceptance of this proposal.

The Acme Gas company of Chicago was recently incorporated, with a capital stock of $50,000, to operate gas and electric plants. The incorporators were Charles W. Smith, Frank R. Hughes and Willis M. Cowen.

The city of Lake Providence, La., is now asking bids on its authorized $17,500 of bonds for construction of lighting plant and waterworks. As soon as bonds are placed arrangements will be made for letting contracts.

ELECTRIC RAILWAYS.

The Canton-Massillon (Ohio) Electric Railway company, which recently increased its capital stock to $1,000,000, has commenced the reconstruction of its Massillon lines.

Charles Dunbar and D. Gindlesperger of Brecksville, O., are the projectors of a road to start from Cleveland, pass through Brecksville and then reach out to Medina County.

The council of the village of Croswell, Mich., has granted a franchise to the Detroit, Lake Huron and Lexington Railway company to operate an electric railway within the village limits.

The Archbold-Brady company of Syracuse, N. Y., has been incorporated for $50,000 to construct street-surface railroads, electric-lighting plants, etc. The directors are W. K. Archbold of New York city, P. T. Brady and R. E. Drake of Syracuse.

The Grand Rapids, Holland and Lake Michigan Railroad company of Grand Rapids, Mich., recently executed a mortgage to the American Trust and Savings Bank of Chicago for $1,500,000 for the purpose of buying the Saugatuck, Douglass and Lake Shore and Holland and Lake Michigan railways, and constructing a double-track trolley line from Holland to Grand Rapids, Mich.

The fifth annual meeting of the Union Traction company of Philadelphia was held in that city on September 19th. The following-named directors were elected for the ensuing year: Thomas Dolan, William L. Elkins, Alexander M. Fox, John B. Parsons, William H. Schelmerdine, Alfred Smith, J. J. Sullivan, P. A. B. Widener, George D. Widener, George W. Elkins, Alexander Balfour and Charles O. Kruger. Mr. Kruger takes the place left vacant by the death of James McManes. The treasurer's report showed that the net earnings for the fiscal year ended June 30th were $938,020.96.

The cutting up of the streets by heavy coal wagons belonging to the Chicago Consolidated Traction company in Oak Park was recently a cause of complaint by the citizens to the Cicero Town Board. The board refused to act on the complaints, and John M. Roach, president of the Consolidated company, pleased at the attitude of the board, sent in a communication with a check for $400, to be applied to the street-repair fund of the district. Mr. Roach stated that, while the company did not consider itself responsible for the bad condition of the streets, it was desirous that the amicable relations existing between the company and the board might continue. The check was accepted, with a vote of thanks.

A threatened strike of street-railway men in Toronto has been averted by a compromise. The men, who are getting 16 cents an hour, asked 20 cents. President Mackenzie offered 17 cents to those who had been two years in the company's employment, and 18 cents to those of five years' service. This offer was accepted. Mr. Mackenzie, after getting a return of wages paid in the chief American cities, was of the opinion that the Toronto men could maintain as high a standard of living as any car employes on the continent. The majority of the men have served five years with the road. The increase in the wage account will be about $40,000 per annum, but the company's earnings this year are increasing at the rate of about $150,000 a year.

AUTOMOBILES.

The youngest licensed automobile driver in the world is now claimed by Chicago. He is Chauncey B. Blair of 4830 Drexel boulevard, and his father is Chauncey J. Blair, president of the Merchants' National Bank. Young Blair, who is 14 years old, received his license on September 21st.

The De Dion-Bouton Motorette company of Brooklyn announces that gold medals and first and second prizes were awarded in a recent 1,000-mile run at the Paris Exposition for De Dion motors and motorettes and for "voiturettes" manufactured by other concerns but operated by De Dion gasoline motors.

A novel use has been made of the automobile by William J. Bryan, who started out in one on September 22d from Lincoln, Neb., in his canvass of the first congressional district of the state. Three speeches were made that day, the last at Firth, 17 miles distant from Lincoln. The candidate returned to Lincoln at night.

The New York Motor Vehicle company has just finished a model public-passenger omnibus, and will have it on exhibition at the Automobile Show, in the restaurant section of Madison Square Garden, New York, November 3d to 10th. This company has an order for a large number of omnibuses, and the present model is the outcome of a considerable amount of study and investigation. It has adopted steam as the motive power. The model omnibus is made to seat 20 passengers, and differs in style and size from anything so far made in this country.

An interesting automobile suit was tried at Hackensack, N. J., where J. L. Guyre sued Dr. W. L. Vroom of Ridgewood for damages from a runaway, said to have been caused by the latter's automobile and resulting in the death of the plaintiff's wife. Dr. Vroom's testimony was that the horse was frightened and turned when 275 feet away from the automobile, which he stopped upon seeing that the animal was afraid. He said that he had the machine under perfect control and gave an exhibition in front of the courthouse to show the court and jury his ability to handle it. During the trial Justice Dixon said: "If the automobile occasionally or exceptionally frightens horses that would not make it a nuisance. In order to make it a nuisance its common effect must substantially interfere with the people who drive horses along the highway." After being out a few minutes the jury returned for further instructions on one point, at the same time informing the court that it had agreed that the automobile was not a nuisance.

PUBLICATIONS.

Among a recent list of titles of new books is this curious one: "Electricity and the Resurrection; or, The Soul and Science."

The Western Electric company, Chicago, has just published a 150-page, electric-fixture catalogue containing a complete list of stationary and adjustable fixtures, reflectors, metal and glass shades supplied by the company. A large stock of this material is constantly on hand, and the company is prepared to make prompt delivery.

At the time of the great Texas storm the Galveston Tribune had in press a 100-page publication entitled "Picturesque Galveston." One-half the edition was saved, and the Tribune tenders the profits of this publication to the Galveston relief committee, under whose auspices the book will be sold to the general public at $2 a volume.

The annual report of Thomas W. Flood, commissioner of wires of the city of Boston, for the year 1899, has been issued as a well-printed pamphlet illustrated by 23 halftone plates. The report shows the work accomplished in putting underground the electric wires of Boston and also much about the general condition of electrical affairs in that city.

The General Electric company is distributing a 92-page pamphlet on the subject of "Aging of Transformer Iron," containing five important arti-

cles that have been issued regarding this subject, as follows: "The Aging of Transformer Iron," by Prof. W. Elwell Goldsborough; "On Slow Changes in the Magnetic Permeability of Iron," by W. Mordey; "Effects of Prolonged Heating on the Magnetic Properties of Iron," by S. R. Roget, B. A.; "Hysteresis in Sheet Iron and Steel," by Arthur Hillyer Ford, and "The Aging of Transformer Iron and Steel," by J. A. Capp. This pamphlet should be of value to every central-station manager. It will be furnished free of charge upon application to the General Electric company.

POWER TRANSMISSION.

The Twin City Power company, recently projected with a capital of $1,000,000 to develop the water-power of the Savannah River, near Parksville, S. C., now has a party of hydraulic engineers at work estimating the available power.

TELEGRAPH.

A fifth submarine cable is about to be laid between England and Germany. An idea of the increase in the cable traffic between the two countries may be gathered from the fact that whereas in 1896, when the fourth cable was laid, the annual number of cablegrams was 1,867,868 per annum, no fewer than 2,465,613 cablegrams are now annually transmitted.

The German Telegraph company gave a banquet on the night of September 22d in Berlin, in celebration of the laying of the new Atlantic cable. Lieutenant-general Von Podbielski, secretary of state for posts and telegraphs, toasting Emperor William and President McKinley, said both fully recognized the importance of direct cable communication between Germany and the United States and the promotion of friendly relations between the two countries.

The United States steamer Iroquois, which has been on a surveying trip to the Midway Islands, to investigate the practicability of locating one of the stations of the proposed Philippine cable on one of the islands of that group, returned to Honolulu recently. Lieutenant Charles Pond, who was in charge of the expedition, will report in favor of the station being located at Sand Island, the western and larger of the two islands.

General Greely, chief signal officer, who went to Alaska to arrange for telegraphic communication with that territory, has reported that by making use of the Canadian line there will be communication with Fort Egbert, Eagle City, by the end of September. The Canadian line extends from Ashcroft north to Dawson City and the boundary line. The United States has constructed a line from Fort Egbert to meet this line. Another line is being built by the United States up the Yukon River, which, it is intended, shall connect with Fort Egbert, but it is not likely that it will be completed this season.

SPACE TELEGRAPHY.

A dispatch from Berlin states that the North German Lloyd steamer Kaiserin Maria Theresia on a recent trip succeeded in sending a message 100 kilometers (62 miles) by a wireless-telegraph apparatus.

It is reported that, encouraged by the success of its negotiations with the British Admiralty, the Marconi Wireless Telegraphy company of London proposes to renew its attempt to install its apparatus on the ships of the United States navy. Speaking to a newspaper correspondent, T. Flood Page, managing director of the company, is reported as having said: "Signor Marconi's invention did not need the seal of approval the admiralty has set on it, but that approval is bound to have an effect in influencing the other naval powers to adopt a system with which the warships of Great Britain and Italy will soon be equipped. It is safe to presume that their European rivals will not let them enjoy a monopoly in the enterprise. We have been in correspondence with the Navy Department at Washington. In fact, Secretary Long has detached an officer as a special commissioner to treat with us."

SOCIETIES AND SCHOOLS.

The Engineers' Society of Western New York has set on foot a movement for an engineering exhibit and a joint meeting of engineering societies at Buffalo during the Pan-American Exposition of next year.

Two June bulletins of the University of Wisconsin, published at Madison, Wis., contain the following papers: "Recently Improved Methods of Sewage Disposal," by Professor John B. Johnson, dean of the College of Mechanics and Engineering, and "The Chemical Engineer," by Magnus Swenson, special university lecturer.

The Armour Institute of Technology, Chicago, opened September 20th, with the largest freshman class in its history. A new course in railway engineering, under the charge of Professor Walte. Anderson, formerly of the University of Wisconsin, was announced. Other new members of the faculty are Leonard P. Dickinson, B. S. (Massachusetts Institute of Technology), instructor in electrical engineering, and C. H. Hurd, M. E. (Cornell University), instructor in mechanical engineering. The 1900-1901 year-book of the Institute, recently issued, contains the usual information concerning the courses, faculty, alumni, etc. The courses of study in the Armour Scientific Academy are also given.

MISCELLANEOUS.

Sealed proposals will be received at the office of the supervising architect of the Treasury Department at Washington until 2 p. m. on October 8th for the installation of a wiring system for the United States postoffice building at Newport, Ky., in accordance with the drawings and specifications, copies of which may be obtained of the supervising architect or at the office of the superintendent of construction at Newport, Ky.

There has just been completed in Milwaukee a 200-ton electric traveling crane, the largest ever built. The crane weighs 400,000 pounds, has a 65-foot span, and will operate on a track 56 feet from the floor. It was built by Pawling & Harnischfeger for the Midvale Steel company of Pennsylvania, and will be used in the manufacture of armor for battleships. It is estimated that 20 flat cars will be required to transport the crane. Its cost is $40,000, and it was a year in building.

Figures published by the New York Sun show that for the first seven months of this year the aggregate output of the United States copper mines was 352,990,360 pounds, against 326,736,800 pounds for the corresponding period in 1899, the increase being equivalent to about eight per cent. over last year's production. It is also stated that from January 1st to August 1st of this year the foreign reporting copper mines produced 113,335,040 pounds, compared with 114,282,560 pounds during the first seven months of last year.

United States Consul Worman of Munich states in a recent consular report that he has received inquiries from several persons in the United States as to the patent rights for the telegraphone, the owners thereof, etc. The Bank für Handel and Industrie of Berlin, says Mr. Worman, represents the syndicate which controls the patents for this device. The managers have informed him that the patent rights in the United States have already been disposed of. They also state that they are not in a position to give the exact information desired, as their attempts to produce the telegraphone in the highest possible perfection have not yet been successful.

Extensive thefts of wire used for carrying electricity have been perpetuated in Chicago of late. The plunderers have taken many wires and cables, and besides have razed police-patrol boxes to secure instruments and batteries. Five hundred feet of cable was removed at four o'clock last Saturday afternoon from the elevated structure west of Hoyne avenue. Two police-patrol boxes in Summerdale have been knocked to pieces and the thieves succeeded in taking the instruments away without attracting the attention of the policemen on the beat. In the LaSalle street tunnel the gang has removed a large amount of cable belonging to the fire-alarm and police-telegraph systems. Electric and street-railway companies have suffered more than the city. Their losses amount to thousands of dollars every year, because of the expensive material used. Electric currents apparently have no terror for the workers, as wires bearing 1,800 volts have been cut and carried away.

TRADE NEWS.

The capital stock of the Cutler-Hammer Manufacturing company of Milwaukee has been increased from $150,000 to $200,000.

The Lake Superior Power company of Sault Ste. Marie, Ont., is in the market for electric-railway bonds for about 2¾ miles of track. Bond makers are invited to submit bids and samples.

Ludwig Gutmann, consulting electrical engineer, has opened an office at 309 Y. M. C. A. building, Peoria, Ill., to carry on the designing of electrical machinery and also a general consulting business.

The Station Equipment company, Chicago, capitalized at $25,000, was recently incorporated, by Charles S. Andrews, Eugene G. Fassett and Guy Brockway. The company is organized to manufacture electrical and other machinery.

The Acme Electric company of Chicago, organized with a capital stock of $5,000, to manufacture electrical supplies and machinery, was a recent Illinois incorporation. The incorporators were W. Y. Miller Charles B. Stafford and Isaac M. Crane.

Foote, Pierson & Co., 82 Fulton street, New York, manufacturers of various telegraphic specialties, as well as other electric supplies, were recently pleased to receive word from Paris to the effect that they had been awarded a bronze medal. Foote, Pierson & Co. were rather astonished at receiving such a handsome recognition, from the fact that they had made no great effort to work for the medal, and had, in fact, made only a very modest, and, as the firm thought, an insignificant exhibit at the Paris Exposition. Such a surprise as this tells its own story as to the excellence of Foote, Pierson & Co.'s product.

The Lea Arc Lamp company of Anderson, Ind., has decided to change its name to the Lea-Hooven Manufacturing company. The following-named gentlemen are officers of the company: President, C. W. Hooven; vice-president, E. S. Lea; secretary and treasurer, A. G. Lea.

Consul Worman of Munich, under date of August 1, 1900, says that most factories in Germany have nothing like the American electric timekeepers, and that an effort to introduce them into Germany, especially into South Germany, where new enterprises are constantly being launched, ought to be successful.

BUSINESS.

The Electric Appliance company, Chicago, is calling attention to a letter from a customer, in which the latter states, in reference to the Adams-Bagnall arc lamp: "It has not one part too few nor too many."

The fine electric-light poles of the Lacombe Electric company, appreciatively referred to by the Denver correspondent of the Western Electrician in a recent letter, were furnished by Berthold & Jennings, dealers in wholesale lumber, poles, etc., St. Louis, Mo.

The Holophane Glass company is now issuing from its New York office literature and catalogues, not only in English, but in French, German and Spanish, as well. This concern is one of the medalists of the Paris Exposition, which speaks well for its novel class of goods.

The Wirt Electric company manufactures theater dimmers, rheostats and special Wirt brushes. Mr. Wirt is an electrical man of wide experience and his goods are well known. Thos. G. Grier of 141 South Clinton street, Chicago, has charge of the western business of the Wirt company.

The friends of Frank S. De Ronde, who has so long handled business for the Standard Paint company of New York, will be interested to know that Mr. De Ronde is now meeting with great success in his new undertaking, which was started about a year ago, under the name of the Frank S. De Ronde company. Mr. De Ronde has established branch offices in New York, Philadelphia and Chicago. His Lythite cold-water paint is said to be a bonanza, as it is a decided novelty in the paint trade. Lythite is being sold now all over the United States.

O. W. Firkins & Co., Minneapolis, Minn., continue to do a large business in Idaho red-cedar poles. Among the recent concerns to which poles were shipped may be mentioned the Mississippi Valley Telephone company, Minneapolis (about 500 poles); Sumner Telephone company, Sumner, Iowa; Fargo Edison company, Fargo, N. D.; Johnson County Telephone company, Iowa City, Iowa; County Telephone company, Waterloo, Iowa, and the Creston Electric Telephone company, Creston, Iowa. Firkins & Co. make a specialty of 40 to 80-foot poles, which are said to be giving the best of satisfaction wherever used.

The Webster Chemical company, St. Paul, Minn., manufacturer of the well-known Crystal chemical coloring for coloring incandescent lamps, is much elated over the constantly increasing demand for its product. Not only is Crystal coloring used largely in the United States, but orders are constantly received from all over the world. Crystal coloring can be obtained in nine or more colors. The process of applying it is simple and practically instantaneous, consisting merely of immersing the lamp in a bath of the solution, withdrawing immediately and drying upon exposure to the air, thus producing, the company says, a brilliant and durable transpareney. A pint will color 300 lamps. The Webster company is constantly receiving the most flattering testimonials from users of Crystal coloring, and states that those who once use it become permanent customers.

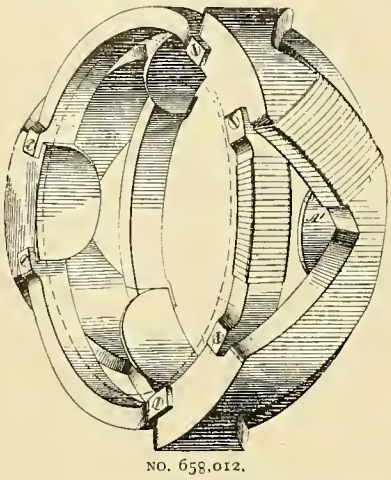
The Driver-Harris Wire company, 84 Mechanic street, Newark, N. J., manufacturer of the Climax and Advance german-silver resistance wires, has recently issued a price-list and wire tables covering its several brands of resistance wire. It is claimed for the Climax resistance wire that it has a high specific resistance and possesses strength and toughness far in excess of the ordinary wires used for resistance work. It has about 48 times the resistance of copper, it is said, while german silver has only 18 times, and ordinary steel wire about eight times the resistance of a copper wire of the same diameter. The low temperature coefficient of this wire fits it for any use to which german silver can be applied, and its high specific resistance renders it an economical substitute. Its mechanical properties make it available for rheostat work where german silver is useless, on account of the brittleness, caused by repeated heating and cooling.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 18, 1900.

657,908. Speed Regulator for Dynamos. Philemon W. Alexander, Tifton, Ga., assignor to the Alexander company, Tifton, Ga. Application filed February 7, 1900.

The apparatus combines with a dynamo a train of gearing provided with a flywheel and a ratchet connection, reciprocatory mechanism for operating the gearing, and an eccentric for connecting the mechanism with the axle of a car.



NO. 658,012.

657,910. Metallic Cement for Electric-conductor Joints. Willard F. Barber, Wilkesbarre, Pa. Application filed February 3, 1900.

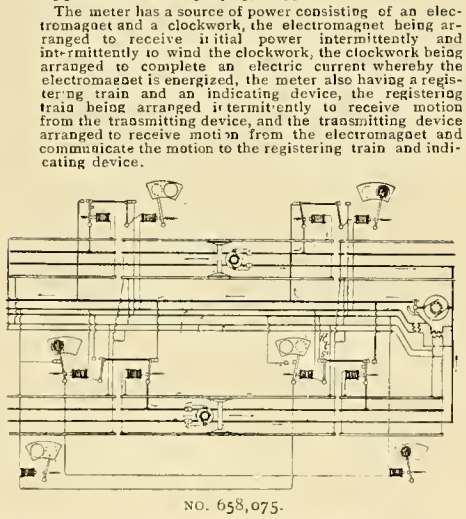
A conducting cement is described which comprises an amalgam consisting of zinc, tin, copper, cadmium, bismuth, lead, antimony and mercury, and a binding material consisting of glucose and silicate of soda.

657,911. Apparatus for Separating Metals from Ores by Electricity. George D. Burton, Boston, Mass. Application filed November 1, 1897.

In an electric furnace are combined a reducing chamber, the body of which is composed of an electroconductive resistance material and provided with an exterior flange, an electrode adapted for contact with the chamber near the top thereof under the flange and serving as a support for the chamber, and another electrode adapted for connection with the chamber at the lower part thereof.

657,983. Electric Meter. Jesse Harris, Lynn, Mass. Application filed July 5, 1899.

The meter has a source of power consisting of an electromagnet and a clockwork, the electromagnet being arranged to receive initial power intermittently and intermittently to wind the clockwork, the clockwork being arranged to complete an electric current whereby the electromagnet is energized, the meter also having a registering train and an indicating device, the registering train being arranged intermittently to receive motion from the transmitting device, and the transmitting device arranged to receive motion from the electromagnet and communicate the motion to the registering train and indicating device.



NO. 658,075.

657,984. Electric Measuring Instrument. Jesse Harris, Lynn, Mass. Application filed July 20, 1899.

The instrument comprises a coil or solenoid traversed by an electric current to be measured, the coil or solenoid having a tapering opening and a movable homogeneous magnetizable arm or body within the opening, and an indicator, the arm and the indicator being arranged to be moved by the influence of the current and to be operative in any position, and having means for bringing the indicator to zero when no current flows through the coil.

658,012. Dynamo-electric Machine. Mark H. Hurrell, Wimbledon, England. Application filed February 13, 1900.

Features of this dynamo are a field magnet comprising a series of like poles symmetrically spaced and arranged to operate upon one peripheral annulus of an armature, a second series of like poles of opposite polarity to the first series, the poles of the second series being spaced alternately with those of the first series and arranged to operate upon another peripheral annulus of the armature, oblique yokes magnetically joining all the poles and coils operating to magnetize the poles. (See cut.)

658,018. Coin-controlled X-ray Apparatus. Fritz Neugebauer, New York, N. Y. Application filed January 25, 1900.

The apparatus combines a lever adapted to be tilted by the weight of a coin, a pair of contacts adapted to be closed by the lever, one contact being adapted to place the bulb in circuit and the other contact being adapted to place a motor in circuit, and means actuated by the motor for dislodging the coin.

658,022. Maximum-electrical-current Indicator and Recorder. Ernest C. Rimington, London, England. Application filed May 3, 1900.

Combined in the apparatus are a closed electrolytic cell, an exit tube for the gases generated by electrolysis, a partially impeded exit to the atmosphere from the gas tube, and means connected to the closed end of the gas tube for permanently recording the highest pressure generated by the accumulated gases.

658,064. Switch for Alternating Electric Currents. Bertram Hopkinson, London, England. Application filed December 22, 1899.

The switch comprises two terminals in a circuit, actuating means for separating the terminals to break the circuit, and means controlled by the alternating current for rendering the actuating means inert until the instant in the cycle of the current when its value is zero.

658,075. Electric-railway System. William Robinson, Boston, Mass. Application filed September 22, 1897.

The system comprises a plurality of continuously closed multiple circuits formed in part of parallel sections of railroad track, a switch magnet included in each of the circuits, a source of electric supply furnishing current to the magnets through the sections of railroad track, the magnets being connected in multiple to the conductors from the source of electric supply and operating independently of each other, a traveling motor, a feed wire furnishing working current to the motor through a sectional working conductor normally disconnected from the feed wire, the circuit of the motor being controlled at successive stages by the switch magnets in succession, and means consisting of the wheels and axles of a car for actuating or controlling the magnets by short-circuiting the working-conductor sections being independent of the switch-magnet circuits. (See cut.)

658,100. Armature for Multipolar Dynamos. James J. Wood, Fort Wayne, Ind., assignor to the General Electric company of New York. Application filed June 14, 1898.

The armature comprises end spiders and an intermediate core and a winding extending across the periphery of the core and overlying the surface of the spiders, and provided with ventilating air ducts or channels extending outwardly between the spiders and core and then laterally along the spiders beneath the winding. (See cut.)

658,117. Automatic Maximum-speed Governor for Electrically Propelled Vehicles. Horace F. Parshall, London, England. Application filed June 12, 1897.

A line circuit is combined with a motor supplied thereby, a circuit-breaker controlling the current flowing to the motor, an auxiliary source of electromotive force, and means for actuating such circuit-breaker by current from the auxiliary source when the motor speed rises too high.

658,192. Electric Conductor. Frederick C. Sutter, Pittsburg, Pa., assignor to the Pittsburg Transformer company of Allegheny County, Pa. Application filed December 30, 1899.

A stranded cable is provided with an insulating covering, a device for preventing the passage of liquids along the cables consisting of a section of the cable devoid of insulating covering and having the interstices between the strands filled with solder or like material.

658,225. Circuit Controller. Charles C. Webster, Asbury Park, N. J. Application filed January 19, 1900.

A circuit controller for an electrically illuminated sign comprises a rotary part, contact plates, each having electrical connection with lamps forming a letter, spring-contact plates co-acting with the contacts and having connection with one of the supply wires, a holding latch for each spring contact, lugs carried by the rotary part for engaging with cam-shaped projections on the spring contact, and lugs carried by the rotary part for disengaging the latch from its holding position.

658,235. Secondary Battery. Victor Cheval and Joseph Lindeman, Brussels, Belgium. Application filed January 19, 1900.

In an accumulator battery is an electrode consisting of a series of cartridges with perforated envelopes containing active material, in combination with another electrode consisting of other perforated envelopes surrounding the cartridges, with intervening spaces for the electrolyte, active material packed around the outer envelopes and between them and the walls of the battery, and conducting rods in such active material.

658,237. Electrical Warp Stop-motion for Looms. Joseph Coldwell and Christopher G. Gildard, Fall River, Mass. Application filed January 11, 1900.

The stop motion comprises longitudinally arranged circuit rods and a lower intermediate electrical conductor, opposite series of drop bars loosely embracing the circuit rods and normally supported out of contact with the electrical conductor by the warp threads of the loom, the circuit rods serving to guide the drop bars in their movements toward the conductor, tie rods located above the circuit rods, and a bridge piece carried thereby and having lower slotted portions embracing the circuit rods.

658,238. Motor-vehicle. Clyde J. Coleman, Chicago, Ill., assignor of fifty-one one-hundredths to Thomas J. Ryan, Chicago, Ill. Application filed September 2, 1899.

An electrically propelled motor vehicle is described. It combines a pair of electric motors, the armatures of which are provided with independent coils or windings, two or more groups of storage batteries, and a current controller co-operating through its switch brushes, in one position to close the circuits with the batteries in multiple and armature windings in series, in another position to close the circuits with the batteries in multiple and the armature windings in multiple series, in another position to close the circuits with the batteries in multiple and the armature windings in multiple, and in another position to close the circuits with the batteries in series and the armature windings in multiple.

658,239. Automatic Feed-water Regulator. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed October 27, 1899.

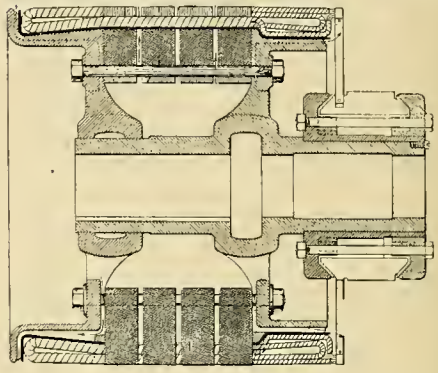
The regulator combines a vapor-pressure generator, a motor, a feed pump operated by the motor, a single separating wall between the generator and pump, means for opening communication between the atmosphere and valve chamber of the pump, an operating shaft for such means, and means within the generator for automatically controlling the operation of the shaft, the shaft extending through the separating wall.

658,243. Trolley. William A. Daggett, Vineland, N. J. Application filed May 23, 1900.

In the trolley are included a frame comprising side plates, a trolley mounted to rotate in the upper end of the frame, a spring-yielding connection between the frame and the trolley pole, and a curved arm extended underneath the spring.

658,282. Signal. John M. Sailer, Janesville, Wis. Application filed December 15, 1899.

Combined with a vibrating hammer of a telephone call device and an uplifting circuit-controlling arm are a signal, a signal-concealing device, a signal-supporting device, the supporting device being constructed to engage the vibrating hammer of the call device and to be released therefrom by the vibration of the hammer, and an extension of the signal-supporting device located above and adapted to fall on the uplifting arm when released from the call device and to be lifted thereby to its initial position when the arm moves upwardly.



NO. 658,100.

658,299. Electric Gas-lighter. Henri de Thiersant and Hans J. Norballe, London, England. Application filed May 14, 1900.

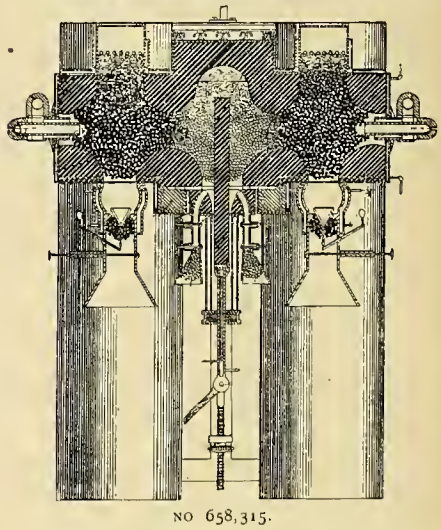
An electric gas-lighting device consists of a main burner, a by-pass burner for lighting the main burner, a cock provided with a ratchet wheel for governing the gas supply to both of the burners, a sparking device for igniting the gas supply from the by-pass burner, an armature and magnet operating the ratchet wheel on the cock and oscillating the sparking device and an auxiliary armature and magnet controlling the movement of the cock and thereby varying the gas supply.

658,301. Telephone Relay. William G. Urmson, New Brunswick, N. J., assignor of three-fourths to John W. Parsons, Henry A. Hull and Josiah Tice, New Brunswick, N. J. Application filed February 5, 1900.

The relay comprising the combination of a microphone having electrodes separated by an air space, conducting material surrounding the electrodes, tension devices for holding the electrodes in a position of poise and an electromagnet for varying the action of the tension devices.

658,315. Electric Furnace. Alfred H. Cowles, Cleveland, Ohio, assignor to the Electric Smelting and Aluminum company of Illinois. Application filed October 22, 1895.

The furnace comprises an electric smelting chamber to be charged with the material to be reduced and having electrodes and electric-circuit connections therewith, two chambers to be charged with fuel, flues connecting the electric smelting chamber intermediate with the fuel chambers, and means for causing a reversing flow of an aeriform fluid through the fuel chambers and the intermediate electric smelting chamber. (See cut.)



NO 658,315.

DESIGNS.

33,230. Electric-cell Body. Ernest F. Yost and William H. Smith, New York, N. Y. Application filed June 28, 1900. Term of patent, 7 years.

33,231. Electric-cell Body. Ernest F. Yost and William H. Smith, New York, N. Y. Application filed June 28, 1900. Term of patent, 7 years.

Western Electrician.

EVERY SATURDAY.

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Electricity at the Pan-American Exposition.

By Frank C. Perkins.

The electrical attractions at the Pan-American Exposition during the coming year will undoubtedly surpass anything previously attempted in the spectacular line. The latest plan of the exposition is seen in Fig. 2 (page 212). Entering the Lincoln Parkway gate, which is the main entrance, as noted at the bottom of this plan, at the left will be seen the Albright Art Gallery, which will be a permanent building and will be left after the exposition as one of the park buildings. This building will be of white marble, costing more than a third of a million dollars.

On the right, on entering the park, is the beautiful new boathouse erected by the city of Buffalo. From this building the electrical boats and gondolas will leave for trips about the park lake, which will be brilliantly illuminated by many festoons of incandescent lamps of four candlepower, eight candlepower and 16 candlepower, which will be installed along the lake shore and through the shrubbery and flowerbeds laid out through the Park Lake Grove.

Park Lake Electric Fountain.

A novel and beautiful electric fountain has been designed for the Park Lake, opposite the electric boathouse, by Luther Stieringer. The details of construction were kindly furnished by Henry Rustin of the electrical engineering department. The electric fountain will be built up with artificial rockwork and will have about 30 orifices, from which streams under various pressures will be used. This fountain will be used for special displays and will be of a very interesting character. The piping system for the fountain combines two sets of pipes, one of which will be supplied with water at high pressure and one with low pressure. The low-pressure pipes will supply water to the fountain jets at about 50 pounds' pressure, while the high-pressure system of pipes is to be supplied by electric pumps at 225 pounds' pressure, handling about 15,000 gallons of water a minute.

The wheat sheaves are to be operated from the low-pressure pipes, while the fog bank will be supplied from the high-pressure. The geyser effects will be elaborate and will be operated from seven-eighths-inch orifices from the low-pressure system of piping. The high-jet effects will be produced from the high-pressure system, which, with openings 1½ inches in diameter, will throw numerous streams of many colors. There are to be 30 direct-current, 40-ampere, focusing projectors operated by a 110-volt current from the power house near the edge of the grounds, used for auxiliary power supplied by steam engines.

Decorative Effects.

Crossing the bridge, between the lake and the North Bay, the New York state building may be seen on the north bank of the bay. This is also of white marble, fireproof and a permanent structure. It will be devoted after the exposition to the uses of the Buffalo Historical society. Continuing up the slight grade, we now come to the "Approach," where we will get the first broad view of the fine group of buildings, beautifully decorated with incandescent lamps of four, eight and 16 candlepower, a total of more than 125,000 lights being used. No arc lamps will be used in the general decorative effects. More than 3,000 arc lamps, however, will be required to light the driveways and paths around the boundary of the exposition and leading drives to the various entrance gates.

Standing in the forecourt (see Fig. 2), and looking north, immediately in front is the Triumph bridge, brilliantly illuminated with its numerous lamps. This bridge will be one of the most beautiful works of the exposition. It is to have four great piers, surrounded and surmounted by sculptured groups modeled by Mr. Bitter and others. On either side of this bridge is Mirror Lake, connecting with the canal which surrounds the grounds. Electrically illuminated bridge cascades flow into these lakes with beautiful effect. Entering the Esplanade, which will hold a quarter of a million people, pergolas and esplanade fountains are on either side, the quiet water of the fountain basins reflecting the varied light from thousands of floating incandescent lamps in the forms of fleur-de-lis.

In the Court of Fountains.

The water displays of the Pan-American Exposition will be a great attraction. In all the courts are to be large pools, into which beautiful cascades and fountains will throw their crystal streams, and to the water features will be added the garden effects, which will comprise large sunken gardens, with formal beds of rare and beautiful flowers; and many plants of a highly decorative character will be displayed throughout the courts.

In the Cascades of the Court of Fountains there are to be thousands of floating incandescent lamps of four, eight and 16 candlepower, operated from the 104-volt, polyphase alternating current from Niagara. The electric fountain in this basin will consist of 16 geysers, which will be supplied with water from a special system of pipes, under a pressure of 150 pounds. There will be 16 30-ampere, direct-current projectors of the focusing type, but specially arranged for operating in series upon a 500-volt circuit. Two sets of projectors, with eight lamps in series, will be used in this particular instance.

The Court of Lilies, on the left, and the Court of Cypresses, on the right, will also be illuminated with special decorative lamps.

Electric Tower and Grand Basin.

Directly in front of the Court of Fountains is the Grand Basin and the Howard electric tower. In a niche of the tower, facing the Court of Fountains, is to be a waterfall 30 feet wide and 70 feet high, and the entire tower, 375 feet high, will be illuminated within and without, and as most ingenious arrangements will be made to produce remarkable effects, the resulting appearance should be something to be remembered. The tower proper is flanked on the east and west by long curved colonnades, which

FIG. 1. ELECTRICITY AT THE PAN-AMERICAN EXPOSITION.—MACHINERY AND TRANSPORTATION BUILDING FROM THE WEST.

sweep to the southward and terminate in airy pavilions, forming a semicircular space 200 feet across. Within this space are many cascades, while all about the basin are leaping jets and playful figures, each with its spurt of water, combining to make a brilliant water scene, particularly as each jet is varied in color and shape. These jets are operated from the 150-pound pressure pipes, and all the projectors are directed toward the water features. Eighty-six direct

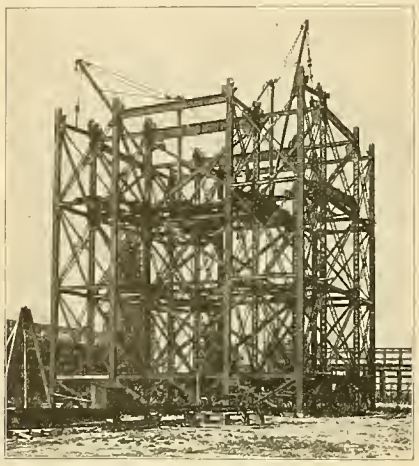


FIG 3 ELECTRICITY AT THE PAN-AMERICAN EXPOSITION.—FRAMEWORK OF ELECTRIC TOWER.

current projectors will be used in the Grand Basin, in the center of the niche, where the tall geyser fountain is located. These projectors are arranged eight in series on the 500-volt circuit, which is to be provided for supplying current for the arc projectors. Thirty amperes will be utilized in these lamps, which are specially constructed for this purpose. The waters thus illuminated by the numerous colors find their way from the high basin within the niche over successive ledges and among a multitude of vases, to the level of the pool.

The accompanying illustration (Fig. 3) shows the progress which is being made in the construction of the tower, while Fig. 4 gives a view of the completed electric tower as it is expected to appear at night.

The main body of the tower is 80 feet square. From the surface of the water to the top of the colonnade is 75 feet. This portion of the structure is enriched by a system of decorative rusticated bands, which give an aspect of great solidity to the base. The shaft of the tower is treated with great simplicity. The center of each side is paneled with fantastically perforated work, through which is indistinctly revealed the massive framework of the tower. This feature is calculated to produce a remarkable effect when lighted from within, as it is the intention to do.

The entrance to the tower is across an ornamented bridge from the plaza on the north side. Elevators will carry passengers to the various floors, which will be devoted to different purposes of the exposition, such as reception rooms, offices, restaurants, belvederes and amusement halls. A large restaurant and roof garden, at a height of 200 feet, will give the diner a broad and beautiful view of the exposition and the surrounding landscape. From the cupola the eye can sweep the whole Niagara frontier and look far into Canada.

The illumination of this tower will require the use of several hundred miles of wire representing, it is said, more than 250 tons of copper of various-sized wires. The entire exterior of the tower will be studded with 104-volt lamps operated by the current from Niagara Falls. These lights will be so arranged that a great variety of effects can be produced. The use of the electric lights, in combination with the sparkling fountains and cascades, will undoubtedly produce scenes of fantastic beauty.

Alternating-current Distribution.

In one corner of the Electricity building are to be located the step-down transformers and switchboards for supplying the alternating power and lighting current for use in the various buildings. About 5,000 kilowatts of Niagara power will be utilized for decorative lighting and operating the various polyphase motors which will be in operation in the electrical and machinery buildings. Nineteen air-blast, step-down transformers will be installed, each set reducing the high-pressure, 11,000-volt current to 2,200 volts, ready for distribution throughout the grounds. In Fig. 1 is shown the machinery and transportation building, nearly completed.

Probably for the first time in the history of incandescent lighting at expositions, an alternating current will be used, with a frequency of only 25 cycles. It will be interesting to note the effect, and it will be easily determined whether the current of

FIG. 4. ELECTRICITY AT THE PAN-AMERICAN EXPOSITION —ELECTRIC TOWER AS IT IS TO APPEAR AT NIGHT.

such a low frequency, which is especially desirable for self-starting, alternating motors, will also prove satisfactory for interior and exterior incandescent decorative effects. Underground conduits will be laid to all the buildings and to the other points of light and power distribution, and the current will be conducted to more than 200 transformer pits, where the current will again be reduced from 2,200 volts to 104 volts for general purposes.

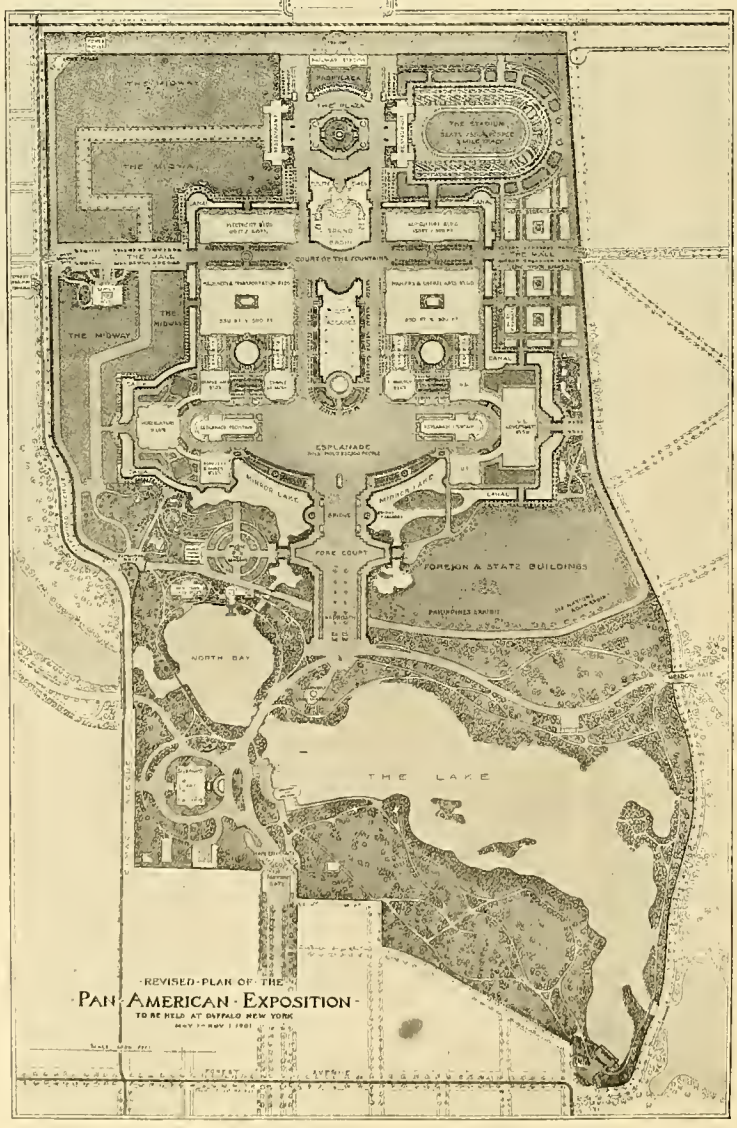


FIG. 2. ELECTRICITY AT THE PAN-AMERICAN EXPOSITION.—MAP OF GROUNDS.

Drainage Canal Power Development.

After various postponements and amendments in committee, the Chicago City Council has approved the contract between the city and the Sanitary District trustees for the development of the Drainage Canal waterpower at Lockport for municipal purposes. The instrument has received the sanction of the sanitary trustees and the signatures of the various officials will place it in force.

The price named in the contract is $4 a horsepower a year, but an annual appraisement by specially appointed representatives of the contracting parties is provided for. The contract is to date 75 years from July 1, 1901.

Development of the power is dependent upon the city's right to issue bonds to the amount of $2,500,000, the estimated cost of the improvement. As soon as the contract is signed, legal proceedings to determine whether the city has exceeded its limit of indebtedness will be instituted by the city law department and carried at once to the Supreme Court. In case a decision is unfavorable to the city, the sanitary trustees, according to the contract, have the power to sell the right to other persons, and the present instrument becomes null and void.

Each party reserves the right within six months after the execution of the contract or within 30 days from the final adjudication by the Supreme Court to annul the contract by serving formal written notice. It can be terminated at any time by either party upon one year's notice. If the sanitary trustees take that action, the city must be paid a fair cash value for the improvement, to be determined in the courts, and in case the city fails to make its payment for six months the plant will revert to the district. For the present the city is required to use all the power generated for municipal purposes, though the district is given the right to draw off 12,000 cubic feet of water a minute, or two per cent. of the maximum power, for its own use.

The Arcadia and Clifton Heights railroad has been incorporated at Harrisburg, Pa., to build a road 2½ miles in length in Delavan County. The capital stock is $25,000.

Dolter Surface-contact Traction System.

The Dolter system belongs to that group of traction systems in which connection between the contact pieces between the rails and the feeding cable beneath is effected by electromagnets placed beneath the car. These magnets are suspended by a chain swing from the truck frame, so that their shoe strips slide over the face of the contact pieces. The current passes first through these to the controller and motor, and thence to the rails. Each contact-box section embraces a cylindrical chamber of manganese, a cover carrying the contact piece, an inverted L-shaped arm pivoted to this cover and swinging its lower end into contact with a fixed carbon button, and a spring connection between this button and the feed cable. The contact box is fixed to two cross-ties of oak in such fashion that it keeps always the same position relative to the rails.

The surface-contact piece consists of two half-disks of steel sunk in asphalt, which insures their electrical insulation and magnetic separation. The whole forms the cover and is fastened to the manganese box by four screws. The circuit-closing lever mentioned above has a short horizontal arm of soft iron, which is attracted by the passing magnets, and a longer vertical arm of insulating material, within which is an aluminum wire by which the carbon-contact button at its lower end is connected to the two surface disks.

The contact shoes on the car are, of course, longer than the distance separating any two successive contact boxes, and are thus kept continually magnetized, while the circuit of the car is closed. A small storage battery is put in shunt around the shoe magnets. Ordinarily, this battery is charged by a small current while the car is in motion. When all current has been shut off, the car may be started again by throwing this battery current through the magnet coils and thus closing the main circuit in the contact box. The lamps of the car are also fed from this battery during stops.

Lest in any way a box should not break circuit with the feeder mains after the shoe had left it, thereby remaining dangerous to pedestrians and horses, a "safety shoe" is carried behind the contact shoe and directly connected to the car wheels. Thus, a short-circuit will be established at the defective box and the aluminum wire therein blown, acting as a fuse.

Mr. Dolter claims many advantages for this system over the Diatto system now in use on several lines around Paris. Any irregularity in the level of the mercury in the cups of the latter system will keep boxes so affected cut in or out. Moreover, the magnetic circuit of the Dolter system is better, allowing no air gaps. The contact shoes used in the Diatto system are so wide that a slight inclination to the vertical may produce a short-circuit to ground, and there is no safety device for cutting out defective boxes.

The company holding the Dolter patents has equipped a line 750 meters long near Maillot, running to Suresne. Since May 1st a car has traveled 1,900 kilometers over this line without showing defects. The facts in this brief account are taken from L'Eclairage Electrique.

Earth Telegraphy Proposed.

Mr. Willet, chief inspector of the French telegraphs, in a paper read before the Electrical Congress at Paris, indicates his belief that in space telegraphy the waves are transmitted through the earth, and not through the air. His theory involves communicating through the geological beds, in which the earth's electricity has the same tension, the idea being that any disturbance at one point on the same electric level creates what would naturally be called a swell in the whole level, leaving the higher and lower strata comparatively undisturbed. Mr. Willet proposes to tap these levels, boring shafts and measuring the electrical tensions with the electroscope. It is said that the French telegraph department has appointed a committee to sink shafts to ascertain the distribution of the electric levels.

The council of Oxford, Miss., is considering the question of erecting an electric-light plant.

New German-American Cable.

The events of the last few years, and especially the South African War and lately the troubles in China, have shown again that the world, as far as transoceanic cable communication is concerned, depends upon the good will of Great Britain, which owns a great preponderance of the cables to all parts of the world, thus controlling the chief routes of the international telegraph service. These and other reasons induced Germany to establish its own direct cable communication with the most important non-European country, the United States of America.

The greatest difficulty in laying the cable was its length. It is a well-known fact that the speed of transmission in submarine cables decreases with the square of the distance, and in order to maintain the usual speed of international telegraphic traffic it was necessary to establish an intermediate station, which could, on account of the course of the cable, only be erected on the Azores Islands. There, however, an English cable company possessed the exclusive right of landing, and the permission of landing the German cable on the island of Fayal could only be secured by placing the contract for the construction of the German line with this English firm.

After the coast end of the cable had been laid on the German island of Borkum in the spring of this year, the cable was formally and impressively named in the presence of the highest German postal and telegraph officials. This ceremony is the subject of one of the illustrations. The entire line was completed during the course of last summer by the English cable steamers Anglia and Britannia, the latter shown in an accompanying picture.

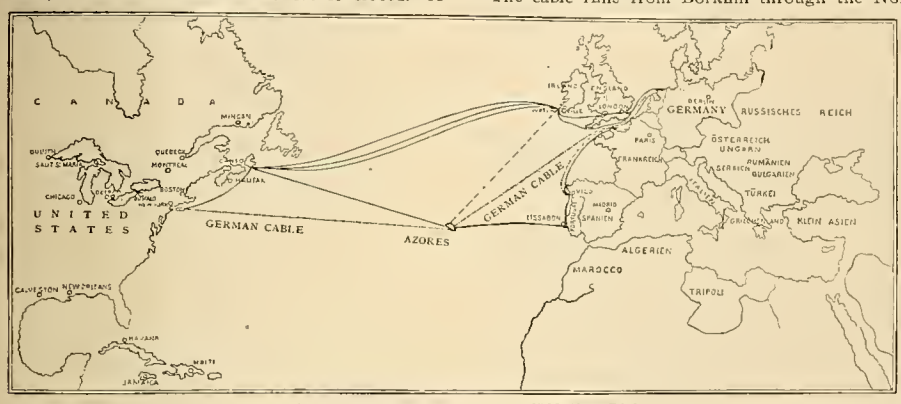
The cable runs from Borkum through the North Sea and the English Channel in a direct uninterrupted line to Fayal, Azores, whence, as shown on the map reproduced from a German contemporary, it stretches without any interruption to Coney Island, New York. The telegraphic messages are here received and transmitted to their points of destination by the Commercial Cable company, which has made a special contract with the German authorities. The German line, through the Commercial Cable company, is also direct connected with the French cable system, extending by way of the Antilles to the northern coast of South America.

In case the German cable should at any point be interrupted, direct communication would not be shut off, as, by virtue of the contract concluded with the Commercial Cable company, the latter's Fayal-Canso (Nova Scotia) line could be used, while during an interruption of the Fayal-Borkum section, messages would be transmitted over the wire of the Europe and Azores Cable company to Lisbon, and from there to Vigo (Spain), where they would be received by the German cable from Vigo to Emden.

The total length of the new cable is 8,086 kilometers (5,021 miles), and the total expenditure amounted to about 19,000,000 marks ($4,750,000). There is no doubt that the enterprise will be a financial success, especially as minimum receipts of 1,400,000 marks have been guaranteed. The cable is worked at Fayal and Coney Island by the German Atlantic Cable company, while at Borkum the administration is in the hands of the German government,

ENGLISH CABLE SHIP BRITANNIA.

which will receive a certain amount of the profits of the cable as soon as the receipts exceed 1,600,000 marks a year. The rate is one mark for each word, the same as that of all other companies between New York and the Continent.



ROUTE OF THE NEW GERMAN-AMERICAN CABLE.

Spokane River Development.

The waterpower of Post Falls, Idaho, on the Spokane River, is to be converted into electrical power and transmitted to the Coeur d'Alene district, there to be furnished to the mines for their operation. The available power of the falls is about 10,000 horsepower, but the plans are for a plant with a capacity of 5,000 horsepower. This, it is estimated, will furnish sufficient power to operate all the Coeur d'Alene mines for two or three years. Among the capitalists interested are R. K. Neil, J. A. Finch, Chas. Sweeny and F. R. Culbertson. These men have secured the entire control of the Post Falls waterpower from its original owner, Frederick Post of Post Falls. The transmission line will be 69 miles long, reaching the Canyon Creek air station in that distance, and the Wardner mines in 50 miles. The power is developed under dams under a 44-foot head.

The owners of the new enterprise being chiefly the owners of the mining interests to be served, the project will, to a large extent, be on a co-operative plan at its business end. Mine owners will not be asked to make any investment in new machinery, but will be furnished with compressed air from the central station, the compressors to be driven by electricity. Active construction work on the plant will be begun immediately, and the company hopes to be delivering power into Coeur d'Alene early next year.

NEW GERMAN-AMERICAN CABLE.—LANDING CEREMONY AT BORKUM.

A franchise for construction of an electric-light plant for Marion, Va., has been granted to Palmer & Grosscup of Washington, D. C.

The Telegraphone.

Among the new apparatus shown at the Paris Exposition, the telegraphone, invented by the Danish engineer, Valdemar Poulsen, has probably awakened the greatest interest, both by the novelty of its principle and by its application to telephone work. The instrument has been examined by a great number of scientists and practical men, and has created a very favorable impression. It is the opinion of some that this instrument solves the problem of the telephone relay, which is so much desired at the present time, and that by its means duplex or multiplex telephony will be possibile. In the Western Electrician of May 19th last a brief description of the apparatus was given, but it is judged that the more complete account of its operation and application which is now available will be of value.

The action of the instrument is analogous to that of the phonograph, but the record is made upon a steel wire by magnetic means. Imagine a horseshoe electromagnet with its poles brought close together; between these poles is made to pass a continuous steel wire at a certain speed. The magnet is in series with a battery and a telephone transmitter. When the latter is spoken into, it causes a series of magnetic impulses in the electromagnet, which in turn react upon the steel wire as it passes along, and leaves upon it a magnetic impression; this record corresponds to the impulses sent from the telephone, or, in other words, to the sound. If in the second place a telephone receiver is connected to the terminals of the electromagnet, and the steel wire again passed between the poles, the magnetization of the steel wire sets up a series of currents in the electromagnet, which are received by the telephone, and a sound is heard which corresponds with the original. To efface the record, a continuous current of some strength is sent into the magnet, when the magnetization of the steel wire is equalized and it is ready for a new impression. To construct a phonograph upon this principle, it is only necessary to wind the wire upon a drum and thus cause it to pass before the poles of an electromagnet.

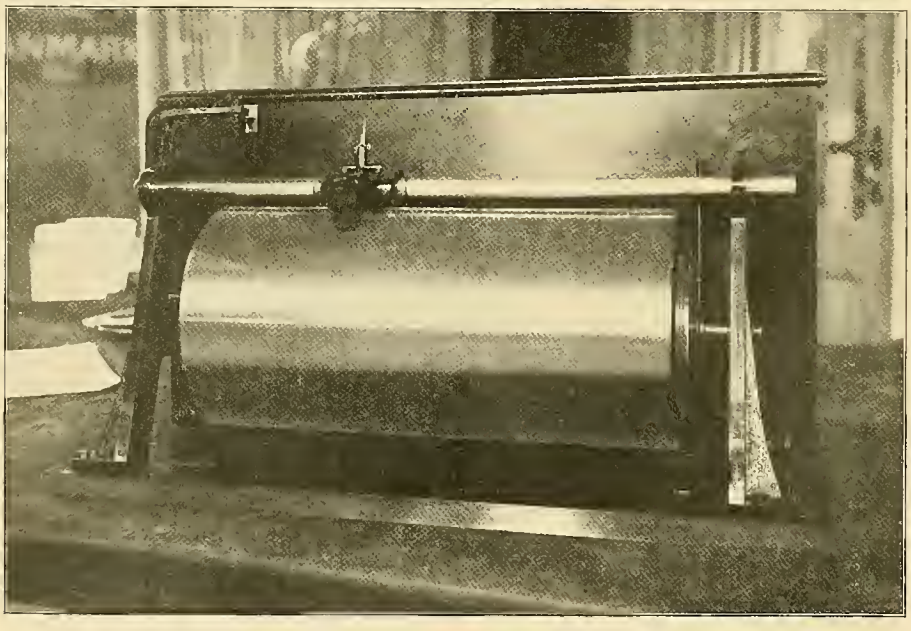


FIG. 1. TELEGRAPHONE.

The instrument exhibited at the exposition is shown in Fig. 1. It consists, essentially, of a cylinder about five inches in diameter and 10 inches long, which revolves between two uprights, being operated from below by a small motor which drives it by a grooved pulley and cord. The cylinder is covered by a continuous winding of steel piano wire about one-twenty-fifth inch in diameter, having a total length of 380 feet. The cylinder revolves at about 120 revolutions a minute. Above the cylinder is a horizontal rod which supports the carriage, which moves freely upon it. To the carriage is fixed the recording magnet. It is formed of two soft-iron cores, each carrying a magnetizing coil; these are embedded in insulating material to form a solid piece, from which the ends of the poles project, these being hollowed out so as to partly embrace the wire, resting lightly upon it. The carriage is guided by a knife-edge, carried upon an arm in the rear, which travels between two adjacent spirals, and thus moves the carriage along as the cylinder revolves. The recording magnet is carried upon an arm hinged to the carriage, and may be raised off the wire or lowered at will, its pressure upon the wire being regulated once for all by a screw adjustment. The current is brought to the magnet by a flexible cord and plug, the latter having two projecting points which fit into holes in the recorder. An automatic arrangement is provided to bring back the carriage to the original position when it has finished its course. In the rear is a shaft which is revolved by a small pulley and cord. It carries a helicoidal winding of steel wire along its whole length. When the carriage arrives at the end of the cylinder, it strikes against an inclined projecting piece which throws it back, lifting the magnet from the wire and allowing a pin to engage with the screw-winding of the rod. The revolution of the rod thus brings back the carriage to the starting point.

The instrument is used in connection with an ordinary telephone transmitter and receiver, one or the other of which may be thrown into the circuit of the recorder. To make the record, the transmitter and battery are connected with the recorder. Upon speaking into the former, the magnetic impulses thus caused in the magnet leave their impression upon the wire as it passes along. After the record is finished the magnet is again passed over the wire with the receiver in circuit. The currents induced in the recorder by the magnetization of the steel wire cause a series of sounds to be heard in the telephone receiver, and the original record is thus reproduced. The reproduction is made with remarkable clearness. As there is scarcely any mechanical friction in the apparatus, there are none of the disagreeable noises which are heard in the ordinary phonograph.

The instrument shown at the exposition is of a simple construction and designed mainly to show the fundamental principle of the telegraphone, without the intention of exhibiting the more complicated instruments which Mr. Poulsen has designed for use upon telephone circuits. It will be seen that the instrument, being capable of registering the message sent through a telephone, finds at once a number of applications in practice. To show what may be accomplished by this instrument, it will be useful to describe two different forms which have been designed. The first of these is for registering a short message, which, in the absence of a subscriber from his instrument, may be automatically repeated into the line when he is called up. The second is used to take down a message of about three minutes, which may be thus received and recorded in the absence of the subscriber.

The first instrument, shown in Figs. 2 and 3, is designed to register a short inscription lasting one or two minutes. In this form the cylinder is placed upright in a fixed position, and the carriage revolves around it. From the hollow base rises an arched support, and from its summit a fixed rod passes below, holding the cylinder. The carriage is supported upon an arch-shaped tube, which is united at the bottom by a cross-piece. This support is made to revolve around the cylinder by the gearing shown below, which is actuated by a clockwork mechanism in the base. The mechanism is started by an electromagnet, seen to the right. When the apparatus is at rest the poles of the recording magnet do not touch the wire, but are made to do so at starting by the arrangement shown in Fig. 3. The body of the carriage is fixed to the main rod by a pin which passes in a groove in the latter, while the arm supporting the magnet is pivoted as shown. To the left is a rod carrying a ball (p), which, when the rotary movement commences, flies out by centrifugal force, and by means of the lever and spring, brings the magnet to bear against the cylinder. In this instrument the ends of the core are hollowed out so as to embrace the wire closely and thus guide the carriage, which ascends as the movement continues.

To secure a constant speed, two devices are used. When the speed tends to increase, the ball (p) flies out by centrifugal force and presses the magnet more closely against the wire, thus giving a braking action. A like action is secured by the cylinder shown at the top, which turns freely about the fixed rod, and is attached to the movable piece by two flexible wires. It thus revolves with the movable piece, and if the speed increases it causes a retarding action by the two wings attached to it. It has, besides, attached to the under side, a centrifugal spring-brake which acts upon the fixed rod. When the magnet arrives at the top it stops the mechanism by striking against the stop shown to the right. This operates an arm which breaks the current of the electromagnet and stops the clockwork movement. When the rotation stops the ball (p) attached to the carriage returns to its normal position, and the recording magnet is lifted from the wire by a spring. This allows the carriage to descend. It does not fall abruptly, however, as the flexible wire carrying the current to the magnet passes up through the tube and comes out through an opening, winding around the cylinder above, as the latter, by means of the braking arrangements it carries, tends to turn somewhat more slowly than the revolving support. The carriage, in descending, is obliged to turn the cylinder in order to unwind the wire, and this causes it to descend gradually. The electrical connection is made with the revolving part by the collector and brushes seen at the top.

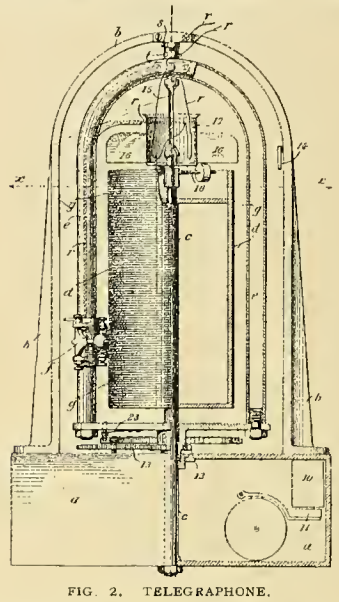


FIG. 2. TELEGRAPHONE.

This form of instrument is used upon telephone circuits when a subscriber wishes to record a short message upon his own instrument, which will be automatically repeated to the person calling him. He may say, for instance, that he is absent and will return at a certain time. With the automatic instrument just described the arrangement of the circuits is quite simple. The connections are shown in Fig. 4. The wire (35) of the outside line is connected directly with the telephone by the wire (36); the other wire (40) is connected to two segments of a circular switch, whose four segments may be united two and two by the arm. In the cut the wire (40) is connected directly with the telephone by (39, 38, 37) and the telegraphone is cut out. In the middle position of the switch the line circuit is broken, and the primary of the induction coil (R) is joined to the telephone; the secondary circuit passes to the telegraphone, so that the subscriber may now register the message he wishes to leave upon his own instrument. By placing the switch in the third position, the primary of the induction coil is joined to the exterior line, and the telegraphone is ready to deliver its message. In the second case, to register the message, the subscriber sends the current into the primary coil, the outside line being out of circuit; this develops a current in the secondary which passes to the electromagnet (22), seen to the right, by the circuit (20, 21, 22, 23, 24, 25); the armature (27) is attracted, causing the lever (41) to drop and close the circuit (28, 29, 30, 31) through the battery (E) and magnet (10); the latter is the starting magnet seen in the base of the telegraphone, which is thus set in motion. At the same time the lever closes the circuit containing the recording magnet through (20, 21, 32, 33, 34, 25). To prevent the current from being shunted through the circuit containing the magnet (23) this circuit is cut when the carriage rises by the button seen below in Fig. 2. The subscriber may then register his message in the telegraphone. Upon reaching the top, the carriage strikes against the arm to the right, and this movement is made to raise the lever (41), breaking the contacts and thus stopping the mechanism; the carriage then arrives at the bottom of its course, and by pressing the button placed below, re-establishes the circuit of the magnet (22), restoring the original conditions. When the switch is thrown to the right, the main circuit is connected with the primary coil; when the subscriber is called up, the current passes in this primary and the secondary starts the telegraphone by the arrangement described. The currents set up in the recording magnet then pass in the secondary and thence through the primary, to the distant telephone, repeating the phrase recorded in the telegraphone. A simple apparatus of this kind may be useful in

many cases. However, it is desirable to have an instrument which will register a message of some length which may be sent through the telephone, and to this end Mr. Poulsen has devised a more elaborate instrument.

In Fig. 5 will be seen an elevation and plan of this instrument. It consists, essentially, of two drums carrying a number of turns of steel ribbon, which is wound from one to the other. At the top is the recording magnet, which is fixed to the body

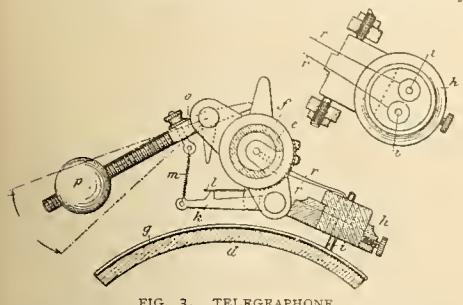


FIG. 3. TELEGRAPHONE.

of the instrument by an arm. To revolve the drums a small electric motor is used, which drives the central shaft by the grooved pulley (47), seen in the plan. On the shaft is mounted the roller (48) which drives the main drums by friction upon an exterior wheel. It is made to act upon one or the other of the drums at will, being mounted upon a lever by which it is thrown to the right or left. It is necessary, however, in winding the ribbon to the right or left, to change also the direction of rotation of the small roller. This is carried out by a commutator connected with the lever which reverses the current through the motor when it is thrown back and forth. When the ribbon has been entirely unwound from one of the cylinders, the rotation is

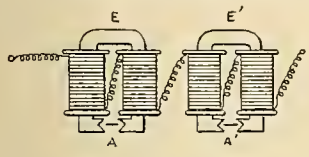


FIG 7. TELEGRAPHONE.

stopped by means of the device seen to the left. When the cylinder has been wound full, its diameter increases by a certain amount, and this causes the roller (60) which bears upon the cylinder to be thrown to the left. The roller is mounted upon a lever, which is arranged to cut off the current when thrown over.

In order to start the motor automatically, a current sent into the apparatus passes into the relay seen on the left. This closes the local circuit of an automatic switch shown to the right. This switch is arranged to be held down for a certain time, usually limited to three minutes. For this purpose the lever carries on the rear arm a projection which rests normally in the slots of the toothed wheel seen

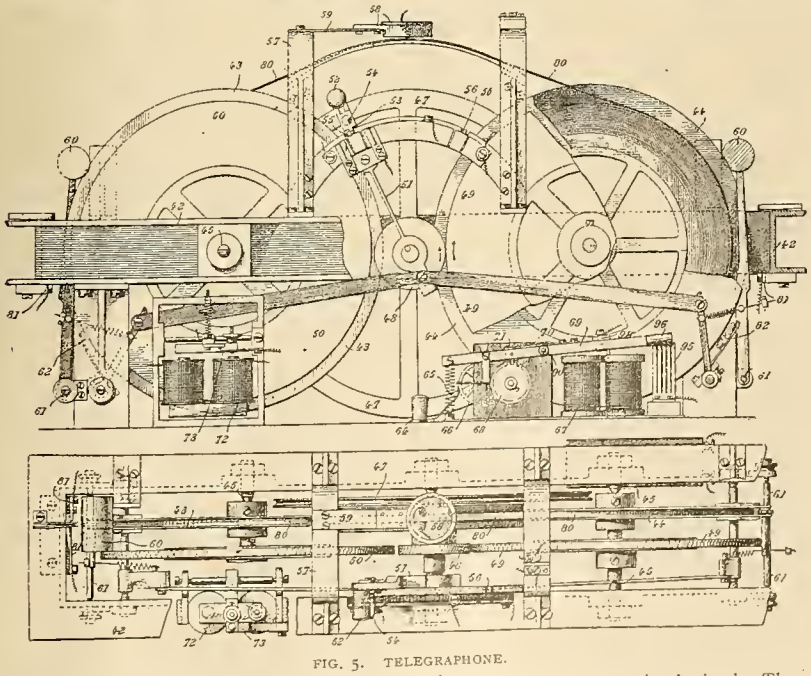


FIG. 5. TELEGRAPHONE.

below. This wheel is connected with a clockwork mechanism, and when the armature is attracted to close the switch, the wheel begins to revolve. The projection of the lever is thus found on top of one of the teeth, and the lever cannot rise until the wheel has advanced by one tooth. The time of closing is thus determined by the length of the tooth. This instrument is mounted with a telephone circuit, using a series of connections similar to those of the first instrument. By the use of the proper connections, the telephone may be used alone, or the telegraphone is automatically set in motion by the current sent by the distant subscriber and his message is recorded.

The telegraphone is capable of different applications in telephone work. Among these may be mentioned the reinforcement of sounds. Mr. Poulsen has devised several methods for increasing the intensity of the sound reproduced by the telegraphone. Normally, these sounds have about the same intensity as those heard in an ordinary telephone receiver, but this intensity may be greatly increased, and this leads the way for the construction of a telephone relay. One method of reinforcing the sound consists in giving a greater speed to the wire as it passes in front of the magnet at the time of reproduction. In this way the electromotive force of the induced currents is increased, with a resulting loudness of sound. It has been found by experiment that by giving the wire a speed of 90 feet a second a sound spoken in an ordinary tone before the transmitter was reproduced by the telegraphone with

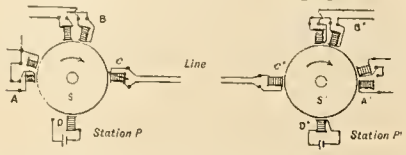


FIG. 8 TELEGRAPHONE.

great intensity, quite out of comparison with the sound as received by telephone.

Starting with the reinforcement of sounds, Mr. Poulsen claims to have solved, by means of the telegraphone, the problem of the telephone relay. This is carried out by the following arrangement, shown in Fig. 6: At (T) is a revolving disk, carrying upon its surface a continuous steel band. In front of it is the recording magnet (A), connected with the microphone transmitter (M) through an induction coil and battery. The disk is caused to revolve at a considerable speed, thus producing the reinforcement of sound mentioned above. The receiving magnet (a) transmits the record to the telephone receiver (t), in which it is received with great intensity. By using a number of receivers, a multiplying arrangement is obtained. The practical applications of such an arrangement will readily be seen.

Another important application is the transmission of two messages over a wire at the same time, or the extension of the duplex system to telephone work. This method was discovered by Mr. Pederson, who has assisted Mr. Poulsen in his experiments, and who has charge of the working of the instrument shown at the exposition. Mr. Poulsen mentioned this method in the communication which he recently presented to the Académie des Sciences, relative to the telegraphone, and considers that it is capable of a wide application. The principle will be readily understood. In Fig. 7 are represented two electromagnets, each provided with a steel ribbon (A), passing at the same speed between the poles. If the magnets (E E') are connected in series, so that their magnetization is in the same direction, and a record thus made upon each of the bands, this record will be reproduced as usual upon

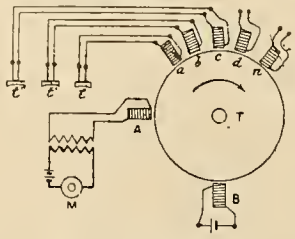


FIG. 6. TELEGRAPHONE.

passing the bands again before the magnets; but if the connections of one of the magnets are reversed, one set of waves will exactly neutralize the other, and no sound will be heard. In the second case, fresh bands being used and the magnets connected with their polarity in opposition, a record is made upon each band. This time one of the bands will be magnetized in one sense and the other in the opposite sense, but with the same form of wave. By passing the bands again, the reproduction will be made, but if the connections of one of the magnets are reversed, the waves will again neutralize each other, being equal and opposite, and no sound will

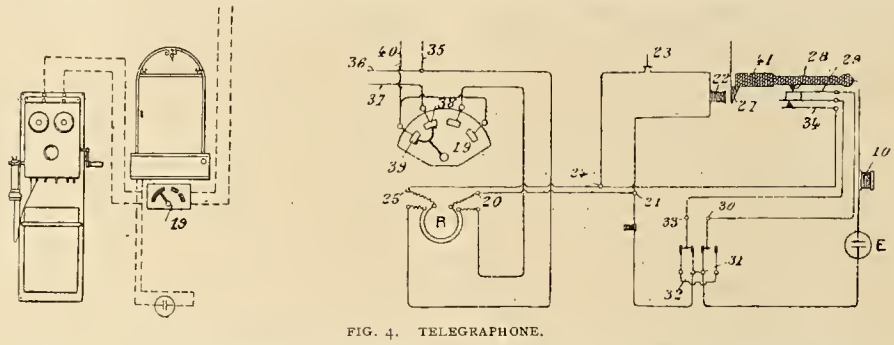


FIG. 4. TELEGRAPHONE.

be heard. Second, a record is made with the two magnets connected in conjunction. The ribbon is passed again and a second record is made with the magnets in opposition. The two records will thus be superposed upon the bands, whose magnetization is now the resultant of the two impressions. Without going into the details of the action, it will be seen that if the bands are now passed before the set of magnets connected in series, the record made upon the bands when the magnets were thus connected will be reproduced. In the second case, if the magnets are connected in opposition, the record formed when in this position will be reproduced. The action takes place in the same manner when only one band is used, and the magnets are placed one behind the other.

The arrangement for forming a duplex system upon this principle may be seen in Fig. 8. The two disks (S) have a steel band at their surface. They revolve at practically the same speed, but it is not necessary to obtain synchronism. At one station is the pair of electromagnets (A), and the second pair (B), placed near the steel band. These act upon the band according to the principle just mentioned, and may be connected in series or in opposition at will. The impression is received in the telephone (C) and transmitted to the second telephone (C'), where a record is made upon the band. This record is then received in the two sets of magnets (A' B'), each set receiving its own message. The record may be effaced by the magnets (D D').

Improvement in the Nernst Lamp.

G. Ahlfeld of Darmstadt, Germany, has recently patented an electric lamp of the Nernst type. On a filament composed of some of the refractory earths a stripe of some one of the highly infusible metals of the platinum group, mixed with an ethereal oil, is painted from end to end. This stripe is allowed to dry, and is then burned into the filament after the manner generally in use in the ceramic industry. There is thus obtained along the filament a thin line of metal which is firmly adherent, and which serves to start the current through the filament, by heating the latter until its conductivity is sufficiently raised.

At a special meeting of the Waterworks Board of Two Rivers, Wis., T. C. Grey of Manitowoc, and S. D. Miller of Chicago, were present to consult with the board relative to filing bids for the installment of the combined electric-light and waterworks system. A special election to authorize the city to issue $20,000 bonds for that purpose will be called as soon as the contract has been let.

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CONVENTIONS AND EXPOSITIONS.

American Street Railway association, Kansas City, Mo., October 16th to 19th.
Automobile Show, New York, N. Y., November 10th to 24th.
Illinois State Electric association, Peoria, November 27th.

The International Association of Municipal Electricians, now a flourishing organization, held its fifth annual meeting last week at Pittsburg. This society has a large field of usefulness all to itself, and, in addition to affording pleasant reunions for its members, disseminates much valuable information. It still devotes itself largely to fire alarms and police telegraphs and telephones, but is gradually broadening out and considering larger questions of electrical construction and inspection. Mr. Mead, who worked so indefatigably for the success of the Pittsburg meeting, was honored by election to the presidency.

Dr. Guilleminot, a French physician, has devised an adjunct in skiagraphy to which he has given the formidable name of radiogoniometer. The angle at which the Roentgen rays strike the part to be skiagraphed can be determined by this instrument and the position of the tube can be adjusted by its use so as to bring the tube into the most favorable position. The principle of the instrument is that of a fixed wire cross and a movable one; the latter is so adjusted that the shadows of both upon a fluorescent screen coincide, and the angle is then read off by means of divided arcs of circles. By a sighting arrangement, or by a rigid metal rod, the line of incidence can be found and marked upon the surface of the subject's body.

Figures compiled by the Treasury Department give an excellent idea of the extent to which American electrical manufacturers are supplying the foreign markets. During the eight months ended with August of the present year the exports of electrical machinery reached the valuation of $3,590,419, as against a value of $1,828,048 for the corresponding period of last year. The value of the exports of instruments and apparatus for scientific purposes, including telegraph, telephone and other electrical apparatus, increased from $3,610,966 during the eight months of 1899 to $4,171,561 for the corresponding period of 1900. The continued growth of the export trade in American electrical goods is most gratifying and nourishes the hope of still greater extension. What has thus far been accomplished has resulted less from aggressive, concerted effort than from individual enterprise. So long as home markets were approximately adequate, foreign markets were neglected. It should now be clear that to secure immunity from overproduction and its train of evils foreign markets should be assiduously cultivated. By this means a safety valve, so to speak, will have been provided, and the dangers of congestion lessened. It should be borne in mind, however, that the inflexible law of the future of international trade is that the seller must seek the buyer, must minister to his wants and produce what he desires.

In the legal warfare that grew out of the negotiations that resulted in the establishment of an Independent telephone company in Rochester, one decision has been handed down that has more than a local interest. It relates to the question of compelling a telephone company to use a conduit already built. In the case of the city of Rochester against the Bell Telephone company of Buffalo, the Fourth Appellate Division of the Supreme Court of the state of New York states that while it is settled that a telephone company, incorporated under a state law authorizing a telegraph or telephone company to occupy any of the public highways with the wires and appliances reasonably necessary for the proper conduct of its business, has the right to use the public highways of a city for its reasonable purposes, it is equally well settled that such use is subject to reasonable control, by the authorities of the municipality in which such streets and highways are located, by virtue of, and as a part of, the general police power. For example, where a municipality has granted to an electric company the right to construct and maintain subways and conduits in the streets of the city upon condition that it would lay sufficient ducts to accommodate the city and any and all other corporations having the right to carry electric conductors under the streets, and that it would rent the use of the same to such other companies upon proper terms, the court holds that under its police power the municipality would have the right to insist upon a telephone company, incorporated under the state law, with power as above specified, complying with the municipality's request that it use the conduit so constructed in a certain street, and to prevent the telephone company from constructing an additional conduit in that street, the conduit already constructed being adequate and convenient and in all respects proper for the use of the telephone company, while to permit it to construct and maintain another and independent conduit in the street would greatly and unnecessarily inconvenience the public.

On the other hand, the court holds that if it should be found, upon the trial of the action brought to determine the rights of the parties in the matter, that it was impossible or impracticable for the telephone company to occupy the conduit thus already constructed, because of the fact that it contained wires charged with powerful currents of electricity, or for any other reason, the municipality would have no right or authority to require the telephone company to use such conduit, because such requirement would be a substantial denial of the right to exercise the privilege acquired by it under the legislative authority of the state.

In other words, in New York state a municipality has the right to compel a telephone company to use an existing conduit unless it is shown that such use is obviously impracticable.

From all accounts the electric-lighting decorations at the Pan-American Exposition are planned on a lavish and brilliant scale. There is to be an electric tower (much larger than the one at the World's Columbian Exposition and differing also in being outdoors, instead of under cover, and a part of the general landscape instead of a private exhibit), electric fountains and incandescent-lamp designs in great variety. No arc lamps will be used in the general design of decorative lighting, but a large number will be employed for service and police lighting, placed and operated in such a manner as not to conflict with the more ornamental illumination. Of especial interest is the fact that both motors and incandescent lamps (104-volt) will be operated with alternating current having the low frequency of 25 cycles. This frequency is all right for the motors, but will the lighting be steady and satisfactory? A recent writer—Mr. J. M. Andrews—states that "Twenty-five-cycle incandescent lighting can hardly be considered a commercial success, except for street lighting at low voltages with poor economy. Flickering can be noticed even with 52-volt lamps, and this is, of course, more pronounced in lamps of higher voltage." Mr. C. P. Steinmetz says that incandescent lighting is "feasible at 30 cycles and satisfactory at 40 cycles," the inference being that it is not feasible at frequencies lower than 30 cycles. However, the problems presented by the Niagara alternating-current supply at the Pan-American Exposition are in the hands of experienced engineers, who have, of course, carefully considered these objections. The event will show the results of their bold conceptions.

Bristol is one English city that is experiencing the benefits of electric railways. The fact is shown in the recently issued report of the chief inspector of English factories, where the effect of the electric-railway system in lessening the centralization and consequent overcrowding of both population and industries is demonstrated. People are apt to regard the introduction of electric railways, so far as the improved transportation touches the question of overcrowding, merely as a means of enabling the city workers to live in purer air of the suburbs, far away from their work. There is, however, another and equally important point of view. It has been contended that once cheap and rapid transit were established, not only would the people be drawn to the outer ring, but that many of the industries would go there also, taking advantage of the cheaper labor to be found in the suburban districts. That is just what seems to be happening in Bristol. The factory inspector of that city says that, owing to the enterprise of the railway company in extending its electric lines into the suburbs, a revolution is being brought about in the domestic life of the work-people. Several concerns, such as manufacturers of tobacco, clothing, corsets, rope, etc., have already built modern factories on the outskirts of the town, and round these factories have sprung up rows of neat cottages, in some cases built and owned by the factory proprietors, who rent them to the work-people. Here the people live in pure air instead of being cooped up in the narrow streets of the city, and yet, thanks to the electric railway, they still have the advantage of city life so far as relates to shopping, amusements, and the like. Bristol seems to be setting a worthy example for the united kingdom.

International Association of Municipal Electricians.

The fifth annual meeting of the International Association of Municipal Electricians was opened in the banquet hall of the Monongahela House, Pittsburg, on Tuesday morning, September 25th, and the association continued in session until Thursday, the 27th. The local committees had made every arrangement for the comfort of the visiting delegates, who were heartily welcomed. The reception hall had been tastefully decorated for the occasion. The five-cluster chandeliers were completely covered with branches of green, while numerous stands held jardinieres of rare ferns and pampas grasses. The sides of the room were adorned with four large American flags, surmounted with shields, which were again surmounted with smaller flags, while on the walls and windows were black and yellow ribbons, the representative colors of the association.

M. W. MEAD, PRESIDENT MUNICIPAL ELECTRICIANS' ASSOCIATION.

As the last strains of the opening overture died away, President Brophy of Boston called the meeting to order. Rev. Dr. John A. Jayne of Allegheny offered prayer. This was followed by songs entitled "The Great Amen" and "Rock of Ages," by the Young Men's Tariff Club quintet. The chairman next introduced Attorney N. S. Trent of Pittsburg, who delivered the address of welcome. Mr. Trent said that Pittsburg contains the largest electrical works in the world. It is the home of light and power. Under the direction of Morris W. Mead, the city electrician, has been founded and reared a system of electric lighting which any city would be proud to possess.

The next speaker introduced was D. J. Guy of East Madison, Pa., and after more music John P. Barrett of Chicago spoke of the growth of electrical means of communication.

Captain Brophy delivered the presidential address in the afternoon. His subject was "Benefits to be Derived from Our Association." Among other things, he said: "There is no country on the face of the globe where fire departments have attained such a high state of efficiency and where fire apparatus has been brought to so high a state of perfection as in the United States, but it can be said, also, that in no civilized country in the world does there exist such a total disregard of rules that should govern the safe construction of buildings. What is it that enables the fireman to reach the scene of the fire so promptly? The application of electricity —the fire-alarm telegraph. Deprive the fire department of this, and I venture to say the force of men would be doubled and the rates of insurance trebled. All due praise should be given to the fire department for its stubborn battles and hard-won victories over the common enemy, fire, but its success is also due, in a very large degree, to the successful operations of the fire-alarm telegraph and the men who have it in charge. All I have said thus far, as to the importance of the fire-alarm telegraph and those who are placed in charge thereof, applies with equal force to the police signal service."

At the conclusion of the reading of the president's address the names of the cities that had asked for the next meeting of the association were read. Among them were Peoria, Montreal, St. Louis, Richmond and Niagara Falls. By a vote it was decided to hold the next annual meeting at Niagara Falls in September, 1901. This closed the first day's work. Many of the visiting delegates were accompanied by their wives or daughters, but the ladies' reception committee had not been unmindful of them, and had planned a delightful trolley ride to Kennywood Park for the evening.

At the second day's session several letters of regret were read from members who were unable to be present. A. P. Barrett of Chicago and H. P. Mason of Brooklyn were elected to membership.

Chief James Walker of the Department of Electricity of Philadelphia was introduced and gave a brief history of the police and fire-alarm systems of that city. He said: "The original police telegraph in the city consisted of 56 wooden boxes and 16 stations. Now there are 700 stations, 1,200 telephones in use and 5,000 miles of underground wiring. The lighting system consists of 8,700 lamps. Over one million dollars is appropriated annually for extensions and improvements of this system. All the electric concerns of the city are under the control of the municipal authorities. The Bureau of Electricity has special officers to inspect the trolley lines and electric lights."

Morris W. Mead of Pittsburg next read a paper by Frank C. Mason, superintendent of police telegraph, of Brooklyn, N. Y. The subject was "Electrical Contacts," and the paper is given on page 222 of this issue of the Western Electrician.

Mr. Mason's paper brought forth the question of tubular connections, which was thoroughly debated by Mr. Brophy, Mr. Ellett and Mr. Walker.

At the afternoon session papers were read by Charles Burger of Boston on the subject of "Automatic Fire-alarm Systems," and by Charles T. Clark on "The Responsibility of the Individual in Municipal Engineering." This concluded the afternoon session. During the evening theater parties were given at the various playhouses.

Thursday's session was convened at 9:45 a. m. After roll call, a set of rules for pole specifications was submitted to the organization for consideration. These rules embraced the following requirements for poles of five arms: "Top arm to be used by the city. Second arm to be used by electric-light company. Third arm for feed wires. Fourth arm for telegraph lines. Fifth arm for telephone lines. All seats to be on reverse side of pole. No converters nearer than 15 feet to the ground. No wires carrying over 300 volts to be nearer together than 15 inches."

The next matter taken up was the election of officers, which resulted as follows:

President—Morris W. Mead, Pittsburg.

First vice-president—J. F. Zeiluff, Paterson, N. J.

Second vice-president—Benjamin McAllister, Bradford, Pa.

Third vice-president—R. E. Moran, Memphis, Tenn.

Secretary—F. N. Foster, Corning, N. Y.

Treasurer—Adam Bosch, Newark, N. J.

Executive committee—M. J. Donohue, Niagara Falls; William Brophy, Boston, Mass.; J. W. Aydon, Wilmington, Del.; F. C. Mason, Brooklyn, N. Y.; F. G. Boyd, Baltimore; W. Y. Ellett, Elmira, N. Y.; George F. Macdonald, Ottawa, Canada; W. G. Canfield, Grand Rapids, Mich.; F. S. Michel, Peoria, Ill.

After extending thanks to the local committee and to the telegraph and telephone companies for courtesies extended, the association adjourned, to meet at Niagara Falls next September.

American Electrotherapeutic Association.

The opening session of the tenth annual meeting of the American Electrotherapeutic association, held at the Academy of Medicine, New York city, was called to order by Dr. Walter H. White of Boston, president of the association, on the morning of September 25th. Randolph Guggenheimer, president of the New York Municipal Council, welcomed the members, his address being responded to by Dr. Charles Dickson of Toronto, and Dr. L. P. Bishop, who spoke on behalf of the Academy of Medicine. The morning session was taken up with the reports of standing committees on scientific questions and with papers on "Galvanization," by Professor A. Tripier of Paris, France, and "Electrotherapeutic Sins," by Rev. H. Newman Lawrence of Stapleton, N. Y. The afternoon session on Tuesday was occupied almost entirely with a long discussion on the use of electricity in the treatment of tuberculosis. Among those taking part in the discussion were Doctors S. A. Knopf, M. J. Brooks, Charles O. Files, Wolff Freudenthal, Lefevre and G. B. Massey. The evening session was devoted to a lecture by E. W. Caldwell of New York on "Some New Appliances for X-ray Work."

Wednesday's session opened with a discussion on "Electricity in Gynecology and the Present Reluctance of Gynecologists to Use Electricity." Papers relating to the subject were read by Dr. Frederick D. Morse of Melrose, Mass., Dr. F. Schavoir of Stamford, Conn., Dr. G. B. Massey of Philadelphia, Dr. Robert Newman of New York, Dr. F. La Torre of Rome, Italy, and Dr. William J. Morton of New York.

After the morning session the members of the association visited the Metropolitan Street Railway company's power house, at Ninety-sixth street and First avenue, and the Brooklyn bridge, where an inspection of the cable machinery was made. In the afternoon Dr. R. J. Nunn of Savannah, Dr. Morton, Dr. Massey, Dr. W. J. Herdman of Ann Arbor, Dr. Francis R. Bishop of Washington, Dr. E. R. Corson of Savannah, and Dr. Emil Heuel of New York, read papers on electrical topics.

The following-named officers were chosen on Wednesday evening for the current year: President, Dr. Ernest Wende of Buffalo; first vice-president, Dr. F. D. Morse of Melrose, Mass.; second vice-president, Dr. D. R. Brower of Chicago; secretary, Dr. G. E. Bill of Harrisburg; treasurer, Dr. R. J. Nunn of Savannah; chairman executive committee, Dr. Francis B. Bishop of Washington. The next annual meeting will be held in Buffalo, beginning the first Tuesday in September.

Chicago Electrical Association.

The fall and winter programme for the season of 1900-1901 of the Chicago Electrical association has just been completed. The meetings of the society are held at 1741 Monadnock block. The hour of meeting is 8 p. m. The papers scheduled on the programme are as follows:

October 5—"Electric Elevators for Safe and Economical Operation at High Speeds," by Hayward Cochrane, electrical engineer, Eaton & Prince company.

October 19—"The Alternating Arc," by C. Wiler, Western Electric company.

November 2—"Roentgen Rays," by A. M. Blumenthal.

November 16—"Incandescent-lamp Photometry," by W. B. Hale, laboratory department, Western Electric company.

December 7—Subject to be announced later, by Charles Wirt, Wirt Electric company, Philadelphia, Pa.

December 21—"Electrical Features of the Paris Exposition," by J. M. Hollister, Western Electric company.

January 4, 1901—"Electricity in the Equipment and Construction of a Ship," by C. C. Mattison, Chicago Ship-building company.

January 18—"Standardization of Arc Lamps," by H. Almert, Buckeye Electric company.

Electric-lighting Progress in Denver.

The Lacombe Electric company, which has the contract for constructing an electric-light system and building an electric station which will eventually be acquired by the city of Denver, has settled upon a site for its large power plant. The location is on West Fourteenth avenue, and the location comprises an entire block, 350 feet by 210 feet, running to West Thirteenth avenue. The station will be built on the bank of the Platte River, so that plenty of water for condensing purposes will be available. The power house will be built of stone, brick and steel. The types of the machinery have not altogether been decided upon, but the arc dynamos will be furnished by the Western Electric company. The order for the incandescent machines and engines will be given by Mr. Lacombe, the president of the company, who is now in the East. The pole-line construction has progressed with great rapidity, and 6,000 poles are now in place. The company's pole yard at Thirty-first and Blake streets is one of the busiest spots in the city. Here the poles are unloaded, trimmed, cut for cross-arms, and from this point are distributed throughout the city, duplicating existing circuits. About 1,500 poles are still on the ground. During Mr. Lacombe's absence supervision of the work is in charge of Mr. M. Stern. Mr. Stern is a thoroughly competent electrical engineer and has been identified with electric lighting from the first in Denver. He devotes considerable time in the Cripple Creek District, where he looks out for the electric-lighting interests controlled by Mr. Lacombe and associates.

Searchlights in Naval Maneuvers.

In the interesting naval maneuvers of last week in and near the harbor of Newport, R. I., the searchlight played a conspicuous part. Army and navy officers were greatly interested. One of the former, Captain Whistler, made the following statement:

The work of the torpedo and battleship fleet on Monday night, superb as it undoubtedly was, demonstrates beyond doubt that a modern fleet cannot run past up-to-date harbor fortifications, such as are to be found on Fort Adams. Newport would have been safe had the Massachusetts and the New York been in the attacking fleet. Not a torpedo boat passed out of the range of its searchlights, and the bigger ships were made as bright as though a midday sun had been shining down on them. In real war our big guns would have torn them to pieces. The attempted attack has also demonstrated, in my opinion, that the searchlight used by the army is superior to that used by the navy. Army searchlights send out a narrower ray of light, but the concentration of effect is greater. The navy light spreads over more ground, but does not furnish as good light for aiming big guns with telescopic sights.

One of the battleships demonstrated to the officers at Fort Adams a new method of destroying the effect of searchlights. They turned their light full upon ours and blinded it out. We could see the ray of bright light streaking out, but could distinguish nothing beyond. This means that forts will have to be well equipped with searchlights. They must have more than it is possible for a single vessel to bring to bear upon them, for it takes a light to snuff out a light.

All-British Cable Project.

It is stated that the reason why contracts have not so far been let for the construction of the all-British Pacific cable is that the tenders submitted were considered, without exception, so extremely excessive that it was deemed inadvisable to award a contract at present. A dispatch from London, dated September 25th, states that the doings of the Pacific cable committee are closely guarded from the public, but it is understood that the matter stands thus: Tenders were received for the laying of the cable in response to an advertised invitation. These were considered and returned for amendment in some particulars. They have now been received back, and in a few days cablegrams will be sent to the Canadian and Australasian governments announcing the acceptance of a certain tender, and the plans for the construction of the cable will then be announced.

Superintendent B. G. Smith will commence work immediately on extensive improvements at the electric-light plant of Kankakee, Ill.

DEVELOPMENT OF THE TELEPHONE FIELD.

Notes from Ohio.

The Central Union Telephone company has about 50 linemen at work in Columbus putting the plant in repair for winter service. This company is also installing toll boxes in many of the residences, the patrons paying three cents a message. Most of these instruments are on party lines, however, and there has not been a very satisfactory service in this respect. This has probably been done to offset the rates made by the Independent company.

The board of managers of the Ohio penitentiary has decided to put a complete telephone system in the big prison. Besides telephones in the different departments, there will be a fire-alarm system, patrol guard registers and other things of the kind that are not usually found in other systems. There will be a switchboard in the office, where any part of the prison can be reached. Some time ago the American District Telegraph company made a proposition to furnish a fire-alarm system, the property to remain in possession of the company, which would charge rentals for it, but it was found that the expense of this plan would within a year be about the same as the total cost of the system which will be put in.

The Home Telephone company of Findlay has leased the south room of the Corwin block at Findlay for 20 years, and as soon as possible it will be remodeled and made into a first-class telephone office. Not much work will be done on this until the lines in the town are completed. The Western Reserve Construction company of Cleveland will begin work on the lines at once. In the business portion of the town all the lines will be placed in conduits underground, but poles will be used in the residence portions where the service is not so extensive. Findlay will have long-distance connections with all the towns that the United States company's lines reach.

The Central Union Telephone company has reduced its residence rates at Portsmouth, Ohio, to 50 cents a month, and it is expected that a like reduction will soon be made in the business telephones. There is a fight brewing between this company and the Portsmouth Telephone company, but the latter will likely conduct the contest on its merits, without making a reduction in rates,

The Citizens' Telephone company of Fostoria is making some important improvements in its plant, and it is said that $125,000 will be spent on it. The company will put up 21,000 feet of cable, and a switchboard to accommodate 600 patrons is now being put in place. Any instrument in the town may be used for long-distance purposes, and all the latest devices have been arranged for. The new offices of the company are in the Foster block, and they are thoroughly fitted out with everything that will go to make the business a success.

The Central Union Telephone company has almost completely rebuilt its plant at Toledo, having spent about $100,000 in the work. The new switchboard was given a thorough test a few days ago, and a number of minor defects were found in it. Workmen at once began on the board, and it will be put in condition before being put into use. The company will also put in new instruments as soon as the board is in condition, and the entire plant will then have undergone a complete overhauling. The new instruments will have no batteries, as the old ones had, but will receive the current from a battery in the central office. The work of repairing the plant has all been done without any particular interruption of the service, and will be completed within a few weeks.

The long-distance lines about Lancaster have been completed so far as it is intended to build them at the present time. The addition of these lines will give the North Electric company of Lancaster a much better service than it has ever had before.

The Lima Telephone company of Lima, Ohio, which was recently incorporated in West Virginia with a capital stock of $100,000, has qualified to do business in Ohio. The legal representative, as required by law in this state, is D. J. Koble of Lima. The company will operate an Independent exchange in that city. O. M. C.

Pittsburg and Vicinity.

The Pittsburg and Allegheny Telephone company has completed preparations for operation in the city of Pittsburg, and a directory will be issued shortly. The South Side exchange is in service in that part of the city, but has not yet been connected with the city exchange. As soon as the wires are strung across the Monongahela River, both exchanges will be in operation. The work in Allegheny is almost completed and North Side subscribers will have the new service within a week. The company is at present serving about 1,200 subscribers in Pittsburg.

The Pittsburg and Allegheny Telephone company has purchased the Allegheny County Telephone company, operating in Braddock and Homestead. This is a valuable acquisition. The Braddock exchange serves about 600 subscribers, and the Homestead exchange about 400. It is the intention of the Pittsburg and Allegheny Telephone company to remodel these newly acquired exchanges and install new switchboards and instruments. The Pittsburg and Allegheny company has about concluded the purchase of the Home Telephone and Electric company, operating exchanges in Wilkinsburg, New Kensington, Oakmont and Verona. These plants will likewise be remodeled.

The Elizabeth Telephone company has been purchased by the Federal Telephone company, and made a part of its system. This plant was established about a year ago by local people, and has prospered from the start. Some time ago it was rumored that the Pittsburg and Allegheny Telephone company had purchased this property, but the report was without foundation.

The Federal Telephone company opened up the following-named exchanges during the past week: Freedom, Aliquippa, Elliott, Glenfield and Monongahela City. M.

Telephone News from the Northwest.

The Wisconsin Telephone company is rebuilding its system in Marinette, Wis. There will be 12,000 feet of cables used.

The Telephone Toll Line company of Wood County, Wis., has been organized at Grand Rapids, Wis., and has started work on a line between Grand Rapids and Marshfield.

Messrs. Dille, Southwick and Crocker have applied to the council of Stevens Point, Wis., for a franchise for a telephone system.

The Houston (Minn.) Telephone company has been organized to build a metallic toll line to Caledonia, Minn. Work has been begun.

The Zenith Telephone company of Duluth, Minn., has scored another victory in the matter of getting its instruments into the railroad offices. All the companies there were reluctant to use other than the Bell service, but one by one they have come around, until now the Northern Pacific is the only railroad in either Duluth or Superior which does not use the Independent systems.

J. M. Kennedy of Kirksville, Mo., proposes to build a line to Keokuk, Iowa, and to Quincy, Ill. Ultimately, he expects to reach St. Joseph and Kansas City, Mo.

Work has been begun on the Mutual Telephone company's system at Creston, Iowa.

The Cedar Valley Telephone company is rebuilding its exchange in Waverly, Iowa.

The stockholders of the Long Distance Telephone company of Ottumwa, Iowa, have recovered possession of the company's books, and now believe they will have a clear track to recover the property of the company. It is alleged that the books show a fraudulent sale of the property.

The local exchange at Bemidji, Minn., is completed and in operation. The switchboard will accommodate 150 connections, but a larger board will soon be necessary.

The Michigan Telephone company will put in a complete new local system at Ishpeming, Mich. The company will also build a new toll line from Negaunee to Cascade, this fall.

J. D. Latterell has bought A. W. Stone's interest in the exchange at Bird Island, Minn., and will conduct the business himself hereafter. Many improvements are planned.

The New State Telephone and Telegraph company is building a line from Lake View to Jefferson, Iowa. A line will also be built from Maple River Junction to Arcadia and West Side. Other extensions are planned.

The Oakville (Iowa) Telephone Exchange company has filed articles of incorporation, with $5,000 capital stock.

The Standard Telephone company has absorbed the lines at Buena Vista and Holy Cross, Iowa.

It is stated that the Cheboygan (Mich.) Independent Telephone company may enter the field at Sault Ste. Marie, Mich. There is considerable complaint over the service now being given. R.

Telephone Affairs in New England.

The offices of the officials of the various telephone companies comprised in the Erie Telegraph and Telephone company, with the exception of auditor and secretary, have been removed from Lowell to Boston, being located now at 15 Congress street. A direct wire connects the Lowell officers with those in Boston.

Attorney Samuel L. Powers of the Bell telephone system is a probable congressman from Massachusetts in the next House of Representatives, his nomination and election from a Republican district being practically assured. Apropos of his candidacy, one of Mr. Powers' political opponents, namely, Hon. F. H. Williams, is quoted as saying a bill desired by the Bell people was introduced last March by Representative Bingham of Pennsylvania, and provides for an amendment to Title 65 of the Revised Statutes, known as the Postal Route Act, whereby the telephone companies shall be given the same rights as telegraph companies to erect poles and string wires throughout the country, without the intervention of state or municipal authorities. The pending bill is an outcome of a decision of the United States Supreme Court, delivered in 1899, that telephone companies were not contemplated in the act, and that the vote of Congress would be necessary to permit them to avail themselves of its privileges. "I do not say that I would not vote for such a bill if I were in Congress," said Mr. Williams, "but I quote the facts to show that, contrary to the statements of some of my opponents, the telephone company does want something of Congress, and that it wants it very much."

The directors of the Erie Telegraph and Telephone company have declared the regular quarterly dividend of 1¼ per cent., payable October 8th. Books closed September 29th and will open October 8th.

The directors of the Wisconsin Telephone company have declared a regular quarterly dividend of 1¾ per cent., payable October 8th. The books closed September 29th and open October 8th.

The directors of the Michigan Telephone company have declared a regular quarterly dividend of 1¼ per cent., payable October 8th. Books closed September 29th and open October 8th. B.

Colorado Telephone Notes.

The Western Slope Telegraph and Telephone company has been organized to construct a telephone line in the northwestern part of the state. The lines will be built over a distance of 145 miles, and at present work is in progress between Rifle and Steamboat Springs. Among those interested in the project are George W. Ballantine and George W. Vallery of Denver and John Fesler of Glenwood. The company will work in harmony with the Colorado Telephone company and will use Bell instruments.

Warren F. Harrison, foreman of the Rocky Mountain Bell Telephone company, was shot and killed by a lineman named Burke at Brigham City, Utah. The cause of the killing is not known.

With the exception of the gap between Denver and Omaha, New York and San Francisco are now joined by telephone wires. While the distance is covered with the exception of only 600 miles, conversation will by no means be feasible between the terminals when Denver and Omaha are joined. Chicago can talk with Omaha, but Denver is not able to carry on a conversation successfully, even as far as Salt Lake City. The Rocky Mountain Bell Telephone company has used about 600 miles of wire in building lines across Wyoming and in Utah during the summer.

The telephone service at Cripple Creek of late has been criticized because it has been inadequate to local demands. The camp has grown wonderfully in every respect, and the demand for communication has been increasing in proportion, both for local and long-distance service, especially to Colorado Springs and Denver. The Colorado Telephone company has been unable to meet the requirements as rapidly as needed. E. M. Burgess, superintendent of the company, recently made the following statement in reference to the complaint: "No one realizes more than we do the fact that our operators in the district are unable to cope with the business. But we cannot put on more operators until more switchboards are in place, and the equipment will be increased as rapidly as possible. We have orders in for new switchboards for the office here and expect to have them in place by the 25th of the month. Then additional operators will be employed and we believe there will be no further cause for complaint from Cripple Creek people. We have already completed a new pole line to Colorado Springs, which will also carry Denver wires, and the number of Springs-Cripple Creek wires will be increased from 26 to 40." D.

NEW COMPANIES.

The Shiloh Mutual Telephone company, capitalized at $900, was recently incorporated at Huntsville, Ill., by E. H. Groslande, J. E. Croxton and T. A. Wilson.

The Central of Georgia Telephone company has been incorporated, with capital stock of $200,000, to establish telephone systems, by T. C. Parker, O. H. Weaver, E. Y. Mallory and J. J. Cobb.

The Staunton Telephone company of Staunton, Ill., was recently incorporated, with a capital of $2,500, to operate a telephone and telegraph line. C. R. Wall, S. P. Williamson and C. Godfrey were named as incorporators.

The Noble County Telephone company of Albion, Ind., was incorporated on September 19th. The capital stock is $15,000. The directors are Thomas A. Huston, M. C. Beck, W. F. Clapp, Edward P. Eagles, Luke H. Wrigley, L. W. Weekes, F. A. Stuempel and F. J. Spencer.

The incorporators of the Grant County Telephone company of New Mexico are as follows: P. T. McGrath, Denver; Joseph W. Bible, Adolph Witzel, William D. Murray, Edward A. Blanton, Jr. The company proposes to build a telephone line from Silver City to El Paso and furnish connections to the principal mines in Grant and Socorro counties.

The Greensburg Telephone company of Greensburg, Ind., filed articles of incorporation with the secretary of state on September 7th; capital stock, $30,000. The incorporators are Alfred P. Bone, W. B. Hamilton and David A. Myers. The company is to operate in Decatur, Franklin, Rush, Shelby, Bartholomew, Jennings, Ripley and Dearborn counties.

Death of John E. Hudson.

John E. Hudson, president of the American Telephone and Telegraph company, successor of the American Bell Telephone company, and for years president of the latter company, died very suddenly at Beverly, Mass., on October 1st. He was sitting in the railroad station waiting for a morning train for Boston when he suddenly threw up his hands and slipped from his seat to the floor. Mr. Hudson was quickly raised up, but he was dead. A physician who was called said that heart disease was the cause. Mrs. Hudson, who was with her husband at the time, was completely overcome. Mr. and Mrs. Hudson had no children.

For 20 years Mr. Hudson had been closely connected with the Bell telephone interests. He early realized the value of the invention and was active in putting it before the public. He was a cultured gentleman of marked ability, a lawyer by

JOHN E. HUDSON.

profession, and his advancement in the company was rapid.

John Elbridge Hudson was born in Lynn, Mass., August 3, 1839. He was a lineal descendant of the Thomas Hudson who came over from England in 1630. As a boy he attended the Lynn schools, entered Harvard University, and was graduated in the class of 1862. He was the best Greek scholar of his class, and before he received his degree, was appointed to a Greek tutorship in the college. But he decided to adopt the profession of law, and entered the Harvard law school, graduating in 1865. He then entered the office of Chandler, Shattuck & Thayer, and was admitted to practice October 25, 1866. He remained with the firm until 1870, when he became a partner in the firm of Thayer, Ware & Hudson.

In 1880 Mr. Hudson was appointed office counsel for the American Bell Telephone company. In 1885 he was made general manager of the company, and in 1887 became vice-president. The same year he was made president of the American Telephone and Telegraph company for long-distance service, and in 1889 was elected president of the American Bell company, holding that position until the amalgamation of the two companies this year, when he remained as president of the combination. Under his administration the operations of the company have been increased immensely, and a notable triumph has been achieved in the development and perfection of the long-distance service. Mr. Hudson was fond of literature and of art. The beautiful Bell telephone pavilion at the World's Fair, Chicago, was conceived by him, and represented him quite as much as it represented telephony.

Mr. Hudson was a member of the American Academy of Arts and Sciences, the American Antiquarian Society, British Association for the Advancement of Science, New England Historic and Genealogical society, Colonial Society of Massachusetts, Bostonian society, American Institute of Electrical Engineers, Selden society, the Bar Association of the City of Boston, the Virginia Historical society and also the Boston Art, the St. Botolph and University clubs.

He was married August 21, 1871, to Miss Eunice W. Healey, daughter of Wells Healey of Hampton Falls, N. H.

Although president of the Bell Telephone company, Mr. Hudson owned only 15 shares of the stock.

When, in 1880, the American Bell company took over the business of the National Bell Telephone company, its predecessor, there were in the entire country but 28,316 miles of wire and 132,692 instruments in use. To-day there are over 1,580,000 instruments in use, 1,017,000 miles of wire, 1,250 exchanges, 1,200 branch offices, 423,000 circuits, 633,000 stations and over 5,000,000 daily connections.

Ownership of Bell Stock.

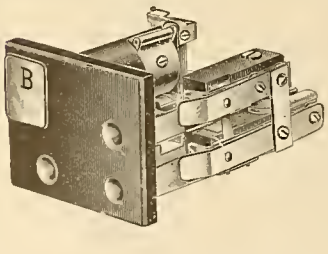
The Boston News Bureau of September 29th says: "One important fact has come to the surface, and that is as to who Theo. N. Vail, formerly general manager of the American Bell Telephone company, represented in his large holdings of telephone shares in the old American Bell Telephone company. Mr. Vail held at one time the largest block of Bell Telephone stock, and this not many months ago. Mr. Vail, although having made a third fortune in Mexico, South America and western mining enterprises since he left the American Bell Telephone company, was not rated as a large enough millionaire to be the holder of $2,000,000 or $3,000,000 worth of Bell Telephone stock, and the general belief was that he represented in these holdings the Western Union Telegraph company. We are able to state that that block of stock, however, in no way represented the Western Union. What Mr. Vail did not own personally in that block of stock, President Mackey of the Postal Telegraph company did, and probably does to-day. It is said that Mr. Mackey is held in high esteem by the American Telephone company's management, and is frequently consulted upon questions of policy. A director of the American Telephone and Telegraph company says the company is spending more money on new construction this year than in any other year in the history of the telephone companies, and that it was never making more money than at the present time."

Slot Telephones in London.

The General Postoffice authorities are making excellent progress with the new telephone system for London. A feature of this system is the attachment to the instruments of a penny-in-the-slot machine, so that a call can be made, automatically registered and prepaid. Eventually, this system will probably be general all over the kingdom. Lines have already been laid in Birmingham and Manchester, but they cannot be opened to the public until next year.

Eureka Three-way Jack.

The Eureka Electric company of Chicago has brought out the ingenious device herewith illustrated for use with its metallic express telephone switchboards or elsewhere for the purpose of increasing the usefulness of toll lines. Where toll lines are in use for a conversation between two given points the remainder of the line has been inoperative hitherto, because two distinct conversations cannot be heard over the same circuit at the same time. The three-way jack illustrated is designed to furnish a switching connection that will make it possible to divide up the line, as it were, into several parts, for as many



EUREKA THREE-WAY JACK.

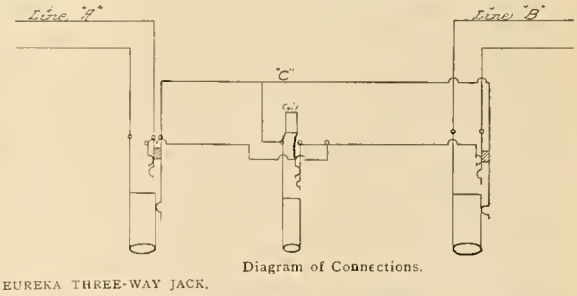


Diagram of Connections.

conversations. Referring to the diagram, the operation of the device will be understood. Line (A) represents the line coming into exchange. Line (B) represents the outgoing line. These circuits are in bridge. (C) represents the jack underneath the coil. The coil is bridged in the circuit. The insertion of the plug in jack (C) lags on to the line and cuts out the coil only, but leaves both ends of the wire so that it can be used for signaling either way. Insertion of the plug in the top right-hand jack cuts off line (B), still leaving the circuit open for line (B) to come in on (C) jack, so that both ends of the line can be used at the same time without interfering with either conversation. Immediately after the conversations have been held, the line is restored to its nominal end-to-end trunking capacity.

The Eureka company furnishes this jack in its switchboards when desired. The three-way jack occupies just the space that two of the Eureka removable, self-contained, self-restoring drops take up, and by displacing two drops the new device may be locked firmly in place. The company also furnishes this device on telephones, separate by itself, wherever it be desired. The drops furnished in these jacks are tubular and self-restoring, of the well-known Eureka pattern, and are furnished in any windings desired, 500, 1,000, 1,200 or 1,600. The usual windings are 1,000 ohms unless otherwise specified.

Damage to Telephone Plant in the Galveston District.

[From the Austin (Texas) correspondent of the Western Electrician.]

Mr. E. K. Baker, general manager of the South Texas District of the Southwestern Telegraph and Telephone company, has returned to his headquarters at Austin from Galveston, where he has been since immediately after the great storm which devastated that city. He has been directing the work of bringing order out of chaos in Galveston and in the storm-swept region of the mainland along the coast. It is conservatively estimated that the company suffered a loss of $400,000 by the storm. In addition to the complete wreckage of the finely equipped Galveston plant [see illustration on page 181, Western Electrician of September 22d], the long-distance lines between Houston and Galveston along the several railroads were blown flat. The local plants at Brenham, Houston and several other places in the storm region were badly damaged. President Charles Glidden contributed $500 and the company contributed $1,000 toward the relief of the storm sufferers. General Manager Baker made the following statement in regard to the situation:

"We are rebuilding our wrecked lines as fast as men can do the work. We have a large force employed in the work, and the long-distance service is now being operated into Galveston. We have no local telephone service in Galveston, as all poles are down and the wires are destroyed. We want to put in an underground system in that city, and at the proper time we will make application to the municipal authorities there for a permit to do so. During the first 15 days after the storm we paid out over $30,000 to employes in wages in restoring the damaged system. This amount is being largely increased daily as the work progresses. This is exclusive of the material we have had to buy."

General Manager Baker cannot at this time give any definite idea as to when the Galveston exchange will again be in working order. Mr. P. G. Reynolds of St. Paul, Minn., chief of construction for the company, is on the ground directing the work of rebuilding and re-establishing the wrecked lines and other property of the company. H.

MANUFACTURERS AND DEALERS.

It was the Telephone Manufacturing company of Sumter, S. C., and not the "Sumpter Telephone Manufacturing company," that received the medal at the Paris Exposition.

The Western Telephone Construction company of Chicago has issued a handsome 75-page catalogue of its switchboards and telephones. The book is well illustrated by half-tone views of the shops and manufactured products, as well as completed exchanges, and is filled with interesting telephone facts. The company builds switchboards, from the smallest size to those of the multiple type for 6,000 subscribers, besides every variety of telephone apparatus. A valuable feature of the catalogue is a summary of telephone troubles, with the proper remedies, and helpful advice for all telephone users.

The Eureka Electric company of Chicago desires to announce that it has now in press its new twentieth-century catalogue. This catalogue, the Eureka people promise, will be the most exhaustive and largest catalogue ever issued in the Independent field. It will contains cuts of all the well-known Eureka apparatus as well as a large number of new and improved up-to-date twentieth-century devices. The company will be pleased to forward this catalogue to any company desiring it.

The Farr Telephone and Construction Supply company, Chicago, has just issued its catalogue No. 14. It is perhaps the most complete and best-arranged telephone catalogue issued by this company, and it will without doubt prove of interest to users and purchasers of telephone apparatus. The catalogue, as in previous publications of the Farr company, contains considerable valuable information for those putting in telephones. The company will be pleased to mail a copy to anyone on request.

The Kentucky Telephone association will meet in Winchester, Ky., on October 9th.

Mistakes in the Rating of Incandescent Lamps.[1]

By Arthur J. Rowland.

Let us first inquire into just what a 16-candlepower lamp ought to be. That it should be one which gives a light equal to that of 16 candles in the direction in which the light is useful seems a natural and fair definition. A little careful observation of lamps as they are installed shows that at least 85 to 90 per cent. of those used are put in place with base upward, or tipped end downward, and it is the light which comes from this tipped end of the lamp which is useful. In cases where the lamp is installed in a different position, either the lamp is subordinated to some artistic feature of the electrolier, or the lamp is installed "side on" to better keep it out of the way. So it comes that the light we ought really to want to know about, the light we ought to measure, is that coming out of the end of the lamp. Or, at least, it is sure that, if we call the axis of the lamp a line through it from the middle of the base up to the sealed-off tip, the light of value is that coming into space below a plane perpendicular to the axis, half way along its length. We can never use more light than this, since for satisfactory lighting the sources must be above us, and in real service we make use of much less. Should we take the average candlepower of all the light rays into space below the imaginary plane just defined, this would be called the mean hemispherical candlepower, just as the average candlepower of all the light rays given by the lamp in every direction is called the mean spherical candlepower.

The placing of lights is to-day being made much more intelligently than by the old rules of so many 16-candlepower lamps per 100 square feet of floor surface, or per 100 cubic feet of room to be lighted. Some certain amount of illumination is now striven for and a proper distribution of light, rather than of lights, is sought.

In a great deal of lighting one tries intentionally to give illumination concentrated about particular points. For example, in lighting a library, it is the library table which is to be brightly lighted; other parts of the room need little more than the scattered rays, otherwise useless, which reach them directly from the light source or after reflection. The light rays in poor planes and the reflected light which comes from the table, the walls and objects in the room, though contributing little to the important light, serve to break up shadows and produce diffusion. Almost the same thing would be true of the lighting of a bedroom, where the light should be concentrated about the bureau or dressing table.

In quite a different sort of lighting, still the same things hold true. Take the lighting of a factory or mill, for example. The light must be on the machines or work, and be very good there. That which gives the room its general lighting is waste light from the light sources. To light the whole room as brightly as the machines would be too costly to be practical. For such lighting let us consider what rays are useful and what rays waste light. If the lamp hangs directly above the thing to be lighted, and its area be not more than five by five feet, no rays of light beyond 30° from the axis of the lamp will be useful, and the higher the lamp is hung, the less the angle in which the useful light is found.

A second sort of lighting is that in which a uniform distribution of light is required, as in concert halls, or auditoriums of various sorts, and in shops for the sale of merchandise. A fundamental principle in this class of lighting is to use many sources of small candlepower each, all so placed that the light from them is directed downward, with perhaps a little diffused side light to break up the shadows, especially in small interiors. The lighting engineer is forced to use single lamps to procure this, except in large rooms, and they are nearly always installed base upward. The light from the tipped end produces the light of value.

A third sort of lighting is for decorative purposes, but that is so very especial and foreign to considerations of candlepower at all in most instances as to merit no consideration here.

The light below the lamp—that from the tipped end—is then the important and useful light in all practical cases. This is true, too, not only from the specific cases cited, but where large electroliers with many lights are used as well; for in such cases the lamps are usually flared out, with axes at some angle approaching 45°, in which case high candlepower from the tipped end and low from the sides of the lamp would contribute to a good, even illumination of the room.

There are five different types of filament in use to-day by various prominent lamp manufacturers, and in most cases a filament type indicates the product of a certain manufacturer who has adopted that as the one used in his standard lamps. These typical filaments are enough different from each other to show interesting individuality. I have classed them as follows:

(a) Straight U-shaped filament—a type rapidly passing altogether out of use.

(b) Single-curl filament—a type much used, having a circular loop in the filament midway of its length. This type was originally designed to render filaments stiffer and less liable to bend without an anchor, and also to shorten the lamp bulb. It was found to give a better distribution of light than type (a).

(c) Long-curl anchored filament—a type differing from type (b) in that the loop is long in the direction of the lamp axis and is anchored to the part of the lamp where the leading-in wires pass through the glass.

(d) Double-filament—a type which uses two filaments like type (a), set so the current passes through them in series, the filaments being in planes approximately parallel.

(e) Double-coil filament—a type like (b), except that there are two turns in the coil instead of one.

Besides being typical in the matter of general form, the light distribution observed from these various filaments is also typical. It is, however, considerably influenced by the exact relation of different dimensions in the filament itself used by particular firms, as, for example, the diameter of a coil or the spread of the filament shanks.

The form of filament has a most important relation to the candlepower distribution, as, of course, it must, since the candlepower delivered in a given direction is determined almost wholly by the amount of filament length visible from that direction. A filament of type (a) shows only the end of the U when one looks in at the tip, and so the candlepower must be low, even if the U be broad. A double filament must show low candlepower for the same reason; and if the filament loops are narrow and the legs of the filaments straight, as they were in the lamps of the make tested, the candlepower may be even lower out from the tipped end than for a filament of type (a). A filament with a coil in it shows much more projected length when viewed from the lamp's end, and so gives comparatively high candlepower in that direction. We see, then, that a 16-candlepower lamp is very different in the candlepower it gives in various directions and very different in a given direction with difference in type of filament. That lamp which gives most useful light is undoubtedly the best. Hence, there is no question but that the 16-candlepower lamp with filament of type (e) is a far better lamp for general lighting purposes than any other. It is almost beyond belief that this has escaped notice in all the years incandescent lamps have been made and used, and yet it has been so. I first had my own attention called to the matter by the Shelby Electric company, for which I was making some tests of candlepower. It is the lamp of that company which I show as type (e). In an attempt to find whether in the past anyone had attached importance to the light coming out from the tipped end, I have been surprised to note how, over and over, this or that experimenter or lamp manufacturer has been on the verge of the discovery and then passed it by. One of the most recent cases I have noticed is that of a lamp manufacturer who advertised sign lamps with "all the light from the end," but seems never to have thought that this would be the right sort of lamp to use as his standard product.

The Shelby lamp (type e) for which data is given was made tipless; that is, the sealing off after exhaustion was not done as usual at the tipped end. The gain in candlepower by omitting the tip, so far as tests which I have been able to make indicate, is about 12 per cent. The loss in tipped lamps is probably due to light absorbed through the thicker glass at the tip and partly to reflection and refraction of light into useless directions, which otherwise might have been saved to be useful.

The only sensible candlepower by which to call an incandescent lamp is that which is useful in producing illumination at desired points. Such a method has never been used in marking incandescent lamps for sale. It is strange how precedent binds us in everything we do. Here, in the matter of incandescent-lamp candlepower, we are all tied to methods of designation which look back to photometric methods used for gas burners. True, mean spherical candlepower and rotation methods are distinctively electrical, but they first came to be of importance because incandescent lamps are so commonly placed in positions impossible to gas burners; and the rotation methods are used simply to save time in measurement, one reading taking the place of a dozen. Mean spherical candlepower is an impossible measurement for commercial purposes. Rotation methods are poor, too. Not only does the speed of rotation affect the result procured, but some of the best modern lamps produce such a flicker at the car of the photometer when rotated at standard speed (180 revolutions) that not only is the making of an observation most trying to the eyes, but the observer can only make a rough guess for the position of his screen when a balance is obtained. A recent suggestion to choose such a speed for each lamp as just removes the flicker is impractical also, for not only does it require an adjustment of speed with different lamps, but with many filaments high speed of rotation distorts the filament or even throws it against the glass, due to centrifugal forces brought into operation by the high speed.

What more rational, then, than to measure the lamp's candlepower looking in at the end? It is the light coming from the end which we make use of—which we are interested in. Then this is the light to measure, and that by which the lamp should be rated. Lamps measured thus are as comparable with each other as lamps measured any other way. The apparatus required to make the measurement would be very simple, for no rotating device would be required, and the lamp need only be inserted in the socket without any care as to which side comes uppermost when its candlepower is determined, since the candlepower must always be read the same. Thus, readings of different observers would agree without respect to anything involved in the measurement, except the standards used and the personal element, which can never be eliminated. Such a radical change of method, however sensible the change, could not be made without the sanction and support of some of the large associations of electrical engineers. In the meantime, however, for eventually this method must certainly come to be used, all lamp users should, in addition to a measurement of candlepower in the conventional way to check up the lamps purchased, take a reading of the useful light out from the tip.

A 16-candlepower lamp should be one giving 16 candlepower from the tipped end. The horizontal candlepower might be considerably less and be irregular in different directions without altering the real value of the lamp. An ideal 16-candlepower lamp would perhaps be one which measures 16 candlepower from the tipped end, had 16 candlepower as the mean horizontal candlepower and was of nearly 16 candlepower mean spherical. Such a lamp could be turned into any position in an electrolier and still give an illumination equally as good as before and as well distributed.

In most lighting, also, the end of the lamp which has been called the tipped end all along should be tipless. Hold a piece of white paper below an ordinary tipped lamp hung with the tip down, as it commonly is, and the reason is unnecessary to state. Variations in thickness of glass and shadow cast by the tip make lines of light and shade that spoil all real value of light procured.

Since the making of such lamps as these is doubtless but a choice of filament form and arrangement, let us hope it will not be long until there are some ideal lamps available commercially.

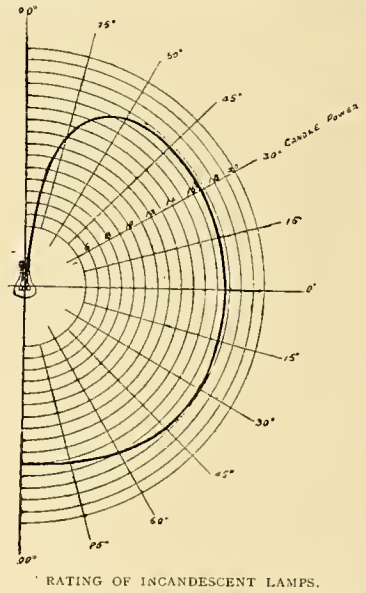
So far no word as to the efficiency of lamps has been said. It does not directly affect the candlepower nor distribution of candlepower. All the lamps mentioned were 3.5-watt, 16-candlepower lamps. But why are they 3.5 watts per candlepower? Each lamp used burned with a consumption of 56 watts. The efficiency or watts per candlepower is strikingly varied by the candlepower to which reference is made. A 3.5-watt lamp turns out to be one which uses this much electric power per candlepower if this is reckoned at its highest value, the mean horizontal. What a terrible inefficiency these lamps have if we calculate the watts per candlepower from the useful light or the light from their tips!

If a lamp can be made which gives 16 candlepower out from the tip and burns at five watts per candlepower, we will have a lamp which is better than any now made. If its life is as good as the present 3.5-watt lamps, it would be a much better lamp than any we now have for all commercial usage.

A New Form of Filament.

Since making the preceding tests there have been developments whcih are worthy of especial mention. A new type of filament for commercial lighting has come into being. The following matter describes its interesting features.

The Shelby filament, which is the most recent product of that company, has been designed and arranged especially to produce a high candlepower



RATING OF INCANDESCENT LAMPS.

in the vertical direction. In the cut is shown the average vertical distribution of candlepower from the new lamp. I call attention first to the arrangement of the diagram. I show the base of the lamp upward, exactly contrary to the conventional arrangement of vertical candlepower diagrams since 1885. This method of plotting is natural and suggests at once the value of large candlepower downward (below the lamp). It is another step away from the conventions introduced into incandescent photometry long ago from gas-photometer practice. I call attention next to the sort of filament and bulb

1. Abstract of paper read before the Franklin Institute of Philadelphia on September 19, 1900. Mr. Rowland is professor of electrical engineering in the Drexel Institute of Art, Science and Industry.

tested. The rude sketch at the center of the diagram only suggests it. The filament itself is a good deal like the old Shelby coil, but with the circular coils flattened vertically, so that a much greater projected length of filament shows from the end. The bulb is also much flatter at the end than in other standard forms, and the light comes through it nearly at right angles to the glass. The lamps for which data are given were made tipless. The loss of light through the tips of lamps having filaments so spreading as these would be very slight. Data of candlepower and efficiencies with the new filament are as follows:

This lamp burned at 116.3 volts using 61.6 watts
Mean horizontal candlepower 16.6
(At 180 R. P. M., 16.0.)
Mean vertical caodlepower 14.9
Mean spherical candlepower 16.1
Mean with axis at 45° 16.5
Mean hemispherical candlepower 16.6

EFFICIENCIES.

Watts per caodlepower reckoned on horizontal candlepower 3.72
Watts per candlepower reckoned on vertical caodlepower .. 4.13
Watts per candlepower reckoned oo spherical candlepower 3.83
Cost of current per 16-candlepower usefal light and per 500 hours of hurning, at 12 cents per kilowatt hour $3.97

In the diagram there is to be noted a wonderfully maintained candlepower as one passes from the horizontal to the vertical direction. The lamp as I received it was one of a lot, none of which was marked for voltage, and I set it at 16 candlepower when rotating in the usual way, and made all subsequent measurements at the voltage so determined. The results set down are therefore on my rating, not on the manufacturer's. The vertical candlepower (almost 15) is beyond comparison with that given by all filament forms except the double coil, which it even excels by 37 per cent. The mean spherical candlepower is also remarkable. The highest I know of in lamps rated in similar manner is below 14.

It may seem strange that a horizontal distribution is omitted in the test. This is purposely done. Regularity or irregularity of candlepower in the horizontal direction is quite unimportant, compared with the vertical. The average horizontal is shown in the vertical plot, and beyond this it is quite unnecessary to go, for all we need care to know of an incandescent lamp as regards its candlepower is (1) what is the vertical candlepower, and (2) what ratio between this and the average horizontal?

I take it that the production of such a filament, such vertical candlepowers and such efficiencies as these are evidence of a demand for lamps of the sort. I cannot but feel that a new era in incandescent lighting has dawned when this is so. In future lamp specifications we may look to see a requirement set down as regards the vertical candlepower of lamps, and the ratio of this to the mean horizontal. In fact, it cannot be long before specifications for lamps for commercial lighting will ask for a certain vertical candlepower, and watts per candlepower on this rating, with a requirement as to a minimum horizontal intensity.

DISCUSSION.

W. C. L. Eglin of the Philadelphia Electric company presented a reflector lamp which, he explained, was made on the same lines as the Shelby lamp described in the paper, but with the effect magnified. The light from this lamp was wholly through the end, and he claimed for it an efficiency of 1.5 watts per candlepower in the direction the light was thrown. He further stated that the coil form of filament was old, having been used in some of Mr. Edison's early lamps. Mr. Eglin went on to say that the light out horizontally from an incandescent lamp, which strikes the walls, is important and necessary in producing good illumination, and so the horizontal candlepower should be considered. He attached no great value to initial measurements, and questioned the life and maintenance of candlepower of the Shelby coil filament.

Francis Head of the Union Traction company in answer stated that he had carried a number of such coiled filaments through a life test, and they had proved fully equal to any of the other makes.

Professor Rowland, author of the paper, said that the paper carefully avoided the question of life and maintenance of candlepower, since the intention was to deal wholly with light distribution. The light distribution must remain the same throughout the life of any lamp, without respect to decrease in candlepower. He admitted that the coiled filament in the old-type Shelby lamp was not new, and called special attention to the circumstance that the advantages it gave had never been observed, for this form alone gives a good candlepower distribution. He further said that the light out to the walls was, of course, a good thing, in order to have them properly illuminated: also, that the light reflected from them may be of a little use when the lamps in service give but low candlepower out from the end opposite the base. As a matter of fact, the useful illumination produced by light reflected from the walls is almost negligible, since it has to pass through the long distance to the walls and back again. Its only value is to break up shadows and aid diffusion. Moreover, if this kind of light is useful, the Shelby coil filament has as much light to send out to light walls and for reflection as any other, while the direct light from it is much greater.

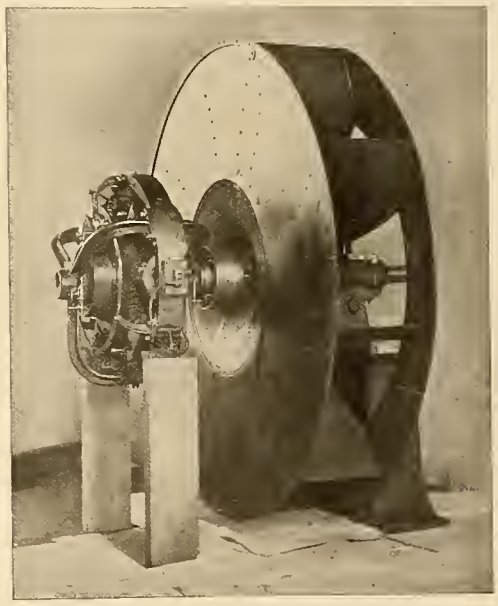
A reflector lamp has use in certain specific instances: For example, to supplement general lighting over a desk when it takes the place of a lamp with such a reflector as a McCleary shade. It is not practical for commercial lighting, however, since it limits the light absolutely to the direction in which the reflector sends it and produces strong, sharp shadows.

An ordinary reflector lamp, acknowledged to consume 50 watts, is extravagantly used for lighting, even though the efficiency may be 1.5 watts per candlepower in the direction in which the light is thrown, for the reason that it illuminates only a small area. With it general illumination would be necessary at additional cost.

A reflector lamp combines a reflector and a lamp in one. While the combination may cost less than lamp and reflector bought separately, when the filament burns out the reflector is gone, too; hence, at the price these lamps are offered, they are too expensive for general use. Separate reflectors are much to be preferred where it is really necessary to use them.

New Type of Electric Ventilating Wheel.

In the accompanying illustration is shown a form of ventilating wheel with special eight-pole attached motor, recently designed and constructed by the B. F. Sturtevant company of Boston, Mass. The fan is designed for the most efficient operation. It is arranged with a large inlet for admission of air through one side only, has curved blades, and a conoidal plate, concentric with the inlet, which serves to deflect gradually the air from an axial to a radial movement. In the inlet of the fan is placed a continuous oiling journal box, which supports the fan shaft upon that side. Immediately outside and at the back of the wheel is a flanged coupling, which joins the fan shaft to the motor shaft.



NEW TYPE OF ELECTRIC VENTILATING WHEEL.

The motor is built within a wrought-iron field ring. Attached to each side of this ring are tripod supports which carry the ring oiler bearings and absolutely center the armature within the field. The field cores are of wrought-iron, with a special type of cast-iron pole-shoe. The peculiar size and shape of this shoe makes possible extreme variation in load without sparking or adjustment of the brushes. The armature coils are built up of laminated, slotted disks, which are solidly clamped between brass rings, having teeth to correspond with the core teeth which support both edges of the core. Self-adjusting and self-feeding brush holders, with carbon brushes, are used.

This type of electric fan is employed without a casing, and usually arranged to draw the air through an opening in a wall and discharge it at comparatively low velocity into the space within which is located the fan and the motor.

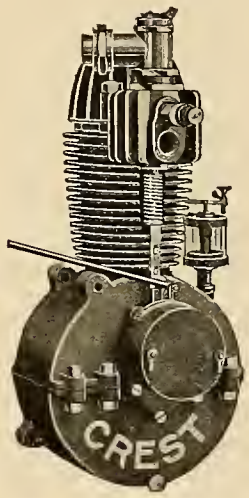
Mr. Yerkes' London Project.

Further details of Mr. Yerkes' electric-railway operations in London are of interest. On September 28th Mr. Yerkes finally purchased the rights and property of the Charing Cross, Euston and Hampstead underground railway for a cash consideration variously stated at from $150,000 to $500,000. The transfer of this franchise made Mr. Yerkes proprietor of the company's authorized capital of £1,776,000. His first act was to elect himself chairman of the company. Then he appointed a board of directors to serve until a permanent organization can be effected among the American capitalists associated with him in the new undertaking. Among the latter are said to be John J. Mitchell, president of the Illinois Trust and Savings bank of Chicago, and Henry C. Davis of A. A. Houseman & Co., New York, who has been named as vice-chairman. Other Americans interested are reported to be Marshall Field, L. Z. Leiter, D. H. Louderback and Norman B. Ream, of Chicago, and members of the Widener-Elkins-Ryan syndicate of Philadelphia. It is said that about $12,000,000 will be invested in an up-to-date electric tunnel railway, using the third-rail system. The company will, it is said, employ American capital and material and English engineers and contractors. The project has attracted much attention on both sides of the Atlantic.

Crest Single-cylinder Gasoline Motor.

The Crest Manufacturing company of Cambridgeport, Mass., manufacturer of the well-known Duplex gasoline motors for automobiles, has recently brought out a new type of single-cylinder motor of three horsepower, that is adapted more particularly to tricycles and light voiturettes. The company purposes to furnish free with every motor purchased a complete set of full-sized working drawings of one of the latest types of French motor tricycles, so that it will be an easy matter for any bicycle concern or repair shop that has a brazing outfit to make a few motor tricycles for its trade. The motor tricycle is largely used in Europe, as it appeals to the rider more than any type of motor carriage, on account of its handiness, the ease in which it is manipulated and low first cost.

One of the special advantages of the new motor is that all the working parts can be removed from the motor without taking the motor from the tricycle or disconnecting pipes. This is an exceedingly important advantage, as it allows for quick repairs on the road, and will be appreciated by all automobilists. It will also be noticed that the manufacturer has increased the heat-radiating surface, as compared with other types of motors, insuring a cool motor under the most extreme conditions of service.



CREST SINGLE-CYLINDER GASOLINE MOTOR.

The Crest motor has a patented sparking device having self-cleaning contacts unaffected by oil or dust. Another important peculiarity of the sparking device is that the motor has to be always started on the slow speed. The handling of the motor has been simplified. The numerous handle rods are dispensed with, the manipulation of the motor being done with one handle. The one handle first closes the exhaust, then switches in the current, giving every change of speed, from the slowest to the fastest. The weight of the motor is 69 pounds, being, it is said, the lightest single motor per horsepower made. Every part of the motor is built to gauge, insuring interchangeability of parts. This motor is so built that it will fit any of the present types of motor tricycle, and is well adapted for light runabouts.

The Crest company thinks that superintendents or inspectors of electric-light companies could utilize tricycles equipped with these motors for emergency-repair calls.

Electric Railways in Canada.

George Johnson, the Dominion statistician at Ottawa, has compiled some very interesting figures about the electric railways of Canada. During the year ended December 31, 1899, the 612 miles of electric-railway track were so used that the total number of miles run by cars was 20,646,847. The number of passengers carried was 104,033,659. This is equal to moving every man, woman and child in the Dominion about 20 times. The mileage run and the passengers carried show that for each mile run the electrics carried 3½ passengers. Compared with the previous year, the number of passengers carried increased nearly 9,500,000, and the number of miles run by over a million. The amount of paid-up capital invested in electric railways in Can-

ada is $21,700,000. The electric cars traveled over 4,333,000 more miles than the passenger and mixed trains of the steam railways. Together, the steam and electric railways carried over 120,000,000 passengers, and the proportion was about 13 by steam to 87 by electricity.

Electrical Contacts.[1]

By Frank C. Mason.

It is curious that the subject of electrical contacts has received so little attention in the literature and discussions of the general subject of electrical application. At the basis of nearly every variety of electrical apparatus, whether for signaling with small currents or for the larger work of heating, lighting, generating and developing electric power and the application of electricity to chemical processes, the contact or point of discontinuity in the circuit is found as an essential part of the apparatus or of the method.

It is well, at this point, to say that this paper will be limited to those uses of electricity employing relatively small currents, as in telephony, telegraphy and signaling, and will not touch on the larger field that its subject embraces in the utilization of heavy currents. However, the line of demarcation between the light current and the heavy current is now by no means so sharply drawn as it was in the days when the primary battery, in one form or another, was the sole dependence of the telephone and telegraph engineer.

When we see the motor-generator and the storage battery used as the central source of energy for a telegraph, fire-alarm and telephone system, we naturally wonder how much longer we can speak of the light-current applications of electricity as a distinction from those employing large and powerful currents generated by dynamos.

Contacts may be roughly grouped into three classes: Those that are intended to be permanent (such as joints in wire and cables), those that are semi-permanent (such as contacts between wire and binding-posts), and operative contacts, or those that are intended to be opened and closed at will, as in keys, switches, etc.

For all these kinds of junctions two enemies exist, constantly tending to destroy efficient electrical contact—chemical action and dirt. It is scarcely necessary to speak of mechanical strains, which are guarded against naturally by the exercise of common sense. Chemical action, as it applies to contacts, is generally due to the remnants of some compound or chemical used in soldering and to the action of air and moisture (either singly or in conjunction) producing oxidation of the surfaces in contact. This action is greatly enhanced by the formation of sparks at contacts of the operative kind, the resultant film of oxide being generally a non-conductor and interfering greatly with the operation of the contact. Dirt, as Emerson says, is merely "matter out of place." In electrical work, dirt means any non-conducting substance that interferes with good electrical contact. It is often dust, but in operative contacts is more frequently the products of oxidation of the points of contact themselves, where (as is too often the case) these are of the baser and more oxidizable metals.

Permanent joints or contacts are used both in line conductors and in instruments. Nowadays, the general introduction of hard-drawn copper wire for overhead-line work has reduced practice in this kind of jointure to a question of the best way to handle that material. Experience has shown that soldering such joints draws the temper of the wire, making a joint of mechanical weakness, while the ancient habit of linemen, of twisting the wire at the joint into tight spirals, leads to the same result. For these reasons, the twisted and soldered joint must necessarily give way to one of the various and excellent types of tubular joint now manufactured for the purpose. In cable work, especially, where paper insulation is used, the best practice now, strangely enough, is to use merely the twisted joint without solder. The wire being soft and subject to no strains, the joint is abundantly strong, while its sheathing after jointing fully protects it from the harmful action of the atmosphere and moisture. To solder such a joint, would merely add the danger of corrosion from the dissolving action and slow electrolysis of the fluxes used.

Permanent joints, in switchboards and instruments, being protected from the weather, are generally soldered. The wires should be tinned, so as to leave no excuse for the use of the mischief-making chemicals sold as "soldering solutions." Tubular solder, having resin or stearine flux in its hollow part, should be used, and the utmost watchfulness employed to keep acid and "salts" away from the work. One easy joint made by these means may plant the seeds of trouble, to be reaped later, and, by the peculiar provision of fate, almost invariably just when trouble or breakdown is most to be feared.

Semi-permanent contacts are, practically, of only two kinds—binding-posts and fuses. The average American binding post is a piece of metal with a hole drilled through it to receive the wire, and another drilled and tapped, to receive a set-screw, which may or may not have a pointed end. The design of this type of binding-post is utterly vicious. The screw may shear the wire nearly in two, leaving it so that the slightest strain will break it off, or it may not come down to a tight bearing on the wire, leaving a loose joint ready to collect dirt and become inoperative. Much the better type is that variety of binding-post in which the wire is held firmly between two flat surfaces, thus insuring a large area of contact, and which is provided with a lock-nut, so as to avoid any danger of the binding-washer working loose. In instruments having binding-posts of the other type, considerable improvement can be introduced by putting small hexagonal nuts, a little larger than the driving heads of the binding screws, on the latter and setting them down firmly on the top of the post, to act as lock-nuts.

In fuses, which are an absolutely necessary part on any installation in a modern city traversed by electric-light and railway conductors, an excellent opportunity for bad contacts presents itself. The practice of securing the fuse wire under a washer or the head of a screw is very bad, as the wire is strained, is apt to be reduced in section at some point and cold flow of the fuse may take place. To obviate these troubles, it is usual to attach pieces of copper to the ends of the fuse wire, screwing these down tightly under the binding washers. If the fuse, as is often the case, is merely squeezed into the copper ends, the trouble is only transferred to another point. Hence, the best solution of the fuse difficulty is to use copper lugs, to which the fusible wire is securely soldered, held down by screws provided with lock-nuts. Care should be taken in installing fuses not to set them in place under strain, as their expansion and contraction under temperature changes produces crystallization of the metal or reduction of its cross-section at some point.

While the two classes of contacts already referred to are, in a large measure, in the hands of the operating force of a fire-alarm, telegraph or telephone installation, the third class, and the most important to all of us—the working contacts of instruments—are confined to these appliances, and their nature is determined by the manufacturer. In keys, relays and vibrating gongs, the switching apparatus of the telephone station, and in all other places where signaling circuits must be made and broken, sparks will be formed, and no practical device known to the art can prevent their formation. While dust, always inimical to good contacts, can be excluded from such places by proper construction of the instrument, nothing will prevent the formation of oxides at the point of sparking, which is also the point of contact, except making these points of some material that will not oxidize.

For this purpose, the only substances known that are at the same time good conductors of electricity and possess the necessary qualities of mechanical strength are platinum and a few other of the rarer metals, such as iridium and gold. The consensus of opinion and experience has shown platinum, or certain of its alloys, to be the only substance commercially available for the construction of contact points of this character. Unfortunately, platinum is a material of such great value that the expense of such contacts is greater than that of any other kind, and, therefore, the temptation of the manufacturer to replace such contacts with those of cheaper material, or to stint the size, has been very great, and too often he has fallen before it. He has introduced contact points of the baser metals in his instruments, and this has far too often invited, if not assured, disaster.

Blame for such substitution of such cheap contacts cannot rest entirely upon the manufacturer, so long as the users of electric-signaling apparatus fail to recognize the value of the higher-priced article, or, recognizing it, fail to specify its use when awarding contracts, and to see that this vitally important detail has been honestly and intelligently executed in the completed instruments.

Pure platinum is a very soft metal, and therefore is not as serviceable for contacts subject to mechanical blows as certain alloys of the metal with other members of the platinum group of metals.

In municipal work, more than in any other, the electrical equipment must be absolutely reliable. A bad contact, sticking together or full of oxides, may mean loss and danger of the gravest sort to the community. Through failure of the fire apparatus to respond to an alarm, or of the ambulance to answer its call, or of the police to appear promptly when summoned, a bad contact may exact a fearful toll in conflagration, or death, or riot. And, in the saving of a few cents' worth of platinum, the vast expenditures of municipalities for fire and police protection, and of the generous public for hospitals, may be nullified. There is no room for economy of this wasteful kind in instruments upon which so much depends and to which, owing to the careful and conscientious superintendence of the members of this association, the public looks with perfect confidence for perfect results.

1. Paper read at the meeting of the International Association of Municipal Electricians at Pittsburg, September 26, 1900. Mr. Mason is the superintendent of police telegraphs in Brooklyn.

A paper was presented to the International Tramway Congress at Paris on the subject of the suitability of electric traction on main railway lines. The conclusions reached are expressed in the closing paragraph, which reads: "The results obtained with electric traction on main-line railroads demonstrates that the present application of this power is no longer experimental, that it will rapidly supersede steam on lines where travel is heavy and congested, and where, for economy in operation and increased passenger receipts, a frequent service is necessary."

CORRESPONDENCE.

London Letter.

London, September 18.—Another claimant has come forward, or rather has been put forward, for the honor of inventing wireless telegraphy. Both Mr. Marconi and Sir William Preece are asked to stand aside in favor of a Glasgow gentleman, who explained his system to the savants at the meeting of the British Association in 1860. The British Association, mark you, the members of which seem peculiarly forgetful of their own proceedings, or they would have corrected Sir William Preece on the spot the other day, when he told the story of his experiments with wireless telegraphy. Here is the British Association record: "Mr. J. B Lindsay, lecturing in Dundee and Glasgow on this subject since 1831, has succeeded in transmitting signals across the River Tay aided by water alone. He also entered into calculations to show that stations in Cornwall and Scotland would enable us to transmit messages across the Atlantic to America." Evidently, subsequent inventors must look to their laurels.

I had the pleasure of meeting Mr. J. R. Salter, A. M. I. C. E., of the London United Tramways company, yesterday afternoon, and in the course of an interesting conversation he said, "All being well, we hope to start the service of electric cars between Hammersmith and Kew bridge in about a month from the present date. The overhead wires, as you can see, have been complete for some time past, the new cars are in our depot, ready for use, and the only thing needed is the completion of the machinery by which the necessary motive power can be communicated." One of the most interesting features of the big generating station which the company has erected at Turnham Green is a self-supporting steel chimney, 250 feet high.

That the Paris Metropolitan railway, which runs underground from the Porte Maillot to Vincennes, passing under the Avenue of the Champs Elysees and the Rue de Rivoli, has met a decided want, is amply demonstrated by the high favor in which it is held by the public. In spite of various hitches and slight accidents, which were more or less inevitable, it is now carrying a large number of passengers. On Sunday about 115,000 availed themselves of this mode of locomotion, and the daily average is over 90,000.

The engineers expect that the scheme, which I have already described, of electric lighting for the Thames embankment will be completed in little more than two months, when not only the embankment itself, but Westminster and Blackfriars bridges and their approaches will be illuminated by electricity. Twenty years have elapsed since a similar experiment was made with the Jablochkoff system, but the trial failed. In the County Council's present undertaking success is assured. There will be 144 arc lamps (500 watts), and they will be distributed over nine circuits, each containing from 15 to 30 lamps in three to six groups at a distance of 45 yards apart. The generating station adjoins Charing Cross underground railway station.

The traffic on the "Twopenny Tube" is now becoming more regular and the merely curious travelers are not so numerous. In the course of a chat I had with the secretary of the company I was told that the passengers carried now range daily between 80,000 and 85,000. "Before the line was opened," he said, "we expected that on Sundays we should have practically no travelers. Happily, our anticipations have not been realized, for we get crowds to and from Hyde Park, Kew Gardens, Richmond and other popular resorts. There has been an inquiry," he added, "as to the temperature of the railway. This remains steady at 55 degrees. This summer the Central London railway has proved itself the coolest place in the metropolis. In the winter the temperature will be as in the summer, for the outer air does not affect the earth so low down as our tunnel, the depth, as you know, being an average of 60 feet." He also said that in an attempt to make the line popular with people living in districts beyond the terminus they had erected sheds for the storing of bicycles, and charge four cents a machine. On the first morning they had no fewer than 96, and they had now decided to have a larger building for the convenience of cyclists.

W. H. B.

New York Notes.

New York, September 29.—Two new air-power cars have been put on the Twenty-third street cross-town line. It is understood that the number will be increased daily until the full equipment is received, and that they will then be transferred to the Twenty-eighth and Twenty-ninth street lines.

The Brooklyn Rapid Transit company put into operation, yesterday afternoon, the new third-rail electric service to Bath Beach by way of the Fifth avenue elevated road to Thirty-sixth street and thence by the old West End route.

The route and plans of construction for the rapid-transit tunnel to Brooklyn reported to Chief Engineer Parsons were adopted by the Rapid Transit Board on September 27th, without dissent. The route will include suitable tracks and connections in the nature of loops under the New York City Hall Park and around the Brooklyn City Hall. Possibly, the most interesting features are the two loops. The first of these branches off from the main line

in Broadway, above Bowling Green, and runs down State street and through Battery Park. The purpose of this is to provide for the return of trains not running to Brooklyn. Much more elaborate is the loop to be constructed around the old City Hall in Brooklyn. This, in fact, is to be a double loop, one track above the other, and when built it will be like two threads of an enormous screw. This loop will provide for the return of trains from Manhattan, and also for the turning about of trains from the other direction. Just how soon the Brooklyn extension can be built will depend much upon the delays which property owners may cause. The adoption of the route and plans is but the first step. Now they must be accepted by the Municipal Assembly and other public authorities. Then a new canvass must be made for property-holders' consents along the route, and, in the absence of these, the consent of the Appellate Division of the Supreme Court must be obtained. No work has yet been done in Section 1 of the subway, which comprises the terminal station and loop at the postoffice, and which will extend to Chambers street. In Section 2, which extends along Elm street from Chambers street to Great Jones street, the work of excavation is well advanced between Prince and Great Jones streets. Much work has also been done in this section in diverting the flow of sewers from the North to the East River. In Section 3, extending from Great Jones street to Thirty-third street along Fourth avenue, work has begun north of Tenth street. Here an overhead cable has been erected. An air-compressing plant has also been established in the Union Square Plaza, at Seventeenth street and Fourth avenue, which will generate power for use along the entire route of this section. The sub-contract for Section 5, from Forty-first street and Fourth avenue to Forty-seventh street and Broadway, has not yet been let. In Section 6, extending between Forty-seventh and Sixtieth streets, excavation is now being conducted at the Circle, Fifty-ninth street and Broadway, by the Metropolitan Railway company, according to an agreement between that corporation and Naughton & Co., the sub-contractors. Work on Section 7 was begun in two places, between Sixty-first and Sixty-fourth streets, and Eighty-sixth and Ninetieth streets. On the other sections, save Sections 15 and 16, work is more or less advanced. More work has been done on Section 14, extending from One-hundred-and-thirty-third street to One-hundred-and-eighty-first street, than on any other section of the subway.

The evening school of electricity, under the direction of the Harlem Branch of the Young Men's Christian Association at No. 5 West One-hundred-and twenty-fifth street, will be opened for its third season during the first week in October. The school will be in charge of Mr. S. A. Small, assistant instructor in electricity at Columbia University. The sessions will be held on Tuesday and Friday evenings, and the course will consist of 48 lectures. The opening session on October 2d will be free to all men, and visitors are cordially invited.

The Third Avenue Railroad company, within the last few weeks, has been gradually replacing the air brakes on the electric cars with hand brakes similar to those in use on other branches of the Metropolitan Traction company. It has been found that the air brakes were hard to keep in order and could not always be depended upon. M. L. G.

Canadian Intelligence.

Ottawa, Ont., September 28.—Tenders have been invited by the corporation of East Toronto, Ont., for the erection of a new electric-light power house.

The Calgary Water Power company has made a new proposition to the town of Calgary, Northwest Territories, for street lighting. The company agrees to erect new poles and adopt enclosed-arc lamps.

The corporation of the city of St. Catherines, Ont., is about to undertake the development of additional waterpower from the Welland Canal, above Thorold.

Boyd & Co. of Huntingdon, Que., have been given a contract to furnish electric light to that town for 20 years. The firm agrees to develop 1,000 horsepower, install a 1,000-light dynamo and to have the works completed by the first of January next.

A special committee of the council of the city of Charlottetown, P. E. I., has been appointed to obtain information in respect to the cost of a municipal electric-lighting plant for the city. An estimate already received places the cost in the neighborhood of $20,000.

The electric-light station of the town of Cayuga, Ont., was recently destroyed by fire, and the ratepayers of the town have appointed a committee to investigate and report as to the desirability of operating the lighting plant under municipal ownership and control. The most modern machines and dynamos will be secured.

The council for the town of Almonte, Ont., has decided to submit to the ratepayers of the town a by-law for raising a sum of money to install an electric-light plant in the town. This will again bring before the ratepayers the question of municipal electric lighting, which was submitted last year and defeated after a close contest. The vote will be taken at the end of October.

Alderman Lamb, chairman of the City Board of Works of Toronto, Ont., reports that he has received satisfactory assurance from New York that a company to build a radial electric-railway system, tributary to Toronto, would be financed in the city of New York. He urges, however, that Canadian capitalists take control of the enterprise and raise the $5,000,000 required to carry out the work. The scheme involves the construction of almost 500 miles of trolley lines, the chief one giving Toronto connection with Georgian Bay and Lake Simcoe.

A. V. W.

From the Buckeye State.

Columbus, Ohio, September 29.—The Akron Electrical Manufacturing company has been completely reorganized, and new articles of incorporation were taken out in West Virginia, the capital stock being increased from $100,000 to $200,000. Of this $100,000 was put on the market and $65,000 has already been sold. The other $100,000 will be kept in the treasury in reserve. The directors of the company, as reorganized, are as follows: L. C. Miles, Will Christy, E. E. Andrews, William Weaver, Dr. J. P. Boyd and S. H. Pitkin, all of Akron, and W. H. Butler of Kent, Ohio. The new officers are as follows: President, L. C. Miles; vice-president, Will Christy; secretary and treasurer, E. E. Andrews. An addition to the factory in South Akron, 45 by 50 feet in size, and one story high, is being built, and a large amount of new machinery has already been purchased. The company manufactures motors, dynamos and other electrical machinery, and the factory is kept very busy. The working force has lately been increased to four times what it was, and the addition of new machinery will increase the capacity of the plant at least one-third. Quite a number of orders for electrical machinery from the United States government have been filled within the last few months, and the officers are in receipt of some very complimentary letters from the men who have charge of these matters for Uncle Sam. This bids fair to become one of the leading industries of Akron, which is already noted for its manufacturing interests.

The net earnings of the Columbus Railway company, from January 1st to August 31st of this year, were $322,536, the gross earnings being $637,202.

The electric-light plant at Richwood, Union County, owned by Edward Schambo, was destroyed by fire on September 24th, entailing a loss of $17,000, with $8,000 insurance. The origin of the fire seems to be unknown.

The city clerk of Springfield, Ohio, has been authorized by the Board of Public Works to advertise for bids for 560 gas posts, equipped with Welsbach burners, and 260 electric lights of 2,000 candlepower, all lights to burn from half an hour after sunset until half an hour before sunrise. The bids are to be made for terms of three, five and 10 years, and to be accompanied by certified checks of $25,000. The successful bidder must give a bond of $10,000 for the faithful performance of the contract.

The City Council of Washington Court House has granted S. W. Cissna, J. W. Willis, E. A. Ramsey, James A. McLean and associates a franchise to construct and operate an electric railway on the streets of the town; also to construct and operate an electric-light plant.

At a meeting of the board of directors of the Cleveland, Elyria and Western Railway company, a few days ago it was decided to extend the line from Berea to Medina, a distance of 17 miles. The line will pass through the villages of Strongsville and Brunswick. With the line now in course of construction to Wellington, this will give the company 82 miles of track and connection with Chippewa Lake. General Manager Pomeroy has announced that work will begin at once on securing the right-of-way for the new line.

Ex-Congressman V. A. Taylor has applied to the commissioners of Summit County for a franchise for an electric line from Bedford to Ravenna, a good portion of the line to be built along the public highway. The commissioners have taken the matter under advisement. There is some hesitation in granting the right, from the fact that there is to be a double track the entire distance, yet the promoters ask for only 10 feet of the roadway. Mr. Taylor has the consents of the abutting property owners.

There seems to be a tendency on the part of many of the cities of this state to return to gas lighting on the streets. This has come about through the improvements in the burners for street purposes and the fact that there are many complaints from people of injury to the eyes. The demand is shown in Cincinnati and Springfield both, just at this time.

C. O. Brigham, chief operator of the Western Union Telegraph company, at the Toledo office, has resigned his position. He is now 60 years of age and has spent the best part of his life in the service of the company, beginning as a messenger boy in 1856. He learned the use of the key in 1860, and has since been in the harness constantly. He is still hale and hearty and hopes to enjoy years of peace and quiet.

The city of Fremont has made a 10-year contract with the Fremont Electric Light company to furnish lights for the city at $70 a lamp a year. This was the highest bid, and the council meeting was a warm one when the bid was accepted.

In an article a few days ago on the electric-railway interests of Northern Ohio, the Akron Beacon Journal paid quite a compliment to Will Christy of that city, who is perhaps identified with more electrical projects than any one man in the state. There is hardly a new industry in the state in which he has not some kind of interest. In the two big electric-railway systems, the Northern Ohio Traction company and the Southern Ohio Traction company, he is heavily interested and holds official positions as well.

The Kenton council has awarded the contract for lighting the city to the Kenton Gas and Electric company at $75 a lamp of 2,000 candlepower and all-night service. This is the town which has been in the dark so long, having been engaged in a bitter fight with the light company. As soon as the contract had been signed up at the council meeting the light was turned on and the celebration that took place was almost equal to a political meeting.

Important improvements are being made in the street-railway and power properties at Lima. New rails have been purchased for the road and will be put down as rapidly as possible, and a number of modern cars have been ordered from the Brill Car Works. They will be equipped with 70-horsepower motors and provided with all the latest conveniences. Three new 400-horsepower boilers have been ordered and will be put in place as soon as possible. New electric machines for the light plant and generators for the road have been ordered also, but it will be some little time before they can be completed. The new owners promise to make the properties thoroughly up-to-date, even to new and modern offices, which will be located on Elizabeth street, near the Faurot House.

Work is progressing nicely on the plant of the Consumers' Carbon company at Lancaster, Ohio. The brickwork is going up at the rate of 20,000 bricks a day. The company is also preparing to build a number of dwellings for its employes.

L. B. Vinson, superintendent of the Ironton division of the Ohio Valley Electric Railway company, has resigned his position. A successor has not yet been chosen.

It is reported that Thomas N. Fordyce of Detroit has made arrangements to build a traction line from Toledo to Cincinnati, a distance of 244 miles. He has placed an order, so the rumor says, with the Westinghouse company, for over $600,000 in machinery and equipment for the road. If this is true, it will be one of the greatest electrical railway projects ever undertaken in the state of Ohio. Work will begin on the line between Hamilton and Cincinnati, where Mr. Fordyce some time ago made a successful experiment in running canalboats by electrical power.

The Columbus, Mount Sterling and Washington Electric Railway company was incorporated in the office of the secretary of state a few days ago, with a capital stock of $10,000, which, however, is only nominal. Cyrus P. West, W. R. Smith, Frank Johnson, Hugh K. Stewart and Hon. D. I. Worthington are the incorporators. It is the intention to build a line of road from Columbus to Washington Court House, Fayette County, touching Mount Sterling and some other points.

A second company, incorporated recently to build a road from Columbus to Washington Court House, is the Columbus and Southern Electric Railway company, with a capital stock of $100,000. The principal office of this company will be in Columbus. The incorporators are J. M. Wilson and H. W. Wilson of Chicago, Judge Joseph Heidy and E. M. Boggess, M. D., of Washington Court House, and Solon Loofbourrow of Mount Sterling. O. M. C.

Northwestern Notations.

Minneapolis, September 28.—The Lake City (Iowa) Electric company has been incorporated, with $20,000 capital stock.

The Queen City Street Railway company is an applicant for a franchise to build and operate a street-car system at Sioux Falls, S. D.

The new electric-lighting company of Hutchinson, Minn., expects to have its system completed and in operation within three months.

The council of Two Rivers, Wis., has granted a franchise to Thomas Higgins of Neenah, Wis., for an interurban line to Manitowoc.

The owner of the electric-light plant at Manson, Iowa, may conclude to shut the plant down. It has been run at a loss, he claims, and he has now increased the rates. If enough patrons stand the increase to make the plant a paying one, it will be continued, but otherwise not.

The State Board of Equalization of Minnesota finds the total assessment of the Twin City Rapid Transit company to be $2,775,000. There is $1,500,000 in Hennepin County, $1,250,000 in Ramsey County and $25,000 in Washington County. As the assets of the company aggregate $31,337,830, the board thinks that over $28,000,000 is untaxed.

The council of Tacoma, Wash., is considering an ordinance which limits the number of passengers a car shall carry. A car seating 35 shall not carry to exceed 70; cars which seat 35 to 60 shall not accept fares from more than 75 per cent. above the seating capacity; those seating 60 or more shall not carry more than 50 per cent. above their seating capacity.

The Postal Telegraph company will probably string another wire overland to the Pacific coast. It will be along the line of the Denver and Rio Grande to Salt Lake, thence through Montana and Idaho to Washington.

New interests have bought into the Seattle-Tacoma Electric Railway company. A syndicate, headed by Jacob Furth of Seattle, Wash., and George B. Blanchard of Tacoma, Wash., now controls. Mr.

Blanchard is vice-president and manager. Engineers will be placed in the field at once to examine the various routes and a selection will be made and the work pushed to completion.

The council of Menominee, Mich., has authorized the mayor and city clerk to enter into contract with the Menominee Street Railway and Power company for 60 arc street lights of 1,200 candlepower, at $70 each per annum.

The Electric Railway company of Muscatine, Iowa, is about to erect a new power station, which it is hoped to complete about the first of February. The present station furnishes steam for the public steam-heating system, but with the completion of the new station, it will be abandoned. The new station will use condensing engines, and will have no exhaust steam for the heating system.

A mass-meeting of the people of Grand Rapids, Minn., voted to purchase the electric-lighting plant, agreeing that the price asked, $11,000, was reasonable. At the special meeting of the Common Council, held thereafter, it was decided not to consider the purchase of the plant, at that figure. This action is regarded as peculiar, as the council called the mass-meeting and resolved to be governed by the decision of the meeting.

The litigation between the city of Little Falls, Minn., and the electric-light and water company, which has been in progress for the last four years, has been settled. The council agrees to abide by the contract, which still has 20 years to run, and the company makes certain concessions which are regarded as valuable. The United States Circuit Court held that a contract to run 30 years was not an unreasonable one, and this decision has taken the ground from under the city's contention.

A Centerville car in Butte, Mont., jumped the track and turned to the side, crushing into a small frame house. There were eight passengers, but no one was seriously injured. One received some painful bruises. The accident was caused by the placing of a piece of slag on the rail. The company has offered a reward of $500 for the discovery of the person who placed the slag on the rail.

The engineer of the state insane asylum at Jamestown, N. D., recommends that the state build a light electric line to the railroad to handle coal, which could then be shipped and delivered to the boiler house. R.

Gleanings from Colorado.

Denver, September 27.—The Denver Tramway company has not yet selected a successor to C. K. Durbin, who recently resigned the superintendency. A new official will doubtless be appointed next month.

Cars of the Denver Tramway company are now crossing the Sixteenth street and Larimer street viaducts. In rebuilding these structures so as to be strong enough to carry the ponderous motor cars, $80,000 has been expended.

Notices have been pasted in the power house of the Pueblo Traction company informing motormen and conductors that wages will be increased on October 1st as follows: Men who have worked for the company for one year are advanced from 18 cents to 19 cents an hour; two years, from 19 cents to 20 cents, and those employed three years or over, 22 cents an hour.

The Mexico Smelting and Refining company has been incorporated, with a capital stock of $1,000,000. Denver and St. Louis money is invested in the enterprise. The company will build a smelter at Algodones, N. M., 25 miles north of Albuquerque, and will also erect an electric-light plant. It is said that $300,000 will be expended in the next six months. The incorporators are A. J. Frank, J. W. Howard, J. S. Risdon, Benjamin H. Charles and E. Meysenburg.

Since the new loop of the Denver Tramway company has been opened a number of changes in the routing of cars have been made. Sixteenth street will probably be used by a greater number of cars, so that the congestion of traffic on Fifteenth street will be relieved.

The city attorney of Denver has just submitted to the City Council an opinion relating to the Denver Steam Heating company, which is of interest to all the local electrical companies. He recommends that the company's franchise be revoked. The company was granted a franchise in 1880, without time limit. The original life of the company was 20 years, and the company claims that the renewal of its corporate life makes the franchise perpetual, and that it still has the right to use the streets. The city attorney says: "I am of the opinion that the city should waive no rights in this matter, and that we should do as we did in the tramway case, and repeal or revoke said franchise and let the company test its rights in the courts. The question will certainly arise again in a few years with the tramway company, where its franchises extend beyond its corporate life."

The Colorado Electric Power company, whose generating station is located at Canon City, and from which current is transmitted to the Cripple Creek District, is receiving many applications for power, especially for hoists. A survey for a new pole line to carry power to Beacon Hill is now being made. The company has also decided to construct a pole line to accommodate mines on Squaw Mountain. Among the mines just supplied with power by the company are the following-named: Jerry Johnson, Twin Sisters on Raven Hill, Home Gold Mining company in the town of Cripple Creek, Little Frank S. on Raven Hill, Denver Leasing company, working the Victor Consolidated mine, on Battle Mountain.

Wire thieves recently stole a large amount of copper from the poles belonging to the Colorado Electric Power company in the Cripple Creek District.

The Colorado Springs and Cripple Creek District Railway company is now operating sections of the road at each terminal. Ten miles of road is finished at the Colorado Springs terminal. This portion is operated by steam. The Cripple Creek end of the line is traversed by electric motor cars. Superintendent Ridgway announces that the entire road will be in operation by the first of the year.

Curtis M. Jennings, of the firm of Berthold & Jennings of St. Louis, which furnished the poles for the lines of the Lacombe Electric company, was a recent visitor in Denver.

M. W. McGrath of Denver has been awarded a franchise for an electric railway by the City Council of Santa Fe, N. M. The ordinance gives Mr. McGrath and assigns the right to build and operate an electric line on the streets and alleys of the city or any additions thereto for a period of 50 years. A five-cent fare within the city limits is provided.

One of the handsomest isolated plants recently installed in Colorado has been placed in the Pope block, Pueblo, owned by Colonel A. A. Pope of Boston, by the Pueblo Electric company, of which F. L. Cuddeback is engineer. Three dynamos are in position—one of 75 kilowatts, a second of 50 kilowatts and another of 12½ kilowatts—made by the Commercial Electric company of Indianapolis, Ind. The two larger dynamos are connected direct to an engine made by the J. B. Allfree Manufacturing company of Indianapolis, and the small machine to an upright engine manufactured by the Racine Hardware company. The marble switchboard is unusually handsome. Water-tube boilers, to the capacity of 100 horsepower, were furnished by the J. L. Mott Iron Works, and tubular boilers of the same horsepower were provided by the Pueblo Boiler Manufacturing company. The architect of the building is Mr. F. W. Cooper. J. W. D.

PERSONAL.

Mr. Ralph D. Mershon, for some years expert for the Westinghouse company in connection with the long-distance transmission of electric power, has been appointed to a similar position with the Montreal street railway and the Chambly Manufacturing company of Montreal.

A paper entitled "Some Advantages of Electrically Operated Press Rooms," was read at the fourteenth annual convention of the United Typothetæ of America, Kansas City, Mo., on September 27th, by B. W. Van Voorhis of the Chicago office of the Crocker-Wheeler company.

It is reported in Washington that Charles H. Duell, the commissioner of patents, is about to resign, to engage in private law practice. Mr. Duell was a patent lawyer in Syracuse, N. Y., when appointed in January, 1898, to succeed the lamented Major Butterworth as head of the Patent Office. He has made a good commissioner.

Israel A. Kelsey, until recently general manager of the Winchester Avenue Railroad company, of New Haven, Conn., died at his home in West Haven, on September 24th, at the age of 41. Mr. Kelsey was interested in several electric railways in Connecticut, Ohio, Massachusetts, Rhode Island and Cuba. He is survived by a widow and three children.

Professor A. W. Rücker, who has been elected to preside at the next meeting of the British Association for the Advancement of Science, to be held in Glasgow in September, 1901, occupies the chair of physics in the Royal College of Science at South Kensington, and has for years been secretary of the Royal Society. He has actively participated in the magnetic survey of Great Britain, engaged in researches on the electrical and optical properties of soap films, and has recently published a work on "The Theory of Sound." Of late he has served the British Association in the capacity of treasurer.

"Jim" Cummings is married. The announcement will be of much interest to many members of the electrical fraternity, for Mr. Cummings, whose specialty is wiring conduits, is one of the best-known and best-liked men in the business. The news comes from abroad in this wise: "Mr. and Mrs. George H. Nixon announce the marriage of their daughter, Kathleen Mortimore to Mr. James Fulton Cummings, at St. George's Church, Bloomsbury, London, England, on August twenty-third day, nineteen hundred." It is understood that Mr. and Mrs. Cummings will make their home in Hyde Park, Canada. Congratulations from electrical friends will be most hearty and entirely sincere.

ELECTRIC LIGHTING.

J. W. Carver has been awarded the contract for putting in an electric-light plant at Windsor, Mo.

The city electric-light plant at Rockville, Ind., was destroyed by fire. The loss is estimated at $2,000.

The electrical power plant of the Krupp works at Essen, Germany, has three generating stations, with six sub-stations for distribution and supplies 877 arc lights, 6,724 incandescent lamps and 179 electric motors.

The town of Mendon, Mich., has voted to bond itself for $8,000 in order to put in an electric-light plant.

At a special election the people of Manchester, Iowa, voted to grant a franchise for an electric-light plant.

The Dallas Electric Light company will install a new plant of 1,200 incandescent lights at Hallettsville, Texas.

An electric-light plant is being put in in Olympia, Wash., by the Olympia Light and Power company at Tumwater.

The Chelsea Power and Improvement company of Chelsea, Mich., has been incorporated, with $10,000 capital stock.

The Lake City Electric company was incorporated at Des Moines, Iowa, for $20,000, by J. J. Coady, T. R. Arney and J. B. Smith.

Houston, Texas, asks for bids for constructing a complete electric-light plant for that city. Bids will be received until November 5th, by the city secretary, A. Lipper.

A resolution introduced by Alderman Taylor of Willimantic, Conn., authorizing the construction of a municipal gas or electrical-lighting plant for that city, was recently passed.

The plant of the Hempstead Electric Light and Gas company, located at Far Rockaway, Long Island, was partly wrecked by an explosion. The building was damaged to the extent of $2,000.

The Henderson (N. C.) Lighting company has been chartered for furnishing the town with electric light. Its capital stock is $10,000. The incorporators are S. H. Pulliam, E. V. Williams and J. H. Bridgers.

A director of the Philadelphia Electric company states that the company's receipts in August increased 16 per cent. over August, 1899, and that the rate of increase since January 1st has ranged from 15 per cent. to 20 per cent.

A company of eastern capitalists has just purchased 600 acres of land on Mill Creek, near Shingletown, Cal., for the location of a new power plant. The company will begin business with a 2,000-horsepower generator and increase the capacity as required.

A novel incandescent lamp is being manufactured by the Spiral Globe company of London. The new lamp consists of a plain glass bulb surrounded by an envelope composed of a spirally wound rod of plain glass inclosed within an outer protective plain glass globe. The effect of this combination is twofold, to conceal the filament without loss of light and to increase the effective illumination of the lamp, the spirally wound glass rod constituting a double convex lens throughout its entire length and serving to refract and diffuse the rays.

ELECTRIC RAILWAYS.

The Cottonwood division of the Birmingham Railway and Electric company of Birmingham, Ala., is now in operation.

The Village Board at Byron, Ill., has granted a franchise to the Illinois and Rock River railroad to enter and pass through the streets of the town.

The citizens of Frankford, Del., have offered to contribute $5,000 toward the construction of the proposed trolley road from that place to Ocean View.

F. Seacord & Co. have been granted a franchise for an electric railway, to be built from Galesburg, Ill., to the county line, by the Knox County supervisors.

The Florence Electric Street Railway company of Florence, Colo., has been incorporated by H. A. Cook, J. Reed, H. Robinson, J. B. Meserve and A. B. McFall. Its capital stock is $500,000.

The directors elected by stockholders of the Washington, Frederick and Gettysburg Electric Railway company of Frederick, Md., met at Frederick recently and organized, with Colonel L. V. Banghman as president.

The survey for the extension of the Penn Yan (N. Y.), Keuka Park and Branchport electric railway, from Branchport to the Pultney landing on Keuka Lake, has been completed. The extension will cost $50,000.

The council of Wapakoneta, Ohio, on September 29th, granted the final franchise to F. D. Carpenter, L. M. Coe and J. Mayor, capitalists of Cleveland, to construct and operate an electric street railway through the village.

The Uniontown and Monongahela Valley Electric railroad is the name of a new line soon to be constructed in Pennsylvania. It will run from Uniontown to Masontown, passing through New Salem and McClelland.

The Moodus and East Hampton Railway company of East Hampton, Conn., has been incorporated, with $150,000 capital stock, to build a railway, to be operated by electricity, from East Hampton station, through the towns of Chatham and

Haddam, to the village of Moodus, in the town of East Haddam.

The Union Traction company of McKeesport, Pa., has decided to expend $15,000 for the purpose of laying a new road between McKeesport and Wilmerding. J. D. Callery and W. H. Keech are interested in the project.

The stockholders of the Selma Street Railway company of Selma, Ala., have decided to increase the capital stock from $30,000 to $50,000, and to authorize the directors to begin the erection of an electric street-car system.

The cars of the Rochester Railway company of Rochester, N. Y., have been increased in length from 18 feet eight inches to 27 feet nine inches by splicing. The larger cars are mounted on double trucks instead of the single trucks previously used.

The Elizabethtown and Westport Railway company has been incorporated, with $100,000 capital stock, to build a surface road 10 miles long, from Elizabethtown to Westport, N. Y. The directors are G. P. Hopkins, M. S. Decker, J. Willoughby and others.

The Waltham Street Railway company has been incorporated, with $60,000 capital stock, to build a line between Weston, Mass., and Waltham. H. S. Milton of Waltham, E. D. Van Tassel of Newton and C. H. Wilson of Brookline are the incorporators.

A plan has just been laid before the French and Spanish governments for an electric railroad across the Pyrenees. A tunnel of 2,500 yards will go through the higher parts of the mountains. The motive power is to be drawn from the falls of the Garonne, on the French side, and from those of the Noguera Ribagarzana in Spain.

The Rockland County Traction company of New York has filed articles of incorporation, with $300,000 capital stock. The length of the road is to be 30 miles, located wholly within Rockland County, with termini at Upper Nyack, Rockland Lake and New City, and running through the villages of Nyack, South Nyack and Piermont.

A large German concern has developed a system of lubricating overhead-trolley wires and trolley wheels, with the idea of reducing the wear and tear due to friction between them. The device evolved, it is claimed, applies a thin and uniform coating of a non-insulating lubricant along the wire. It is made of aluminum and may be carried by the trolley arm, or independently.

The South Side Elevated Railroad company of Chicago has recently purchased 30 new motor cars, said to be capable of a speed of 43 miles an hour. Six of these cars are already in service. They are handsome in design, equipped with 150-horsepower motors, which will be able to start the trains under way more quickly than the old motors. As a safety precaution, the platform gates on the cars are made much higher than those now used, although weighing no more. Several persons have been injured and one killed in attempting to scale the low gates now on the cars.

Sargent & Lundy of Chicago have been retained by the New Orleans City Railroad company of New Orleans to design the new power house which that company is soon to build. Full plans of the station are not yet completed, but a contract for a part of the power installation has been closed with the E. P. Allis company of Milwaukee. This includes a vertical, cross-compound condensing engine, with a five-foot stroke, and cylinders of 32 inches and 68 inches diameter, respectively. The engine is to run at 75 revolutions a minute, with 120 pounds' steam pressure. The engine will be direct connected to a 1,500-kilowatt generator.

AUTOMOBILES.

The Lozier Motor company is moving its automobile works from Toledo, Ohio to Plattsburg, N. Y., where the machinery will be driven by electricity from a new power station now building on the Saranac River.

The Baltimore and Ohio Railroad company is to have an electric-vehicle service in Chicago for the accommodation of passengers to and from the Grand Central station. The vehicles will bear the name of the road and will be offered to the passenger at the rate of 50 cents a mile and 25 cents for every additional mile.

The De Dion-Bouton motorettes and quadricycle won all the events of their classes at the recent Tristate Fair in Guttenburg, N. J. They also came in first and second in the Automobile Club run on September 22d, from the Waldorf Hotel, New York, to the Larchmont Yacht Club, against steam machines and other types of gasoline machines, over 15 vehicles being in the run.

Lieutenant-general Miles, commanding the United States Army, in his annual report to the secretary of war, will renew his recommendation for the further use of the automobile in the army. General Miles says that automobiles may be adapted for use as couriers, carrying dispatches, movement of staff officers from one command to another, for small reconnoitering parties, for investigating the topography of the country in which the army proposes to operate, for small detachments engaged in constructing bridges or establishing depots, for rapidly supplying ammunition and for the movement and care of the wounded.

The following-named new companies have recently been incorporated for the building of automobiles: The Wittman Automobile company, at Lincoln, Neb., with a capital stock of $25,000; the Remington Automobile and Motor company of Ilion, N. Y., with a capital stock of $250,000; the Houghton Automobile company, at East Orange, N. J., with a capital of $250,000, and the National Automobile company of Philadelphia, Pa., with a capital stock of $1,500,000.

It is said that Emperor William of Germany has become a devotee of the automobile, using a machine constructed under the instructions of the German War Office and propelled by a benzine motor capable of imparting a speed of 60 miles an hour. The cost of the vehicle was $9,000. In addition, the emperor has just accepted three automobiles from different manufacturers, with the intention of trying them during the grand maneuvers, in order to determine personally the services which they may render.

PUBLICATIONS.

The Sterling Arc Lamp company of New York has issued a clearly written and well illustrated catalogue of 12 large pages describing its enclosed-arc lamps for all circuits.

The 235-page catalogue of the Electric Gas Lighting company of Boston has appeared in an eighteenth edition, containing a complete list of electrical house goods and light supplies. A large section is devoted to call systems, telephones and exchange apparatus.

Frank H. Stewart & Co. of 35 North Seventh street, Philadelphia, have just issued their large illustrated "Catalogue, No. 7." The book contains 104 well-illustrated pages, 8 by 11½ inches in size. While the firm is able to furnish anything the electrical trade requires, this catalogue illustrates only such goods as are in every-day demand. The lines of switches, sockets, lamps and lamp fixtures shown are especially comprehensive. The book also catalogues a large assortment of linemen's and repair-shop tools and adjuncts. The catalogue of electric bells and gas-lighting supplies manufactured by the Stewart company is issued separately.

Two recent publications of the International Correspondence Schools of Scranton, Pa., give synopses of their courses in mechanical engineering and drawing, electric railways, lighting and power. The complete mechanical course embraces comprehensive studies in hydro-mechanics, pneumatics, heat, steam engines and boilers, dynamos, motors and machine design. In the electrical courses are taught the principles and technics of electric railways and lighting, dynamos and motors and the manipulation and design of the latter. Many testimonials are quoted from students now holding positions of importance and responsibility.

The B. F. Sturtevant company of Boston, Mass., has issued a second edition of its catalogue No. 101, "Steel Plate Planing Mill Exhausters." The 40 pages of the book illustrate the various new types of blowers and centrifugal suction fans made by the firm for use in pulp mills, tanneries, cotton mills, and wherever noxious gases are to be removed. The company manufactures accurate instruments for testing fan systems, and this book gives some valuable tables on the pressure and horsepower lost by friction of air in pipes, etc. Sturtevant motors and generators, some of these direct connected to engines, and ranging in power from eight to 100 kilowatts, are also listed.

The Compagnie Générale de Traction of Paris has issued an exceptionally handsome book of 123 pages, containing illustrations and brief descriptions of the principal installations of the company in the towns of France. In 1898 Mr. Krantz, minister of public works, reported: "The facilities for public transportation in Paris are inferior, not only to those existing in other capitals of Europe and America, but even to those in many second-rate cities." This pamphlet recounts the remarkable progress made by the French since that time, in bringing the condition of electric traction nearer to the standard others have set. Many thoroughly modern power plants are shown, that of Vitry being especially fine. An interesting chapter describes the storage-battery lines of Asnières and St. Denis.

ELECTRICAL SECURITIES.

The Chicago City Railway company on October 1st issued its $500,000 of new stock to holders of record on September 13th. This gives one new share at par to each holder of 26 shares of old stock.

Chicago Union Traction's earnings showed a small gain in September, which, with the gain in the month preceding, reduces to $4,665 the decrease for the three months of the present fiscal year. The gross earnings of the system in September were $640,740.80, as against $633,253.80 in the corresponding month last year.

MISCELLANEOUS.

United States Consul Hanauer at Frankfort, Germany, reports that the total production of platinum from the Ural region in Russia in 1899 was 13,242 pounds.

The next international railway congress will be held in Washington, D. C., in October, 1904.

In a recent paper on "Mechanical Draft" read before the New England Cotton Manufacturers' association, Walter B. Snow states that, from a comparison of a considerable number of plants, it appears that, under ordinary conditions: "A single force-draft fan with direct-connected engine and short stack can be installed for less than 20 per cent. of the cost of a brick chimney. A single induced-draft fan with direct-connected engine and short stack will cost less than 30 per cent. of a chimney. A duplex induced-draft apparatus, consisting of two fans with direct-connected engines, inlet and outlet connections and short stack, will cost but little more than 40 per cent. of a chimney. The latter arrangement is only employed where, as in the case of an electric-lighting plant, it is the practice to introduce relay units."

An English amateur aeronaut, the Rev. J. M. Bacon, thinks that he has solved the problem of communicating from the clouds to the earth without the use of wires. In the past the war balloon has been of little practical service for the reason that wires have been considered necessary in notifying the troops below of the enemy's movements, and because the wires have prevented ascension beyond the reach of guns. The fate of General Shafter's war balloon at Santiago is a fair sample of what usually has happened. The old balloons were limited to an ascension of 1,000 to 1,500 feet, while it is said that the Rev. Mr. Bacon is able to converse at an altitude of 2,000 to 6,500 feet. The Bacon apparatus consists of a huge drum, hung below the balloon, and which the aeronaut beats by electrical means, to the dots and dashes of the Morse code. These signals have been heard for several miles.

TRADE NEWS.

The Electrolysis-proof Conduit Manufacturing company has been organized at San Francisco, Cal., with a capital stock of $200,000.

The Palmer-Nicholls company of Providence, R. I., is said to have decided to establish a factory in Los Angeles, Cal., for the manufacture of electric wire.

Articles of incorporation were filed in Indianapolis, Ind., on September 24th, for the Mead Electric company of Marion, with a capital stock of $100,000. The directors are M. C. Mead, O. H. Keller and Mary Mead.

The contract for installing new mains and repairing the electric work in the United States postoffice and sub-treasury at Boston, Mass., has been awarded to the Lord Electric company of that city, at $3,988.

The National Cable and Wire company of Pittsburg, having a capital of $1,000,000, has purchased the mower and reaper works at Latrobe, Pa., and is making preparations for an early start. Electrical supplies will be manufactured.

The contract for furnishing the United States engineer's office in New London, Conn., with a generating set and accessories has been awarded to James S. Barron & Co. of New York city, at $2,134. Generators from the Eddy Electric Manufacturing company and engine from the Buffalo Forge company will be used, and the work is to be completed within 60 days.

The Chicago and Alton Railway company is installing an electric-power plant in the Bloomington shops. Electric power will be used entirely throughout the works. The buildings will all be equipped with the Evans exhaust hot-water heating system, and the exhaust steam will be utilized for heating the 12 or 15 buildings, all from the central station. The heating will be installed by Evans, Almirall & Co. of Chicago.

The L. G. Martin Electric and Manufacturing company of Pittsburg, Pa., has organized for business and elected the following-named officers: President, R. A. McDonald; secretary, J. B. Richards, and treasurer, D. W. Dunlevy. The directors of the company are L. G. Martin, D. W. Dunlevy, Pittsburg; J. B. Richards, R. A. McDonald, Aspinwall. The purpose of the company is to repair, manufacture and restore electrical plants and also to repair gas engines and light machinery.

F. B. Sage & Bro. of 123 Liberty street, New York, have succeeded to the business of the American Electric Specialty company of the same address. They announce that they will continue to manufacture the direct-reading ohmmeter previously made by that company and will handle all other business that that company had. They state that the business in the direct-reading ohmmeter is steadily on the increase, and that the tests made on this instrument show it to be entirely satisfactory.

The Western Electric company, Chicago, has just shipped a number of new series enclosed alternating arc lamps, to be installed at Birmingham, Ala. These lamps are to be operated on a 2,000-volt circuit, each lamp taking 80 volts. One thousand constant-current, open-arc lamps and 200 enclosed arcs have been ordered by the Denver City Construction company from the Western Electric company:

84 constant-current, enclosed-arc lamps of the Western Electric type are shortly to be installed on Diversey boulevard, Chicago.

BUSINESS.

The Electric Appliance company, Chicago, is jubilant over the fact that three of its agencies have carried off prizes at the Paris Exposition. The winners are the Adams-Bagnall arc lamp, Packard incandescent lamp and the Packard transformer.

The Edison decorative and miniature lamp department of the General Electric company, Harrison, N. J., has revised its prices on all classes of miniature lamps and receptacles, and will be pleased to mail a copy of its catalogue and new price-list to anyone interested.

The new ship-building plant for the Risdon Iron Works, at San Francisco, Cal., will be built by the American Bridge company of New York, and will consist of a boiler shop, machine shop and foundry, all of the latest design.

The American District Steam company of Lockport, N. Y., reports the busiest season in its history of more than 20 years. Exhaust-steam plants are being constructed in a large number of cities, taxing the company's facilities for turning out work to the utmost. The company's new manufacturing plant is being worked extra hours, and an extension is contemplated.

Charles H, Besly & Co. of Chicago write: "Our general business is very good. We have made a number of large shipments to the North and Middle West of complete shop equipments and are receiving many orders for small tools from the same sections. Many orders for Helmet oil, Bonanza cups and Helmet babbitt are daily received from western mining districts. During the recent automobile exhibit at Washington Park, Chicago, it was a daily occurrence for owners or representatives of various automobile manufacturers to call at our store and say, 'Give me a can of Helmet oil and some Bonanza oil cups for my machine; I want to win that race this afternoon.' Our new catalogue is now ready for distribution and will be mailed free to any address upon application."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 25, 1900.

658,336. Electric Railway. Edward M. Bentley, New York, N. Y. Application filed August 5, 1896.

In this system there is an exposed sectional working conductor normally disconnected from the circuit; the vehicle is provided with a traveling contact device adapted to pass over the sections of the working conductor in succession and to receive current therefrom. A feeding conductor and an intermediate, manually controlled circuit closer are operated from a distant point.

658,388. Mechanism for Imparting Successive or Alternating Movements. Elisha Moore, Meductic, Canada. Application filed November 15, 1899.

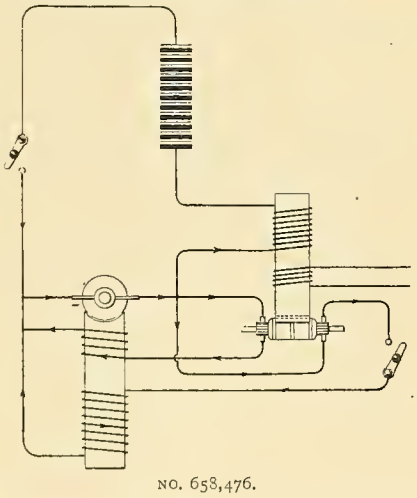
This mechanism combines with a shifting member, armatures, a common axis for the armatures connected with the shifting member, magnets for the armatures, and a relay having an armature common to both of its magnets interposed in the circuit between the magnets and the source of supply.

658,412. Method of Treating Ores. Gustaf M. Westman, New York, N. Y., assignor to the Arsenical Gold Reduction company, Newark, N. J. Application filed January 12, 1899.

This process of treating arsenical ores consists in melting the ores by the passage of electric currents through them, thereby vaporizing the arsenic. Portions of the electrodes are cooled, while portions of the electrodes intervening between the ore and the cooled portions are maintained in a melted condition. The precious metals are collected in these melted portions of the electrodes.

658,431. Dynamo Brush. Carl Endruweit, Berlin, Germany. Application filed August 7, 1899.

A dynamo brush is described employing a material prepared of chemically pure metallic foils and an elastic organic substance which is treated with a liquid favoring the cohesion with the metal foil. The organic substance is subsequently carbonized. The brush is so compiled that metal and carbon appear in alternate layers.



NO. 658,476.

658,445. Electric Car. Arnold A. Ingraham, Lowell, Mass. Application filed October 2, 1899.

In combination with a car truck is an electric motor supported by springs resting upon transverse bars. Longitudinal bars support these transverse bars with transverse bars in turn supporting the longitudinal bars. Finally longitudinal beams support the last-named transverse bars outside the wheels of the truck.

658,476. Dynamo Regulation. Imle E. Storey, Trenton, N. J. Application filed February 23, 1900.

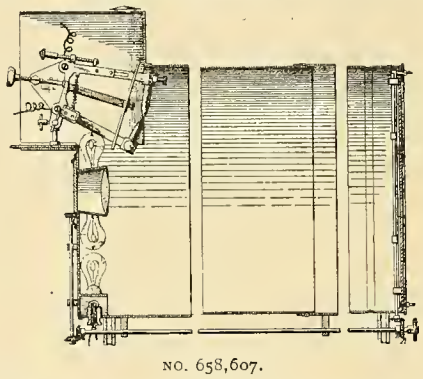
With a main generator adapted to be driven at a variable speed and having on its field magnet an exciting coil and an opposing coil, is combined a dynamo-electric machine whose field magnet is energized by the generator, and whose armature is connected with the opposing coil, or is in a shunt circuit from the main generator, and which shunt circuit includes the opposing coil; or with the main generator may be combined a motor dynamo whose field magnet is connected in the main circuit of the generator, and whose two armature circuits are connected respectively in the shunts of the main generator which include the exciting and opposing coils. (See cut.)

658,483. Process of Oxidizing Negative Electrodes for Primary Batteries. Clyde J. Coleman, Chicago, Ill., assignor to Thomas J. Ryan, New York, N. Y. Application filed December 20, 1899.

A process of oxidizing negative electrodes for primary batteries is described. It comprises the oxidation of a body of finely divided or porous copper into a coherent mass by placing it in an oxidizing atmosphere, and simultaneously supplying to it a requisite amount of moisture and the required degree of temperature above normal. Means are provided for properly controlling the supply of moisture and temperature.

658,536. Apparatus for Treating Ores. Gustaf M. Westman, New York, N. Y., assignor to the Arsenical Gold Reduction company, Newark, N. J. Application filed December 16, 1899.

A furnace for treating electric conducting ores by means of electric currents comprises two horizontal electrodes of cast iron, and wrought-iron pipes extended within the body of each electrode for forming a cooling-fluid circuit, the electrodes being located in depressions in the bottom of the furnace. A horizontal bed between the electrodes receives the ore to be treated; there is a vapor-escape flue in the upper portion of the furnace, and a tap extending from the bed of the furnace at a point between the electrodes, for withdrawing the molten metal.



NO. 658,607.

658,539. Means for Raising Pile or Nap on Fabrics. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed August 23, 1899.

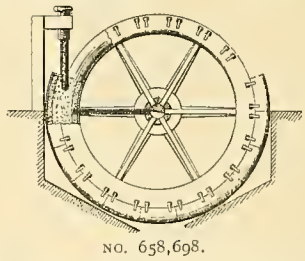
A device is described for raising the nap or pile on fabrics, comprising a saddle bar over which the fabric is drawn with the pile outward, mechanism for moving the fabric over the bar while under tension, and an elongated terminal adjacent to the pile on the fabric along the line where the latter passes over the saddle bar. A generator of electricity of high tension is connected by one pole with this elongated terminal.

658,601. Appliance for Imparting Heat and Electricity to the Body. Ignaz Timar, Berlin, Germany. Application filed November 10, 1899.

This device is an appliance for heating and electrifying the body, combining a metallic frame with electrical terminals, and a receptacle attached to one side of the frame, and adapted to contain a heating material which is "soluble in its own water of crystallization."

658,607. Projecting Apparatus. Frank J. Adams, New York, N. Y., assignor to the Naturascope company, New York, N. Y. Application filed September 11, 1899.

The projecting apparatus comprises a casing, a plurality of lenses in the front end of the casing, a number of lamps in the front end of the casing and grouped around the lenses in such a manner as to prevent their rays of light from passing directly to the lenses. There is also a dissolving slide movable over the lenses, a shutter at the rear end of the casing, for alternately opening and closing a number of openings in the rear end of the casing, and means for simultaneously actuating the dissolving slide and the shutter. (See cut.)



NO. 658,698.

658,612. Telephone Directory. William J. Bell, Baraboo, Wis., assignor of one-half to Herman Grotophorst, Baraboo, Wis. Application filed May 24, 1900.

This device includes a box provided in one of its walls with a slot, a spring roller contained in the box and having a recess in its periphery, and a sheet extending through the slot of the box and bearing the names and telephone numbers of the subscribers of a telephone system, or other desired matter.

658,664. Thermostat. William E. Mack, Oswego, N. Y. Application filed September 19, 1899.

The thermostat includes a base, a train of gearing mounted thereon and provided with suitable driving means, the train having a terminal brake, and an electromagnet mounted in proximity to the gearing with its cores extending in the same direction as the plane of the base, combined with an armature pivoted above the magnet having an arm extending down in front of its core, and another arm at right angles thereto extending over the magnet. A cord attached to the end of this arm passes over the brake-wheel, and is suitably fastened to the base. Means are provided for moving the armature away from the magnet; there are also cores to tighten the cord, and means for supplying energy to the magnet.

658,698. Electric Furnace. Charles S. Bradley, New York, N. Y., assignor to the Cyanide company, Ampere, N. J. Application filed February 10, 1900.

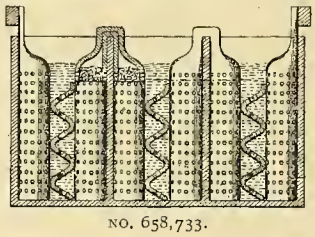
In an electric furnace means are furnished for delivering current to the furnace, together with a movable receptacle adapted to contain carbide-producing materials and to present different portions of such materials successively to the action of the current. Gas-delivering means are adapted to deliver gas to the receptacle at a definite part of its movement; these comprise pipe connections to the different parts of the movable receptacle, and valve mechanism adapted to control such pipe connections to admit gas successively through the pipe connections to different parts of the receptacle. (See cut.)

658,706. Electric Stove. Herbert J. Dowsing, London, England. Application filed September 12, 1899.

An electric heating stove consists of a suitable casing having an open front and a sloping roof, a reflector plate located within the casing adjacent to the rear wall of the stove, and terminating at its upper end at a point below the roof. The reflector plate is of zigzag form and provides a series of elongated air channels within the casing, the rear wall of the latter having air openings through it leading into the air channels. A number of vertically disposed incandescent electric lamps are supported within the casing in front of the reflector plate, one of the lamps being arranged opposite each ridge or projecting portion of the zigzag reflector plate.

658,733. Secondary Battery. Clyde J. Coleman, Chicago, Ill., assignor to the General Electric Storage Battery company of New Jersey. Application filed December 8, 1899.

A secondary battery comprises in combination, a partitioned battery casing and positive and negative electrodes arranged therein, each of the electrodes comprising a series of perforated cylindrical conducting casings filled with active material and arranged side by side in close relation in order to mutually support each other. The positive series of such casings are integrally and individually connected by saddle connections with the negative series of the casings. (See cut.)



NO. 658,733.

658,734. Secondary Battery. Clyde J. Coleman, Chicago, Ill., assignor to the General Electric Storage Battery company of New Jersey. Application filed October 2, 1899.

A secondary battery electrode comprises a perforated casing having a longitudinal cell containing the active material, and formed by a series of longitudinal sections united together by longitudinal flanges at the edges of the sections, and a pair of closure pieces fitting the respective ends of the cell to afford an easy and convenient manner of introducing the filling of active material into the cell or chamber.

658,739. Coin-setting Electric Meter. Frank Kraemer, Chicago, Ill. Application filed November 6, 1899.

In a coin-operated electric meter are included a main circuit, a derived circuit adapted to be closed by the instrumentality of a coin, a switch in the main circuit, a magnet for closing the switch, and a toll-measuring magnet in a derived circuit, a toll-measuring device and a switch-releasing magnet in another circuit, and a means operated by the motor mechanism of the meter, for closing the circuit through the toll-measuring device and the switch-releasing magnet.

658,741. Electric Welding Machine. Otto Parpart, Cleveland, Ohio, assignor to the Standard Welding company, Cleveland, Ohio. Application filed January 31, 1898.

In a tube-welding machine are combined two electric-current conducting devices respectively connected with opposite electric poles and adapted to press respectively on the opposite edge portions of the butt-joint of a tube, and two rolls tending to force the butt edges together by compression of the tube along lines of pressure angular to those of the conducting devices.

REISSUE.

11,857. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Application filed August 18, 1900. Original No. 652,457, dated June 26, 1900.

In a phonograph is combined a phonogram having a record thereon formed of a series of more or less connected gouges or waves with rounded sides and bottom, some of the waves representative of fundamental tones and principal overtones being characterized by a greater width than length, with a reproducing device having a curved bearing surface engaging the bottom and side walls of the record and of a form adapted to enter and accurately track all of such representative waves.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, OCTOBER 13, 1900. No. 15

Operation of the Electric Fountain at the Paris Exposition.

The Electrical Palace and Fountain form together one of the principal attractions of the Paris Exposition. They have been illustrated heretofore in the Western Electrician in a projected or incomplete state. It is the object of the present article to give some idea of the decorative effects produced and the means by which they are accomplished. It should be explained, however, that the illustration (Fig. 1) shows only a portion of the water jets of the fountain and these reduced in size. But while the beauty of the moving-water effects is thus inadequately represented in the picture, the general plan of construction and architectural embellishment is more clearly shown in consequence.

The location of the Electrical Palace and Fountain is at the extreme end of the Champ de Mars. The design, which is highly ornamental, has been carried out by Mr. Henard, one of the leading architects of Paris, assisted by a number of artists. In the illustration the facade of the Electrical Palace is seen in the rear of the fountain. Its principal feature is an open-work design constructed in repoussé zinc and painted in buff and white. At the top of the design is a large figure representing the Genius of Electricity, standing upon a car drawn by two chimeras. The large star seen in the rear has been designed with a view of being brilliantly lighted by an arc projector directed upon it; the metal framework forming the exterior is joined by a number of wires, upon which are strung glass pieces of different forms. The design contains a great number of incandescent lamps of different colors, most of which are invisible by day. There are also a number of large porcelain globes along the top and bottom, containing lamps, and upon the projecting points are 18 large globes, ornamented with metal work. At night, when the design is illuminated, a remarkably brilliant effect is obtained, especially as the colors are arranged in different combinations, which may be constantly changed. At other times the whole design is lighted up with one color.

FIG. 1. ELECTRICAL PALACE AND ELECTRIC FOUNTAIN AT THE PARIS EXPOSITION.

However, the electric fountain is richer in design and gives the finest effects of illumination. The main arch of the fountain is very handsomely decorated with different groups and reliefs. The arch surrounds a central niche, also very richly decorated. In the center of it is the basin, from which flows the main cascade. Above the basin is a grotto surrounded by a number of figures in relief. Below is a series of basins by which the water is caused to flow from the top to the lower basin in a series of cascades. The main basin, on a level with the ground, covers a large area. It has five fountains on each side, which project the water to a considerable height. The fountains are illuminated from below through panes of glass corresponding to each of the jets, a powerful arc projector being placed under each, giving different colors. The cascades are illuminated by incandescent lamps of different colors, placed below the borders of the basins. The main fall and the central niche are lighted up by a great number of lamps, as well as the main arch of the fountain.

Under the fountain has been provided an extensive basement in which are contained all the apparatus for illuminating the jets and cascades and controlling the arc and incandescent circuits. The basement is built in several different levels. The highest of these forms a room of considerable size, which contains the switchboard for the circuits of the machines and the two main controlling boards for producing the different effects of the fountain. For the incandescent lamps a rheostat has been provided, by which all the lamps of one color may be lowered and those of another color thrown on, thus passing from one color to another and giving all the intermediate tones. This room also contains a number of the arc reflectors for lighting the jets. On a lower level are also a number of projectors, and from this point two galleries branch out, passing under the main basin and following the line of the fountains. These galleries contain the greater number of arc projectors which are used to light the vertical jets. In front of each projector is placed a mirror of sheet-iron covered with mercury, at an angle of 45°, the mirror being carried on a pivoted wooden frame. Above, in the floor of the basin, are inserted panes of thick glass, some of these being not less than one inch thick. A large pane is provided for each jet, and the system under the main basin for each of the two groups of fountains, consists of five groups of projectors. The four groups in the rear have each four apparatus, three of these being grouped around a projector in the center. In front, on each side, is a large group containing 11 projectors, or 10 grouped around a central apparatus, which is somewhat larger than the others.

A view of one of the projectors is shown in Fig. 2 (page 228). The apparatus carries three color screens, which are operated by an electromagnetic device. These screens are formed of red, yellow and blue glass, and each is mounted in two halves. These two parts are connected together by an arm, so as to open and shut at the same time; they swing open by their own weight when in normal position. One of the shutters has an arm which projects at the side and carries a soft iron core, entering into a solenoid attached to the frame of the apparatus. When the current is thrown on, the armature is drawn in, thus closing the screens. Each pair of screens has a separate solenoid, two being placed on one side of the frame and one on the other. A separate circuit passes from each solenoid to the controlling switchboard in the main room, so that a single operator can control all the solenoids and screens of the fountain, and thus throw one color into all the jets, or, by another arrangement of circuits, produce any combination of color desired, according to a prearranged diagram. The fountains are also illuminated in white by leaving open all the screens and using the light of the arc. When all the screens are closed, there is virtually no light in the fountain. This arrangement is utilized in starting the arc lamps at first, and after they all burn at normal candlepower the screens are opened and the colors are thrown on as desired.

A number of jets in the upper basin are directed forward at an angle and describe a curve, falling in spray upon the bed of the basin. To light these jets a different arrangement has been adopted. The projectors are of the same type, but three or more are used for the same jet. One of these is placed so as to throw the light through a window placed at the beginning of the jet and immediately in front of the pipe, thus lighting up the first part. As the jet in falling covers a considerable space with its spray, two or more windows are provided here, each having a separate projector, which is placed in advance of the windows and throws the light back into the jet at an angle of 45°. In this way the jet is illuminated along its whole length. As the surface of the latter windows is somewhat large, it is desirable to avoid bare spaces in these panes, as this would produce a bad effect. An artificial spray is formed, covering the whole of the window, by means of a series of perforated lead pipes.

One of the most interesting features of the underground installation is the automatic switchboard by which the circuits of all the screens of the projectors are controlled, giving the various combinations of color in the whole arc system of the fountain. The incandescent system, which is also very extensive, has a similar controlling arrangement. A view of this apparatus will be seen in Fig. 3. This switching arrangement was designed by Vedovelli & Priestly, one of the large electrical firms of Paris, who have installed the whole of the electric apparatus of the fountain. The switchboard consists of two stout iron frames, each supporting a series of levers, forming a keyboard, and three upper sets of levers for closing the different circuits. The keyboard is formed by the projecting ends of the lower series of levers, thus making a long range of keys very much resembling a piano keyboard, except that the keys are raised instead of being depressed as in ordinary cases. The rear end of each lever is connected by a steel wire to one of the contact levers in the upper series, these being disposed in three ranges. Back of the levers is a series of mercury cups, into which pass the terminals of the projector circuit, each of the two wires of a circuit passing into a mercury cup, these two being placed in pairs, one behind the other, at the rear of each lever. The lever carries two projecting pins which fall into the two cups and form a bridge, and thus when one of the lower keys is raised it pulls down one of the upper levers, closing the circuit of a solenoid. When the key is released, the upper lever is brought back by a counterweight placed in front.

The keys are operated by an automatic arrangement, consisting of a metal cylinder about six inches in diameter, which passes along under them. This cylinder carries rows of tapped holes around its circumference, corresponding to each of the keys. By placing a screw in one of the holes a projection is formed, which strikes the key as the cylinder turns, raising it and thus making contact at the back. By placing the screws in the holes according to a given system, any distribution of color in the jets may be obtained. The two cylinders are operated at the same time by a worm gearing in the center, turned by a hand-wheel. There are also five main switch-levers below the cylinder, each of which operates a different arrangement of circuits. The first of these closes the circuits of all the solenoids of the projectors, thus shutting all the screens and causing extinction of the light, or, when all the screens are open, the entire fountain is illuminated in the white light of the arc. The second lever throws on all the solenoids corresponding to the red screens, and all the jets are illuminated in red. The third and fourth give the same effect for the other two colors. The fifth lever acts upon the lower keyboard, lifting all the keys at once so as to allow the cylinder to be taken out and a new one inserted. A number of these cylinders have been provided, each with a different color design.

While the arc system is used for the illumination of the vertical and horizontal jets of the fountain, an extensive incandescent system has been provided for lighting the cascades and the central niche, as well as the front of the Electrical Palace. The main fall which proceeds from the grotto in the central niche, as well as the cascades which descend from

the basins placed below it into the main basin, are all lighted by lamps placed in the rear and under the borders of the basins. The cascades are arranged so as to fall in separate streams, instead of in a continuous sheet of water, as a more effective illumination is secured in this way. The separate streams and drops reflect the light and appear luminous, while with a large sheet of water, only the lamps in the rear would be seen, and the water would not appear luminous in itself. The separation into streams is carried out by a series of glass strips placed along the border of the basin, held in an iron support. The border of the basin is curved down somewhat in front and the lamps are thus partly concealed. Back of the row of lamps is a continuous reflector of corrugated and silvered metal, which throws the light forward into the streams at the proper angle. The lamps are placed in alternate colors, red, blue and yellow, and each color may

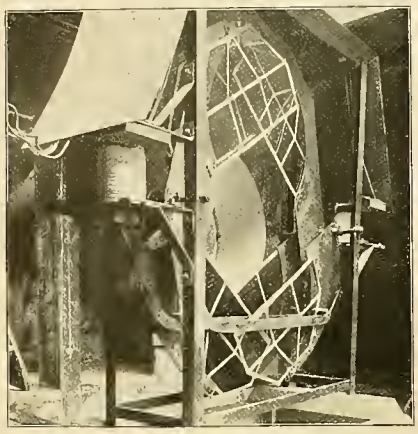


FIG. 2. OPERATION OF THE ELECTRIC FOUNTAIN AT THE PARIS EXPOSITION.—TYPE OF ARC PROJECTOR.

be lighted separately, making three sets of circuits which pass to the switchboard below the fountain.

The grotto is nearly filled with a fine spray, which is also illuminated. To form the spray a series of three circular pipes, one above the other, is used. These pipes are perforated with small holes. Upon the pipes is mounted a series of waterproof lamps with reflectors, which light up the spray in different colors.

The main arch of the fountain and the central niche contain a great number of lamps, which give a brilliant illumination in different designs. The greatest number of lamps, however, is used for the illumination of the front of the Electrical Palace. The ornamental border at the top contains thousands of lamps of different color, which, when lighted up, bring out the design with a brilliant effect. The whole design may be produced in any of the three colors, or different combinations of color may be obtained. The combinations are all carried out from a controlling apparatus in the basement, quite similar to the one already described. The large opal globes at the top and bottom of the design contain each three lamps of different color. A series of arc projectors is placed upon the roof, back of the design, and lights up the stained-glass patterns which thus appear in rich colors. The group at the top of the design is lighted up at intervals by the powerful arc projector of the Eiffel Tower, which is directed upon it.

The incandescent circuits have a controlling apparatus which is of considerable interest. This device is a kind of rheostat, built for heavy currents, which is used for lowering the brilliancy of the lamps and, at the same time, changing from one color to another. Its general appearance is shown by Fig. 4. It consists of an iron framework with a slate panel at the top, forming a long table. On the top are two rows of contact plates, each being connected to one of the resistance coils in the body of the apparatus. Each row of contact strips contains three series, one for each of the circuits, and over each series travels a contact piece, supported upon a long rod. In the rear is a motor, which gives a to-and-fro motion to the sliding contacts by means of an endless screw and gearing, which operates an arm at the side. Another endless screw gear operates the two cylinders shown in the rear, which carry three segments. The brushes above bear upon the segments and make connection for one of the circuits, red, blue or yellow. The action is such that the cylinder, which moves very slowly, introduces a new color when all the resistance is in its circuit, and the lamps thus start at a very low candlepower. This is done while the preceding color is at its maximum brightness, with all its resistance out of circuit. The contact piece moves over the table, and the new color is gradually increased in brightness as resistance is thrown out, and the other color is caused to diminish, so that finally, the latter is extinguished and the new color is at a maximum. At this time the carriage has arrived at the end of its course, and the segment of the revolving drum throws on a new color. The carriage returns over the contacts, and the process is repeated for another color. In this way the whole or different parts of the incandescent system may be made to gradually change color, and, in passing by, the intermediate tones are given.

For the arc and incandescent systems about 450 kilowatts of current is used. The arc lamps take 100 kilowatts. They burn on 10, 15, 25 and 35 amperes, and are arranged in series of three, four or five. For the incandescent circuits 300 kilowatts is taken. The three-wire system, at 500 volts, is used, with 250 volts on the lamps. The latter burn normally at 30 to 50 candlepower with 220 volts, so that by using 250 volts their brilliancy is greatly increased. The circuits are fed from the main switchboard, to which are connected the large generating units in the dynamo rooms.

In the rear of the basement are located the pumps which furnish the water supply for the cascades and jets of the fountain. There are two pumps, each driven by a motor of the railway type, which takes about 25 kilowatts. The total water supply is about 1,500 liters a second when the fountain is running full. This is distributed at three different pressures, 000 liters a second, at a pressure of 47.5 meters, 300 liters a second at 64.5 meters, and 200 liters at 33 meters. From the pumps a system of piping supplies the basin in the grotto and the different jets. To supply the vertical jets of the main basin, two large iron pipes diverge from the rear toward the front, and the different fountains are located along the line of these pipes, each jet being formed by a small pipe tapped off at the proper point and curved upward, with its mouth slightly above the water level.

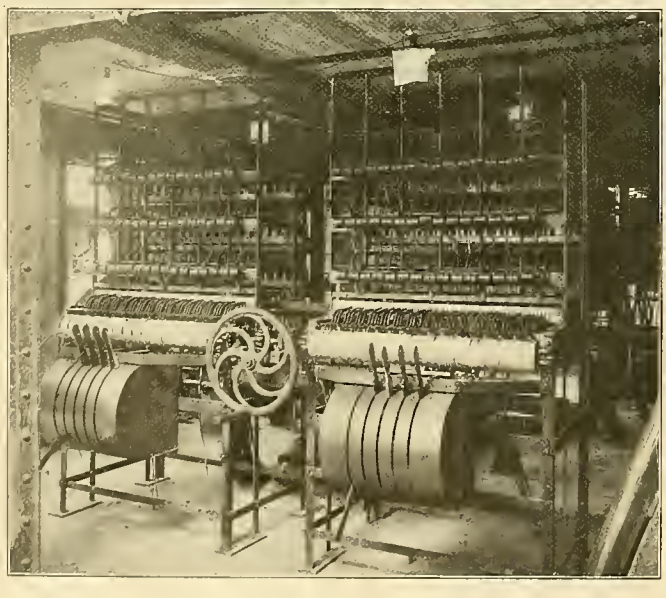


Fig. 3. Controlling Keyboard for Shutters of Projectors.

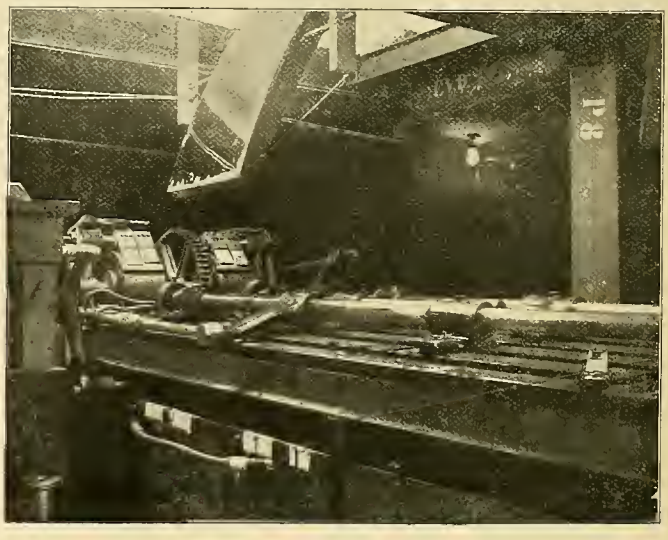


Fig. 4 Rheostat for Changing Colors.

OPERATION OF THE ELECTRIC FOUNTAIN AT THE PARIS EXPOSITION.

It is said that the Ohio Valley Electric company is about to expend in the neighborhood of $200,000 on improvements at Ashland, Ky. The power house there will furnish light for the cities of Ironton, Ohio, Catlettsburg and Ashland, Ky., and Huntington, W. Va. The company also operates the electric-car line from Ironton, Ohio, to Huntington, W. Va., which is to be completed by the first of the year.

Exchange Telegraph Company.

Articles of incorporation of the Exchange Telegraph company, organized to transmit commercial quotations for the Board of Trade of Chicago and other exchanges, were filed in Trenton, N. J., on October 5th. The capital stock is $5,000,000. The stated objects of the company are to acquire by purchase or lease, and to operate, throughout the United States, a system of telegraph and telephone wires, to conduct the business of transmitting messages by telegraph and telephone, and transmit and sell market and all kinds of news, to operate tickers and like instruments for the prompt transmission of all market quotatoins and other news; also, to lease to other companies wires, and to conduct in the cities and villages of the United States a general messenger service; also, to manufacture and sell electrical power and do a general telegraph and telephone business. President Warren of the Chicago Board of Trade said that the new company had its origin in the efforts of the board to prevent the delivery of its stock quotations to the bucket-shops, and the disinclination of the existing telegraph companies to co-operate with these efforts.

The Chicago Board of Trade has authorized an exclusive contract for space in its building with the new company, and for the delivery of its quotations to points which the new lines will reach. These lines, as planned, will be about 4,700 miles in length, and will take in New York, Washington, Philadelphia, Baltimore, Pittsburg, Louisville, Cincinnati, St. Louis, Kansas City, Omaha, Cleveland, Buffalo and other points where the grain business will justify it.

Actual construction work will be begun as soon as practicable. A representative of the Exchange Telegraph company is now engaged in securing from other exchanges contracts for free space, and the co-operation of all the exchanges will insure, it is said, the success of the new company. The incorporators of the company are Louis B. Daily, Clifford Perkins, Evan J. Dudley, Charles H. Barkley, Kenneth B. McLaren, Forrest P. Gould, Millard W. Baldwin, Thornton Parker, John I. Billings and Adolphus Smedburg, all of New Jersey.

Trouble and Rumors of Trouble.

Allegations of bribery, in which members of the City Council, the Gamewell Fire-alarm Telegraph company of New York and the Municipal Signal company of Chicago are mixed up, with charges and countercharges, are attracting attention in Cleveland, where a contract for fire and police telegraphs recently awarded to the Gamewell company has been under investigation. One member of the City Council of Cleveland was arrested and gave bonds to answer to the charge of accepting $200 as a bribe from the Gamewell company. Other testimony given during the investigation seemed to indicate that an officer of the Municipal Signal company had offered bribes.

In Jeffersonville, Ind., there is a charge of bribery growing out of the proposed transfer of the Jeffersonvill Light and Water company to the city. It is said that a man well known in electrical manufacturing circles offered $1,000 as a bribe to a councilman of that city to induce him to resign from office, with the hope that another man who would favor the municipal-ownership proposition might be elected.

New Colorado Telephone Exchanges.

By J. W. Dickerson.

With the spread of prosperity in commerce, agriculture and mining in Colorado there has been an increasing demand for telephonic service throughout the state. The Colorado Telephone company has been extending its service in all directions, but the increase hardly keeps pace with the demand, despite the fact that a liberal policy has been pursued. During 1900 the sum of $500,000 will have been expended in new work. The money necessary for the outlay was raised by increasing the capital stock from $1,000,000 to $1,800,000.

The following list shows most of the points at which new exchanges have recently been opened in the state: Eaton, Fruita, Ouray, La Junta, Delta, Rocky Ford, Sterling, Fort Morgan, Brush, Loveland, Berthoud, Breckenridge, Eldora, Castle Rock, Walsenburg, Hastings.

Among the new lines constructed are those from Sunshine to Jimtown, Greeley to Sterling, Silverton to Ouray and Loveland to Estes Park, with extensions from La Junta to Las Animas and from Fowler to Sugar City. An extension through Grand Junction to Ouray brings the entire San Juan country into communciation with Denver. Still, at some points the service is not yet sufficient to meet the requirements. For example, a very considerable part of the business relating to mining deals in the camps of Victor and Cripple Creek—and the number is legion—is transacted by telephone with Denver and Colorado Springs, and, although 13 circuits are now in service, the company has commenced the construction of seven in addition, making a total of 20 circuits.

Construction has recently been made from Denver to Salt Lake City, 650 miles, but service will not be provided the public between the points named. The connection between the two cities was made over the wires of the Colorado Telephone company to Terry's Ranch, near the Wyoming state

FIG. 1. NEW COLORADO TELEPHONE EXCHANGES.—BUILDING AT COLORADO SPRINGS.

line, just below Cheyenne. Thence the wires of the Rocky Mountain Bell Telephone company were used into Salt Lake City, by the way of Ogden. While communication could be had, it was not satisfactory. The toll charge for a five-minute conversation would necessarily be $6 or $7, and the service could not be such as is demanded by the public.

The company furnishes satisfactory service to a number of points in Wyoming, in connection with the wires of the Rocky Mountain Bell Telephone company. Among these points, with distances from Denver, are the following: Evanston, 550 miles; Rawlins, 300 miles, and Laramie, 163 miles. Service to Laramie and Cheyenne has been provided for a considerable time.

The "crack" exchange in the chain that etxends throughout Colorado is that which is located in Colorado Springs, and certainly this city deserves the best of service, for there are few cities in the United States in which the proportion of subscribers to population is so great. The number of subscribers in Colorado Springs and Manitou is 1,000, or about one subscriber for every 23 persons. The local patronage of the toll lines is unusually liberal, for Colorado Springs is largely interested in mining property and controls the mining-stock market almost altogether. The building (Fig. 1) consists of two stories and a high basement. The material is red brick, with terra-cotta trimmings. In the front of the main floor is located the public office, where booths are provided for local and long-distance conversations. The three principal points with which communication is desired are Denver, Pueblo and Cripple Creek. Adjoining the public office is the office of the local manager, Mr. R. F. Morris, and in the rear is the inspection department, well equipped with all appliances to facilitate the work.

In the basement is located the power plant (Fig. 2), which contains four Western Electric generators, one Western Electric motor, one set of storage batteries and a gas engine, furnished by Fairbanks, Morse & Co. The current from the storage batteries is used for calls and actuates the clearing-out signals on the switchboard. Two of the generators

FIG. 4 NEW COLORADO TELEPHONE EXCHANGES.—OPERATING DEPARTMENT AT COLORADO SPRINGS.

are driven by the electric motor, current being taken from the circuit of the El Paso Electric company. The gas engine furnishes power for the other two generators, this constituting an auxiliary set, and one set is always in reserve.

The main distribnting board is located in the same room (Fig. 3). The cables are carried in underground conduits in the business portion of the city, and are connected with the switchboard through fuses and arresters. All testing is done at this point.

The operating department (Fig. 4) occupies the entire top floor, and is an unusually light and attractive room. The relay switchboard is stated to be the latest type placed in an exchange west of Chicago. The signal on the switchboard is a tiny incandescent lamp, which is lighted when the

Fig. 3. Distributing Board at Colorado Springs.

Fig. 2. Power Plant at Colorado Springs.
NEW COLORADO TELEPHONE EXCHANGES.

subscriber takes the receiver off the hook. The clearing-out signal is given when the receiver is again hung on the hook. The system works admirably. The work is performed more quietly and more rapidly, for the operators merely are obliged to ask for the number; interruptions are unnecessary: the light signals show all the rest.

As it has been intimated, the toll boards located here do a lively business. Fifteen circuits run from Colorado Springs to Denver, six to Pueblo and 20 to Cripple Creek.

A tastefully furnished room is set aside for the use of the operators.

The new building of the Colorado Telephone company at Pueblo (Fig. 5) is a structure composed of two stories and a basement. The ground dimensions are 40 by 50 feet on the corner of D street and the alley between Victoria and Union avenues. As the property on the north side is vacant, plenty of light is obtainable. The basement of the building is divided into three compartments, as follows: Battery room, room for hot-water heating plant, and storeroom and work shop. On the ground floor the public office is located. This department is handsomely finished in selected ash, and includes two sound-proof booths. The public clerk's desk is enclosed and the operator is enabled to reach by instrument every department in the building. This desk is connected by burglar alarm with the chief inspector's room, where a man is always on duty. Immediately back of the public office is the well-appointed office of the local agent, Mr. C. G. Seelye. From the agent's office entrance may be gained by stairway to the operating room and to the linemen's room in the rear, which occupies the entire back portion of the building, and is 20 by 40 feet in size, with a large entrance on the alley side. Here are arranged nine lockers for instruments, tools, linemen's clothing, etc.

Opening from the linemen's room and facing the street and alley is the terminal room, in which all the armored cables are distributed after entering the building in the basement. The cables, which are carried on a distributing rack, are composed of 100 wires each. Here are located the motors and generator for ringing purposes. Two currents are

used, the alternating and pulsating. In the same room is located the chief inspector's desk, equipped so that connection may be had with every department in the building, and in the same department are his testing apparatus and table. On the latter are kept the chart books, books showing life of instruments and inspectors' routings. The table is provided with a gas stove for cord repairing and light work. A special iron stairway leads from this room to the operating room on the second floor,

FIG. 5. NEW COLORADO TELEPHONE EXCHANGES.—BUILDING AT PUEBLO.

which is 30 by 40 feet in size. It is lighted by nine large windows on three sides and a skylight on the roof. Here are located five sections of standard Western Electric switchboard for local purposes, which now carry 600 subscribers. Two toll

FIG. 7. NEW COLORADO TELEPHONE EXCHANGES —OPERATING ROOM AT YORK BRANCH EXCHANGE.

tables are provided for nine metallic circuits connecting Pueblo with all parts of Colorado. In the center of the room and between the toll tables and local switchboard is the chief operator's desk provided with an equipment to reach every operator and every department in the building.

In the room in the rear of the operating department is an apartment designed for the exclusive use of the young lady operators. It is provided with a small library, rattan lounge and comfortable rattan rockers. Adjoining is the lunch room equipped with gas stoves, dining table, china closet, chairs and metal lockers for the operators' wraps.

During the last two years the business of the Pueblo exchange has nearly doubled. The present force consists of 18 operators and clerks, four inspectors, four linemen, two messengers, one collector, one janitor and the local agent.

In the city of Denver the Colorado Telephone company supplies telephones to 4,000 subscribers. According to the figures in the report of the census enumerators recently made the proportion of instruments to population would be one in every 32. The majority of instruments are connected directly to the operating room in the company's building on Lawrence street, but 650 subscribers are cared for at the sub-exchange on York street, shown in Fig. 6. The location is in the eastern part of the city, at a point where it is, relatively speaking, in proximity to a large number of telephones in homes. The structure is well built, with one story and a basement. The operating department (Fig. 7) is a large room and well lighted. The distributing room is located in the basement. The lines are carried down through the sidewalk to the distributing rack. In the district covered by this exchange the wires are strung on poles. In the distribution room is located the machinery for ringing. Current is obtained from the circuit of the Denver Tramway company.

Converters and Rectifying Transformers.[1]

By P. Janet.

The problem of the transformation of alternating and direct currents lies at the basis of all electrotechnics, for it is solved by that marvelous device, the Gramme collector; yet it is only of recent years that it has assumed an important place in the studies of electricians. The ease with which high potentials are produced by means of the alternating current has made this the type par excellence for the tranmission of electrical energy; yet in many cases the direct current has continued the better form for the utilization of this energy; electrolytic operations and the charging of accumulators absolutely demand it, while arc lighting by its means is incomparably the best.

Despite the remarkable progress in alternating motors, the direct-current machine is in many cases, that of traction, for example, still preferred. In incandescent lighting alone is it at a disadvantage. Under these conditions the dispute which we have witnessed between extreme partisans of direct or alternating current is amusing. The former, while applauding the excellent transmission secured with continuous currents of high tension, have been forced to admit the incontestable merits of polyphase circuits for long-distance work, as developed on all sides; the latter to satisfy the legitimate exigencies of railways, arc lights, or of pre-existing direct-current motors, have been forced to attempt the transformation of alternating energy into a form more marketable. The result of this evolution has been the creation of apparatus whose merits and disadvantages the congress has now to discuss.

We may classify these in four groups:

1. Electrolytic rectifiers.
2. Simple commutating apparatus.
3. Converters or motor-generators.
4. Rectifying transformers.

I. Electrolytic Rectifiers

Apparatus of this type depends upon a peculiar property of aluminum electrodes. When one of the electrodes of a voltameter is formed of a sheet of aluminum, the other being of any metal whatever, current will pass without difficulty if the aluminum

FIG. 6. NEW COLORADO TELEPHONE EXCHANGES.—YORK BRANCH EXCHANGE.

electrode be negative. The current is arrested almost completely if this be positive—a fact attributed in the first case to the formation of a thin layer of alumina. Such a voltameter may withstand a potential difference of 20 volts in an acid electrolyte, and one amounting to 140 volts in an alkaline liquid. It is easy to conceive arrangements for utilizing this property in the rectifying of alternating currents, or what amounts to the same thing, in the realization of an actual electric valve. How far this solution of our problem is an industrial one—what may be its power capacity—what the efficiency of such transformation—are questions which will be of great interest to examine.

II. Simple Commutating Apparatus

An ordinary commutator, performing in synchronism with the current which it is to rectify, evidently furnishes a simple solution of our problem; but the heavy sparking, when current intensity is considerable, constitutes the principal difficulty offered. Despite ingenious artifices devised to prevent this, as, for example, to reverse the current at the precise moment of zero value, we have not much to hope from this method.

III. Converters or Motor Generators.

The transformation of alternating currents, single or polyphase, into direct may evidently be accomplished by directly coupling an alternating motor and a continuous-current generator. If the motor be of the synchronous type, it is possible to condense the two sets of fields into a single system, and to unite upon a single armature the windings for direct and alternating currents. Pushing the simplification still farther, we finally obtain a converter whose field is excited by a direct current and whose single armature receives at one side a single-phase or polyphase alternating current, and gives out at the other, by means of commutator and ordinary brushes, a continuous current.

It is of interest to examine these machines from the point of view of economy of material, of efficiency, and of operation. As regards the first, it is evident that by use of converters one system of fields is made to do the work of two, without sensibly modifying the dimensions, and even in reducing the dimensions; it has then every advantage on that ground. As regards the armature, it is also evident that the weight of copper required will certainly be less than the sum of the weights of copper carried by an alternating-current motor and by a continuous-current generator. Allowing that the respective intensities of the direct and alternating currents add themselves algebraically in the wire of the armature, the total Joulian heat therein is diminished, permitting, if one so desires, an economy of copper.

It is of interest to push the discussion further in comparing the maximum output of a machine when working successively as a generator for direct currents and as a converter. A very slight advantage lies with the direct-current generator over the operation of the same machine driven as a monophase converter; but if energized by polyphase currents the converter shows a very marked superiority, the more decided, indeed, as the number of the phase is increased. Thus it is that a two-phase converter (or rather one with four phases) has an advantage over the three-phase converter; and one of six phases is superior to a converter of four-phase currents. The advantage is such that for equal weight of material the same machine may be nearly two times more powerful working as a six-phase converter than when performing as a direct-current generator; and by the same line of reasoning, a six-phase converter may have for equal weight a maximum output almost 50 per cent. greater than for a three-phase converter.

It is thus of advantage to augment, as far as possible, the number of useful phases. With this point in view, ingenious artifices (a description of which will be too long to insert here) permit us to pass very readily from three-phase to six-phase, and if this were necessary, it would be possible to force this multiplication of phases still further, by means of purely static devices.

From the point of view of efficiency, it is evident at first sight that the advantage lies with the converter over the motor-generator group. Admitting in the latter case efficiencies of 90 per cent. for each of the two machines, the total efficiency of the transformation will be 81 per cent. A converter may have an efficiency of 90 per cent; it may even work under better conditions than a generator, since for equal power and equal induction, the weight of its armature will be less, and in consequence the loss in hysteresis less. But it should be pointed out that a converter is rarely employed alone. It is necessary to add a suitable transformer to convert to the required potential the high tension of the transmission circuit, since for motors of a certain output, at least, this high tension cannot be directly applied.

It is thus fair to compare with each other the transformer-converter as a unit, and the motor-generator, but with the high efficiencies of transformers even then the superiority rests with the converter. This is supposing throughout that the conditions of frequency imposed permit the realization of a sufficiently practical machine—a supposition not always attainable.

From the point of view of operation, the converter imposes a sensibly constant relation between the direct and alternating potentials, which may be a disadvantage. It presents the general merits of synchronous motors as regards the advances in phase, which may be produced in a circuit, but it has a tendency to reinforce the higher harmonics—an element which may become serious if the power transformed is an important fraction of the total power produced, and especially if the conductors are underground.

The armature reaction is slight in the converter, because, in the polyphase converter, the couple being nil, the flux proper of the armature produced

1. Paper read before the International Congress of Electricity in Paris, August 18–25, 1900. Mr. Janet is a professor in the University of Paris.

by the alternating and the direct currents ought to be equal and opposed, and in consequence destroy each other. In the monophase converter this still holds true in part, but there exists a turning flux of a frequency twice that of the potentials at the brush terminals.

IV. Rectifying Transformers.

It will be seen that the conversion described in the foregoing involves two stages: First, it transforms given electromotive forces of a small number of phases (six or more in practice) into electromotive forces of a great number of phases in the successive segments of the Gramme ring. Second, the collector transforms these electromotive forces into a continuous potential difference. Now it is possible to realize the first transformation by means of apparatus comparable to the ordinary transformer. By this means the moving parts will be reduced to an ordinary commutator. We shall examine such type of machine from the same points of view as before:

First—As regards economy of material, it is clear that in the rectifying transformer we suppress the fields and armature of the converter. Comparing an ordinary transformer with a phase transformer, it appears that for like output and conditions of operation the weights of the two are approximately the same. We must, however, take into account the small synchronous motor required to drive the collector of the rectifying transformer.

Second—As to efficiency, the latter system economizes in losses from hysteresis and Foucault currents, and, despite the small motor, appears to claim the advantage here.

Third—As to performance, it is evident that for the same reasons as with a direct-current machine, it will be advantageous to subdivide the collector as much as possible—to multiply the number of phases. With fixed brushes, this means to enlarge the size of the part rotating. Thus, the advantage here rests with the converter, in which this subdividing presents no difficulty, especially if the collector be stationary and brushes rotated—a method as yet not sanctioned by practice.

Summary.

In summation three really practical systems exist for the solution of the problem which occupies our attention: Motor-generators, converters and rectifying transformers. It will be of interest to receive precise data allowing a comparison of these three systems from the point of view of actual practice.

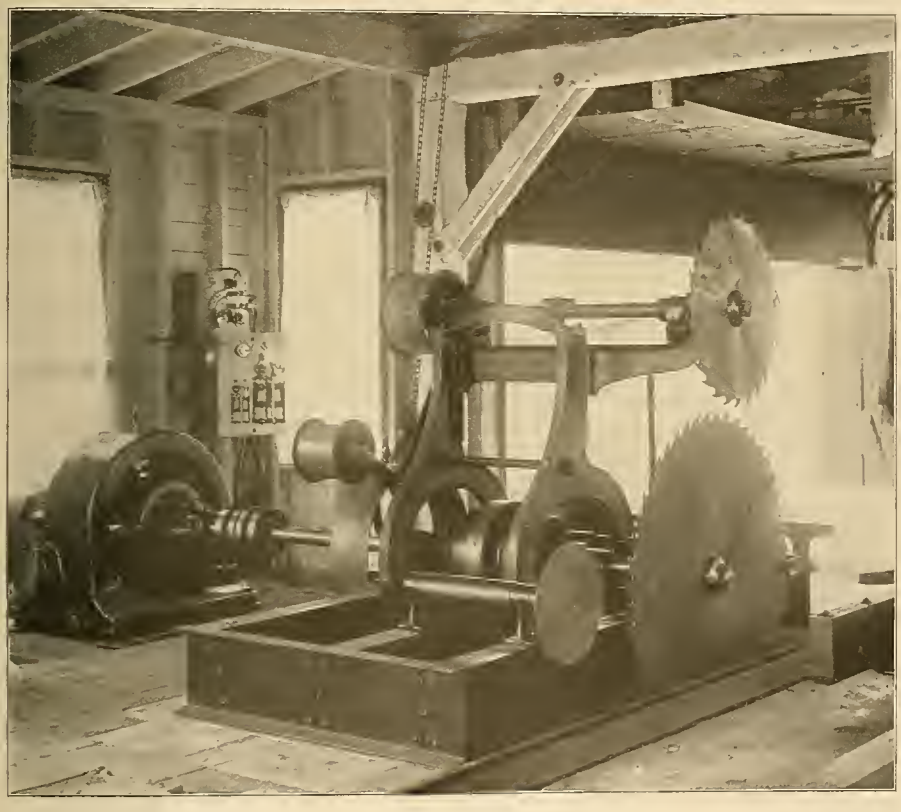
Mr. Cowper-Coles, the electrometallurgist, has worked out a system for drilling and slotting metals by means of electrolysis. A jet of an electrolyte is caused to impinge on the plate or other object to be drilled. The plate or other object is made the anode of an electric circuit, the nozzle from which the jet flows forming the cathode, and a current of electricity being passed through from the plate to the nozzle. The plate is worn away where the jet impinges on it. To define more sharply the hole or slot cut, he has made the nozzle brought right up against the plate, but separated from it by an india-rubber washer, which determines the size and shape of the cut.

Electric Sawmill.

Direct-connected elevator service is usually considered as furnishing the most severe conditions under which a direct-current motor may be called to operate. The interesting example of direct-connected work illustrated herewith exceeds elevator service, both as regards extreme variation of load and the necessity for operating under unfavorable conditions as to location and skilled attention.

The plant in question consists of a 35-horsepower New England motor rigidly coupled to a 48-inch Chase sawmill. It is installed in J. P. Rust's mill at Keene, N. H. It will be noted that a top saw is provided for use in cutting extra large logs. The speed of the saw is 800 revolutions per minute. In the type of motor used the armature is carried by a casting independent of the magnet frame, but fitted therein. This casting is bolted to the frame at three points around the circumference, and is provided with longitudinal adjustment for regulating end thrust. This design insures the alignment of the bearings, exact centering of the armature with great stiffness of the frame, and is well adapted to meet the severe conditions of this case.

The motor is heavily over-compounded. The shaft is extended at the commutator end and provided with a pulley, from which is driven a blower, not shown in the picture, to remove the sawdust. The shaft is rigidly connected with the saw arbor by an insulated coupling.



ELECTRIC SAWMILL.

While it was expected that the motor would be subjected to occasional overloads, and the machine was designed accordingly, the actual service demanded of the motor is considerably more severe than was anticipated, and the following figures may prove interesting: The normal rating of the motor is 135 amperes at 220 volts. When not cutting and driving the blower only, the minimum current is 30 to 35 amperes. When taking a cut the current is constantly and rapidly varying from 50 to 240 amperes. It has been found necessary to lock the overload device on the starting box, as it operated at 200 amperes maximum. Notwithstanding the unusual demands on the motor, it has operated without any extra attention. The brushes require no shifting under the conditions, and the following extract from the report of the installing engineer is interesting: "The overload device on starting box throws off when set at 200 amperes. What shall I do about it? The load of the motor with blower and mill when not sawing is 50 amperes. When sawing medium-sized logs it takes about 150 amperes, but frequently jumps to 210, but the motor gives no trouble about it, even then, and I have not, as yet, seen it spark in the least."

The generator is also manufactured by the New England Motor company, and is known as type D. It is a six-pole machine, over-compounded and wound especially for this installation. It may be stated, in conclusion, that both the motor and generator are of standard size and weight, and the results obtained are in no way due to the use of extra large machines adapted for the occasion.

Electrical Phenomena in the Euphrates Valley.[1]

By Ellsworth Huntington.

During a recent 10 days' geological trip through an almost unvisited part of the Taurus Mountains to the south of Harpoot I heard of a phenomenon which I should be glad to have you explain, either by letter or through the columns of the Review. Before leaving Harpoot I was told by a man from Aivose that Keklujek Mountain, near his village, fought with Ziaret Mountain, on the other side of the Euphrates River. The weapons were balls of light, which the mountains threw at each other. As the region was one of volcanic activity in comparatively recent times, and as hot springs and extinct craters are still to be seen, I thought at first that this must be a traditional account of a volcanic eruption. Subsequent investigation, however, showed that the story had its origin in a meteorological phenomenon. At first I was skeptical as to the truth of what follows. After hearing substantially the same story from 10 or 12 men whom I saw in five different places separated by an extreme distance of 40 or more miles, I became thoroughly convinced of its truth. It may be a common occurrence, but I have never heard of it, and can find no account of it in the few books at my command.

The facts, upon which all agree, are as follows: A ball of fire is sometimes seen to start from one mountain and go like a flash to another. At the same time there is a sound like thunder. This occurs by day or by night, although by day no light is seen. It always occurs when the sky is clear and never when it is cloudy. It sometimes happens two or three times in a year, and then, again, is not seen for several years. For the last two years it has not been seen. It is most common (or possibly never happens except) in the fall, at the end of the long dry season of three months. The mountains show no special features different from other mountains. I visited one of them, Karaoghlon (Black Son) Mountain, and found it to be composed of metamorphic schistose shale of cretaceous age. Its height is 7,350 feet, and the top is comparatively flat. One observer said that a glow remained after the flash, but all the rest contradicted this. Another said that the ball of fire was first small, but grew larger as it passed over, and then grew smaller again. He evidently was between the two mountains.

In every case the flash crosses the Euphrates River, which here flows through a deep, precipitous valley, at an elevation of 2,000 feet above sea level, or at from 3,500 to 5,500 feet below the tops of the mountains. The valley and the lightning seem to have some connection. I asked about other mountains, e. g., whether the flash ever went from Ziaret to Chakchak, and was told that it never did so. The flash goes indifferently in either direction. Ziaret Mountain stands out prominently and is said to be visible from the cities of Harpoot, Malatia, Arghuni, Choonkoosh, Diarbekir, Severek and Oorfa.

In several places the people said that this lightning was seen only when Turkey was at war. Later, at Kefferdis, near Mount Ziaret, we heard the origin of this tradition. Once, at a time of a war scare, lightning flashed from Mount Ziaret. The people in Malatia heard the sound of the thunder. No clouds were in sight, and they did not think it could be thunder. So they said: "The Russians are coming; we hear their guns."

[Discussing Mr. Huntington's contribution, the editor of the Monthly Weather Review, Professor Cleveland Abbe, is inclined to discredit the accuracy of the statements made by the natives. He says: "In general, the air ordinarily offers such a resistance to the passage of electricity, while the earth is such a good conductor of electricity, that it would be easier for two electrified peaks to discharge through the earth than through the air. We cannot, therefore, think of a lightning flash passing between two neighboring peaks. On the other hand, a cloud or a mass of electrified air that has not quite attained the cloudy condition may lie between two peaks, and flashes may proceed from it simultaneously to the two peaks in such a way as to lead a careless observer to say that one peak discharged over to the other. If this is the approximate explanation of the Euphrates phenomenon, then it will happen only when the wind is in certain directions, such as to cause the formation of an incipient cloud and thunderstorm between the two peaks, and this wind direction will depend upon the relation of the peaks to the course of the river valley below."]

Contract for All-British Pacific Cable.

According to advices from Melbourne, Australia, the contract for the building of the all-British Pacific cable has been formally awarded to the Telegraph Construction and Maintenance company of London, whose offer to do the work was for £1,886,000. The contract calls for completion of construction within 18 months of the signing of the papers.

1. From the United States Weather Review. Mr. Huntington is connected with the Euphrates College at Harpoot, Turkey.

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CONVENTIONS AND EXPOSITIONS.

American Street Railway association, Kansas City, Mo., October 16th to 19th.
Automobile Show, New York, N. Y., November 10th to 24th.
Illinois State Electric association, Peoria, November 27th.

In a recent article a German writer, discussing the causes of breakages in overhead line material, naturally concludes that most of these breaks are caused by undue wear on the trolley wire at certain points, as, for instance, where the wire is bent round at a splicing ear. Where possible a spring suspension is recommended. Where a trolley line passes under a low bridge the trolley pole comes down to an almost horizontal position and the upward pressure is considerable. In such cases the author recommends running the trolley wires through wooden troughs having the lower sides open for the passage of the trolley wheels. This suggestion is all right; it embodies the essential feature of a wrinkle in overhead-railway construction that has been in use in this country for several years.

Evidently there is a screw loose in the mechanism of the plan for the great consolidation of the Western Union, Postal, Bell and T. T. C. companies, assuming that such a plan was at one time in existence. The Postal Telegraph-cable company apparently does not care to be connected with such a combination, even by rumor. It has taken the public into its confidence, and, by an official circular, dated October 8th, issued by William H. Baker, its vice-president and general manager, declares that "the officers of the Postal Telegraph-cable company and of the Commercial Cable company deny emphatically that either company is contemplating any such combination, and state that the control of the Postal Telegraph-cable company and of the Commercial Cable company is not for sale." This confirms, in direct and positive language, what Mr. Baker had heretofore insisted to be the fact in interviews with representatives of the Western Electrician and other journals. The announcement seems to be straightforward and single-purposed, and the Postal company has undoubtedly strengthened itself with the public by its aggressively independent position.

Among labor unions the wiremen and gasfitters have been at odds for a long time over the question as to which body of workmen should do the pipe work for interior wiring. Each union claimed that this class of work fell within its province. In Chicago the local Building Trades Council, which is a representative governing association of trade unionists of the character indicated by its name, decided in favor of the gasfitters, but the electrical workers did not accept the decision as final, and now appear to have come into their own again. The electricians purposely courted suspension from the local body by refusing to accept its settlement and appealed the case to the National Building Trades Council. This august body, as the electrical workers had shrewdly suspected, took a different view of the matter, and gave the wiremen "quarterly working cards," despite the previous action of the local council. Thus the electricians have good labor-union authority for installing the piping for interior wiring and can bid defiance to the ambitious gasfitters. This is the sensible solution of the dispute, for it is much more convenient for contractors and owners to have one set of men do a wiring job rather than two.

Conditions favoring an expanding export trade in American electrical machinery for South Africa appear to be especially favorable. The United States consul-general at Cape Town, J. G. Stowe, quotes from the British and South African Export Gazette to show that in the early days of the Rand direct-current dynamos from England were used almost entirely, but following the Frankfort exhibition polyphase dynamos and motors almost entirely superseded the older types. As the English manufacturers made no effort to supply the new machines, German, Swiss and especially American firms secured the Rand trade. American machinery required Americans to understand and operate it, and American engines were imported to drive it. Now the colony is full of American engineers, American practice is quite the proper thing, and American terms are the vernacular. Orders for machinery to the value of millions of pounds will be given out during the next year or two, not only for mines, but for towns, which will increase rapidly in size. In overhead-line equipment, and especially on railway lines, the material comes largely from the United States, simply because of the readiness of the American manufacturers to adapt their products to existing needs of the country. Now, it appears, is the time for American "hustlers"—men to study the markets, ascertain its wants and carry their samples with them.

It seems ridiculous that at the dawn of the twentieth century—to coin a new expression—a European country actually prohibits the importation of useful electrical apparatus simply from distrustful ignorance. But although Mr. Griscom, the American chargé d'affaires at Constantinople, has saved one consignment of specialties from the United States—small reading lamps, toys with battery attachments, and the like—and has secured the promulgation of an irade authorizing the introduction of similar articles into Turkey, the general interdiction against dynamos, electrical plants, telephones, etc., still exists.

The circumstances under which Mr. Griscom brought about the exception noted are amusing. About July 1st an American firm made a shipment of minor "electrical novelties" to the Turkish capital. Upon arrival there, the merchandise was seized in the custom-house and refused admittance to the empire, the introduction of electrical appliances of any description being at that time prohibited. Mr. Griscom caused some samples of the goods to be taken to the palace and brought to the attention of the sultan. The latter was much attracted by the novelty of the articles and bought the whole consignment for his personal use. He also issued the edict authorizing the introduction of similar goods into the country.

The Sick Man of the East must have his playthings, but he is still a barrier to the introduction of that civilization which is sometimes styled European. Even the "Heathen Chinee" has a few electrical power plants, but there is a considerable section of Europe in which this useful apparatus is under the ban.

Some curious figures are compiled by The Engineer of London apropos of the awards of prizes and medals at the Paris Exposition. Our contemporary divides the awards apportioned to the different nations into groups, according to the classification of the exposition authorities. It then gives the total number of grand prizes and gold medals in comparison with the total number of entries of each nation in each group. By this arrangement the relative number of entries to prizes, for each nation is seen at a glance. And the United States is at the bottom of the list in both machinery and electricity! Under the head of machinery, for instance, Switzerland comes first, with only 0.58 of one entry for each grand prize or gold medal, Next in order is Belgium, 1.6 entries; Germany, 1.8; Austria, 2.8; Russia, 3.2; France, 3.8; Hungary, 4.7; Great Britain, 4.6, and the United States, 7.8. In electricity the American showing is a little worse, if anything. Here are the comparative figures: Austria, 1.1 entries for each grand prize or gold medal; Germany, 1.3; Hungary, 1.8; Switzerland, 2.1; France, 2.5; Russia, 3.4; Great Britain, 4.2; Belgium, 4.6; United States, 9.8. It will be noted that no lesser honors than grand prizes or gold medals are considered. That is one reason for the unfavorable showing of the United States. Another is the relative remoteness of this country from Paris, which militated against the exhibition of heavy American machinery. The loss of the steamer Pauillac will be recalled when this aspect of the case is considered. Still, it is to be remembered that in each of the groups mentioned the United States had a greater number of entries than any other country save France. Political considerations had, perhaps, something to do with the determination of the awards, for it will be observed that Russia is far ahead of the United States in each group, and of course no one will contend that this relative standing is indicative of the real achievements of the two countries in machine design and electrical development. The fallibilities and prejudices of jurors are also to be borne in mind. But when all is said it is remarkable that, in the principal awards, the United States should stand at the foot of the list in each group in which it is, in fact, at least the peer of any other nation.

Excitation of Induction Machines.[1]

By Maurice Leblanc.

An induction machine connected to a circuit fed from an alternator may work as a motor or as a generator, according to whether its velocity of rotation is less or greater than that of synchronism. In either case the induction machine need not turn synchrononsly with the alternator; it may be coupled with it as readily as one can couple two direct-current machines, and when used as a generator, it may be coupled with the alternator, in series or in parallel, whereas two alternators can only be coupled in parallel.

These are important advantages which always accompany the use of this type of apparatus, but the induction machine with armature circuits closed on themselves has one grave fault. The currents for exciting its fields are taken from the circuit, and, as their frequency is very high, the apparent work necessary to force them through the machine is of the same order of magnitude as the actual work which it should perform, even if its air gap be very small.

It results that (1) alternators operating as induction motors work at a disadvantage; (2) if it is desired to employ an induction machine as a generator or transformer, the alternator necessary to excite it must be almost as large as itself.

It is, fortunately, easy to suppress this defect. In any case one may draw from the circuit the currents which should suffice to excite an induction machine and utilize them instead, by machines of comparable dimensions, to the excitation of an alternator of the same power.

Whether the currents circulate in the field circuits or in the armature circuits, the number of ampere-turns necessary to develop the magnetizing force will be the same. If these currents have the same intensity, the circuits they traverse will have the same coefficient of self-induction. But in the first case the frequency of the currents will be that of the circuit. The work necessary to force them through the inductor circuits will be much greater (30 to 40 per cent.) than the real work representing the heat effect in the circuits.

In the second case the frequency will be only that due to the "slip," and will vary from 0 to 2. The apparent work will be of the same order of magnitude as the real work. We shall see that this apparent work can be produced by direct-current machines, the dimensions of which will be the same as if they were to furnish an equal amount of real work.

Consider an induction machine with two poles. Let α be the frequency of currents received from the circuit, or which it furnishes to the circuit, and ω its velocity of rotation; call β the frequency of slip; then by definition $\beta = \alpha - \omega$. We will suppose that the machine embraces only two armature circuits, differing in phase by 90°, the coefficient of mutual induction being zero, and that we put through these circuits two currents i_1 and i_2, such that

$$i_1 = a \sin 2\pi\beta t, \qquad i_2 = a \cos 2\pi\beta t.$$

calling a a constant.

Let H be the maximum value of the electromotive forces induced in the two circuits. In order that our problem may be solved it is necessary to have

$$a = \frac{H}{\sqrt{R^2 + 4\pi^2\beta^2 L^2}}.$$

But this condition will not ordinarily be fulfilled. In order that it may be, it is necessary that R and L have values less than their real values.

We have thus to solve the following problem: To annul or make very small, by artificial means, the resistance and apparent self-induction of a circuit traversed by an alternating current of low frequency.

It is necessary to develop two electromotive forces in the circuit; the one proportional to the intensity, the other to its derivative. As we are dealing only with currents of low frequency (between 0 and 2) we may employ, to this end, continuous-current machines which we will excite by alternating currents having the frequency and phase desired.

Under these conditions the dimensions of the machine will be those of a direct-current dynamo capable of performing actual work equal to the apparent work which it ought to furnish.

Consider now a direct-current machine mounted in series and working as a generator. Let R be the total resistance of the circuit, L its coefficient of self-induction, E any electromotive force whatever, developed in the circuit, U the velocity of rotation of the machine, and i the intensity of current produced. The electromotive force developed by the machine will be proportional to the speed U, the intensity i, and a constant coefficient K. We may write then

$$E + KUi = Ri + L\frac{di}{dt}$$

$$E = (R - KU)i - L\frac{di}{dt}$$

It is as though the electromotive force e acted on a circuit having a resistance $r = (R - KU)$. This gives us means to make artificially the resistance of the circuit as small as we please.

Suppose now that we have two identical circuits, the seat of two electromotive forces E_1 and E_2 of the same frequency β, but differing in phase by one-fourth period. We will include in each circuit a direct-current dynamo. The two will be identical and turn with the same velocity U. The first circuit embraces the armature of the first dynamo and the field of the second. The second circuit embraces the armature of the second dynamo and the field of the first. The two field circuits are to be wound in opposite directions.

We will have then at each instant

$$(1) \qquad E_1 + KUi_2 = Ri_1 + L\frac{di_1}{dt},$$

$$(2) \qquad E_2 - KUi_1 = Ri_2 + L\frac{di_2}{dt}.$$

Differentiate these equations with respect to time, then, multiplying them by R_1 and R_2 respectively, and both by KU, and adding separately the three sets of equations thus obtained, we get the two following differential equations:

$$RE_1 + KUE_2 + L\frac{dE_1}{dt} = (R^2 + K^2U^2)i_1 + 2RL\frac{di_1}{dt} + L^2\frac{d^2i_1}{dt^2},$$

$$RE_2 - KUE_1 + L\frac{dE_2}{dt} = (R^2 + K^2U^2)i_2 + 2RL\frac{di_2}{dt} + L^2\frac{d^2i_2}{dt^2}.$$

From their form we see that, R, KU and L being supposed constants, the exponential terms involved in the general expressions of current intensities i_1 and i_2 will have the factor $e^{-\frac{R}{L}}$.

These exponential terms then will vanish in time, and a steady working will be established, whatever the value of KU. Suppose that, once this regime is established, we have

$$i_1 = a \sin 2\pi\beta t, \; i_2 = a \cos 2\pi\beta t.$$

The equations (1) and (2) will then become

$$E_1 + KU\, a \cos 2\pi\beta t = Ra \sin 2\pi\beta t + 2\pi\beta La \cos 2\pi\beta t,$$

$$E_2 - KU\, a \sin 2\pi\beta t = Ra \cos 2\pi\beta t - 2\pi\beta La \sin 2\pi\beta t,$$

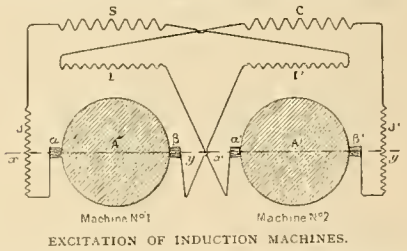
$$(1') \quad E_1 = Ra \sin 2\pi\beta t + 2\pi\beta\left(L - \frac{KU}{2\pi\beta}\right) a \cos 2\pi\beta t,$$

$$(2') \quad E_2 = Ra \cos 2\pi\beta t - 2\pi\beta\left(L - \frac{KU}{2\pi\beta}\right) a \sin 2\pi\beta t.$$

From equations (1') and (2') we see that the conditions are as though the coefficient of self-induction of each of the circuits considered was equal to

$$l = L - \frac{KU}{2\pi\beta}.$$

This apparent coefficient l can be given any value whatever, positive, zero, or negative, since, as we have seen above, the regular operation will be established whatever the value or sign of the product KU.



EXCITATION OF INDUCTION MACHINES.

We are enabled thus to realize a special exciter for the induction machine, as shown by the accompanying figure. In the cut (S) and (C) are armature circuits of the induction machine; (A) and (A'), the two armatures of the exciter; (α β) and (α β'), their brushes; (J) and (J'), the field circuits of the exciter dynamos, mounted in series with their armatures; (I) and (I') the field circuits of each of these dynamos, mounted in series with the armature of the other dynamo.

This machine will be built of two direct-current machines mounted upon the same axis (x y). Each of these will be supplied with two field windings, and the connections of the system will be made as shown in the cut.

The direction of winding of field circuits (I) and (I') should be such that if the action of the field (I) produces an electromotive force $-KU\, a \cos 2\pi\beta t$ in armature (A), that of the field (I') produces an electromotive force $+KU\, a \sin 2\pi\beta t$ in the armature (A'). This is necessary in order to take account of the sign of the derivatives of the sine and cosine functions. Since the field circuits (J) and (J') are wound in the same direction, the coefficient of mutual induction of the two armature circuits of the induction machine will be always zero.

The exciter, formed by the union of two direct-current machines, and which may be driven in any manner whatever, permits us to diminish artificially, to any desired extent, the resistance and the coefficient of self-induction of each of the armature circuits of the induction machine.

One may imagine an endless number of similar methods for attaining the same results, but all will be characterized by the employment of machines whose field coils will be excited by alternating currents having the frequency of slip of the induction machine which it is desired to excite.

If an induction machine, excited as we have described, is put on a constant-voltage circuit, whether it performs as a generator or as a motor:

1. The magnitude of the couple developed on its axis will at first increase with the slip, reach a maximum, and then again decrease.

The exciter should be so dimensioned that the maximum value of this couple will be much greater than the maximum load the machine will have to carry.

2. When the slip is nothing the machine will necessarily take from the circuit the wattless currents required for its own excitation, the armature circuits having then no current. If the slip increases, the intensity of these wattless currents will decrease to zero. If the slip increases still further it is the machine which will furnish the wattless currents to the circuit; but the intensity of these will at first increase with the slip to a maximum, then diminish again to zero. For greater values of slip the circuit will supply wattless currents to the machine.

For one value of the slip it is possible, either by varying the resistance of the armature circuits of the induction machine, or by varying the excitation of its exciter, first, to produce upon its axis a couple of determined magnitude; second, to make the machine furnish to the circuit wattless currents of determined magnitude. But it is important to avoid all regulation—and nothing is easier. If the machine perform as an induction motor we see that its cos ϕ should equal 1, when its load has its mean value. As a function varies but slowly near its maximum, this will keep a high value.

On the other hand, a single circuit will feed generally a large number of motors, differently loaded. There will be exchange of wattless currents between light and heavily loaded motors, and hence the general cos ϕ of the installation will differ very little from unity.

Induction machines can be as well coupled in series as in parallel, for the magnitude of the resisting couple on its axis, with equal intensities in their field circuits, depends only on the velocity of rotation, and not on the phase of the movement of the machines. Since this couple increases with the velocity, it is sufficient to connect these with machines whose motor couple is constant or decreases with the velocity, in order to maintain a state of stable dynamic equilibrium. We can couple these machines in series with a compound alternator of constant current instead of constant voltage. It is sufficient to saturate the magnetic circuit of the ring whose alternating-current circuits are mounted in series with those of the alternator.

Conclusion.

The direct-current machines which we propose to employ as exciters for induction machines may have a flux so intense that the excitation will not vary. On the other hand, we can always give the exciting armatures a high velocity of rotation.

If the machines are to be employed as generators, the necessity for exciters can be no objection, since they will only replace those now employed for alternators. If operated as motors, the slight increase of material which results will be largely compensated by the increase of power of the motors; the influence of their magnetic losses will be considerably diminished. Thus we have furnished 120 horsepower with a motor which gave only 70 when its armature circuits were closed on themselves, at the same time that we made its cos ϕ equal to 1, by closing the armature circuits through electrolytic condensers, in default of a special exciter.

Induction machines excited as we have described give us generators which may be coupled together like direct-current machines, without requiring to run in synchronism. They furnish us alternating-current motors starting under load and having, after attaining their normal velocity, a mean cos ϕ equal to 1.

1. Abstract of paper read before the Paris International Electrical Congress of August 18–25, 1900.

Chicago Automobile Club.

The Chicago Automobile Club has decided to hold an exposition and race meet some time next May. This decision was reached at a special meeting on October 4th. It is intended to conduct the exhibit upon a more extensive scale than any similar event hitherto attempted in this country, with a manufacturers' display, at the Coliseum, and races at the Washington Park track. These latter will include both amateur and professional contests, and will be for the American championship. A committee consisting of Dr. M. B. Pine, chairman; L. D. Sheppard, M. D., and J. D. Burdett, was appointed to look after the preliminary details.

A club run has been arranged for Saturday, October 13th, to one of the suburbs, where the members will probably remain over night, returning to Chicago Sunday.

Charles T. Jeffery has been obliged to resign the secretaryship of the club, owing to private business. H. M. Brinckerhoff, general manager of the Metropolitan West Side elevated railway, was elected his successor.

American Street Railway Association.

All signs indicate that the nineteenth annual meeting of the American Street Railway association in Convention Hall, Kansas City, on October 16th, 17th, 18th and 19th, will be a successful and largely attended gathering. The eastern delegation will leave New York at 10 a. m. on Sunday, October 14th, on the New York Central railroad, and, going by way of Albany, Buffalo, Cleveland, Indianapolis and St. Louis, will reach Kansas City at 9:30 p. m. on Monday, October 15th. Most of the Chicago people will leave on Monday evening, arriving in Kansas City the next morning. President Roach and Secretary Pennington will endeavor to get away earlier, however. Space for exhibits has been in demand, and a rearrangement of the allotment, with additional spaces, was necessary to make room for all the exhibitors who applied.

DEVELOPMENT OF THE TELEPHONE FIELD.

Breguet Telephone Transmitter.

While the common-battery and automatic-calling telephone systems are much further developed in America than on the continent, the new Breguet transmitter now introduced on the official lines in France, to supplant the 1893 models, is interesting as embracing an ingenious calling and switching mechanism. Two operations are still required to "ring up," and, compared with the simple commutating devices now in vogue in American telephones, the Breguet box seems clumsy.

The microphone is of the d'Arsonval type. In Fig. 1 are seen the horizontal carbons (m), (n), and the vertical carbon (c), covered with a cylinder of foil (f). (a) is the regulating magnet and (r) the spring supporting it. By the regulating spring (V) the magnet (a) may be approached to or withdrawn from the movable carbon (c).

The calling button is combined with the auto-

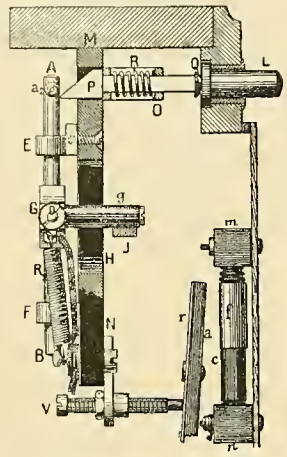


FIG. 1. BREGUET TRANSMITTER.

matic commutator. It is useless to press the button (L) when the automatic commutator is in the position for conversation. In order that this button may act upon the commutator and "ring up," the telephone must be on its hook, fastened to (g), Fig. 2. The button (L) moves the piston (Q), sliding in the double guide (O), and terminated in the wedge-piece (P). The inclined face of (P) can thus raise the rod (A) by the roller studs at (a_2). The spring (R) is to restore (L) to its original position. The movable telephone hook (I), Fig. 2, is completely independent, and the body of the commutator is cross-formed. The rod (A B) slides in the guides (E), (F), mounted upon the ebonite plate (M N), Fig. 1. When the receiver is on its hook (I), the cross-piece (G) is held up, so that the piece (P) may catch hold under the studs (a), when (L) is pushed in.

The horizontal arm of the commutator is composed of the central piece (G), uniting the two branches, and the two metallic pieces (b_1b_2), insu-

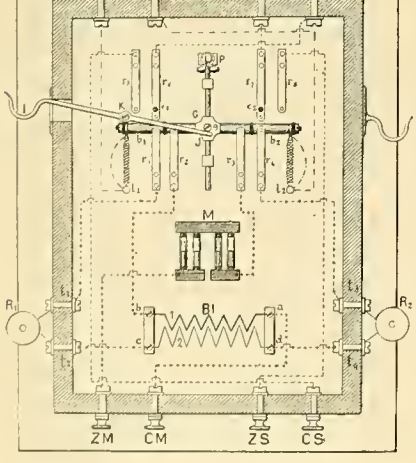


FIG. 2. BREGUET TRANSMITTER.

lated by ebonite washers. Through a large aperture in the ebonite plate (MN) extends the stud (g), on which the receiver hook (J) presses (Fig. 1). The commutating springs (r_6), (r_7), Fig. 2, are longer than the springs (r_5), (r_8), and are supplied with insulating pins (e_1), (e_2), placed at the same height as the contacts of the springs (r_5), (r_8). When the hook (I) is up the horizontal arm is in contact with the springs (r_1), (r_2), (r_3), (r_4). The other springs are insulated. This is the position for conversation. When the hook (I) is lowered contact is made with (r_6), (r_7), the other springs are insulated, and the subscriber can then call up the line. Then, when the button (L) is pushed in, contact is made with the springs (r_5), (r_8), and (r_6), (r_7) are insulated, and the calling current is sent upon the line. The line wires (L_1), (L_2) are connected by (l_1), (l_2) to the pieces (b_1), (b_2) of the commutator.

The wiring may be understood from Fig. 2. The call is received by (L_2), (l_1), (b_1), (r_6), (S_1), through the bell (S_2), (r_7), (b_2), (l_2), (L_2). The signal is made by (C S), (r_5), (b_1), (l_1), (L_1), (L_2), (l_2), (r_8), (Z S). Conversation is carried on through the primary circuit and the secondary circuit, (L_1), (l_1), (b_1), (r_1), (t_1), (R_1), (t_2), (c d), (t_4), (R_2), (t_3), (r_4), (b_2), (l_2), (L_2). (R_1) and (R_2) are the two receiving instruments.

This description is taken from l'Electricien.

Mr. Kellogg in Europe.

[From the London correspondent of the Chicago Daily News.]

London, October 3.—"Europe's medieval telephone systems depend on American ideas for development and regeneration," said Milo G. Kellogg, president of the Kellogg Switchboard and Supply company of Chicago, to the Daily News correspondent to-day. Mr. Kellogg has come to Europe to study the possibilities of the continental situation with a view to introducing American telephone apparatus. Mr. Kellogg said:

"Right here in London there are two current illustrations of America's commanding position in the world's telephone field. One is the fact that the general manager of the National Telephone company of the United Kingdom is now on a tour of inspection in the United States, accompanied by his engineers. They have assimilated ideas in every important exchange from New York to San Francisco.

"The other is the fact that the equipment of a rival system about to be established by the postoffice department of the British government is now in process of manufacture in Chicago and New York.

"In Germany the advancement of American ideas has been even more marked, though this year the German government has rehabilitated the national telephone system, giving preference to German inventions and appliances. Much has been made of the gigantic 12,000-line switchboard plant. A description of this system has just reached American telephone experts, who are very much astonished to discover that this much-vaunted system is 10 years behind American ideas."

Mr. Gaine's Mission.

"Magnates of the American telephone world frequently visit this country," writes the London correspondent of the Western Electrician, "and are unanimous in praise of the various telephone exchanges, many declaring that England has nothing to learn in this respect. All the same, it is known that constant novelties in telephone apparatus are being patented in the United States, and so as to keep abreast of the times and secure the very latest improvements for his company, Mr. W. L. E. Gaine, the general manager of the National Telephone company, has, I am informed, gone over for a few months' tour to pick up unconsidered trifles."

Output of Bell Telephones.

Boston, October 6.—The American Telephone and Telegraph company's September statement of the output of instruments, made up to September 20th, shows a continued decrease:

September:	1900.	1899.	1898.	1897.
Gross output	44,190	56,698	31,977	19,198
Returned	30,942	20,073	12,931	7,105
Net output	13,248	36,625	19,046	12,093
December 21st to September 20th:				
Gross output	435,891	488,737	244,724	162,743
Returned	190,810	145,227	108,259	69,106
Net output	245,081	343,510	136,465	93,637
Total outstanding	1,925,473	1,468,760	1,055,586	866,264

Independent Progress in Boston.

The Massachusetts Telephone and Telegraph company, the new Boston and suburban Independent company, expects to be in operation before January 1, 1901. The company now has 175,000 feet of duct laid in Boston streets, and is about to let a contract for 40,000 feet more, making upward of 40 miles, which will soon be available for practical use. The switchboard to be used in the central exchange has arrived and is in process of installation.

Toronto advices state that by a new agreement between the Bell Telephone company of Canada and the American Telephone and Telegraph company of the United States, the Canadian company has been enabled to make a reduction on all rates from Canada to United States points. The reduction is a considerable one.

Mr. Cochrane Made Temporary President of the Bell Company.

Alexander Cochrane of Boston has been elected president pro tempore of the American Telephone and Telegraph company.

Mr. Cochrane declines to become the permanent president of the corporation, but will serve until the directors decide upon a successor to the late President Hudson. A committee of the board, comprising Messrs. Cochrane, C. W. Amory and Henry H. Howe, have the matter of the permanent presidency in charge.

As chairman of the executive committee of the Bell companies for a number of years, Mr. Cochrane has had an active part in the development of the telephone business, from the days when he first associated himself with the inventor Bell and other promoters of the new factor in modern life. Probably no other member of the directorate is more thoroughly acquainted with the company's affairs than he is. He is a busy man in other great Boston interests, being at the head of the Cochrane Chemical Works, as well as a director in the Boston and Maine Railroad company and also in several Boston banking institutions.

Some rumors have connected Governor Crane of this state, who is one of the heaviest owners of telephone stock, with the possible future presidency of the company, but nothing definite regarding the outlook is known as yet.

Free Telephone Service Abandoned.

Recently an experiment has been made of the use of a free telephone. It was in an inconsiderable town in Wisconsin, says the St. Paul Globe, and the telephone company, at the suggestion of the mayor of the community, established a free public station. It was placed in a booth at the intersection of two principal streets, on the sidewalk. At night the booth was lighted with electricity. Its interior contained nothing but a card of the subscribers and the instrument. Two or three months after the experiment was inaugurated it was declared to "have proved a popular success from the start." But the sequel was not satisfactory. While the company's list of subscribers was increasing with remarkable rapidity, and the increase was generally regarded as due to the increased value of the telephone service to merchants by reason of the number of people with whom the free telephone brought them in communication, three months later the experiment was abandoned as a failure. The reason for the failure, as declared by the company and the merchants, was the abuse of the free service by certain irresponsible members of society who abused the privilege offered to them. "Youngsters and irresponsibles" had defaced the booth and used the instrument "recklessly and viciously, making telephone calls for mischief and worse."

Telegraphs and Telephones in New Zealand.

The latest annual report of the Post and Telegraph Department of New Zealand shows a larger growth in telegraph and telephone business than usual and a large increase in the receipts through all the districts. The excess of revenue over expenditure of the telegraph and telephone for the year ended March 31, 1900, was £21,581, or 12.6 per cent. on the total volume of business. The net expenditure on telegraph construction was £26,771. At the close of the year 1899 there were 19,228 miles of telegraph lines and 7,150 telephone subscribers' stations in the colony. The telephone revenues for the year amounted to £13,303, and 3,159,083 telegrams were transmitted. The largest multiple switchboard on the island is that at Wellington, having 1,417 subscribers, an increase of 138 for the year. The demand for new telephone lines, as reported last year, still continues.

Franco-German Telephony.

The long-distance telephone lines that have been for some time under construction between Berlin and Paris were recently tested. There are now connected with Berlin the French cities of Dieppe, Fontainebleau, Havre, Lille, Paris, Rouen, St. Denis, Versailles, Bordeaux, Orleans and St. Etienne. Five marks is charged for three minutes' conversation with all but the three cities last named; with these the price is 6.5 marks. For urgent business a rate three times as great is charged. There are two lines in operation to Paris, one direct and one by Frankfort. Both lines are built of bronze wire, five millimeters in diameter. The direct line is 1,200 kilometers in length.

Long-distance Work in Ohio.

The United States Telephone company of Cleveland has been doing a great deal of construction work during the last year, and is now engaged on some important lines which will be finished within a few months. In an interview with Judge James M. Thomas, general manager of the company, a few days ago, the Western Electrician correspondent was given some interesting particulars about the company's extensions.

Work on the line from Toledo to Saginaw and St. Charles, Mich., is progressing nicely and the wire has been strung a portion of the way. This line is 185 miles in length and, of course, the work of building it seems to be a large undertaking, but Judge Thomas feels sure that it will be completed by September 1st of next year. Work will be pushed on it as rapidly as possible.

Workmen are now engaged on a line from Akron south through New Philadelphia, Zanesville, Cambridge and Caldwell. This will give the Independent exchanges communication with river points and many towns in Eastern Ohio which they have heretofore not been able to reach. A line is also being built at this time from Newark to Zanesville for the use of the exchanges in Central and Eastern Ohio.

Another line is now under way from Akron west through Medina and Norwalk, the terminus, for the present, being Fremont. A spur from Pemberville will go to Toledo.

The company has just completed a line from Columbus to London, which has been in operation only a few days. Another is being built from Columbus to Newark, and still another from Delaware to Galion.

Two new copper circuits are being strung on the line from Cleveland to Ironton, in the southern part of the state. This will add greatly to the facilities of that portion of the state also.

A heavy trunk system is being built from Akron to Cleveland, to carry all the lines that can be gotten together there, and there are quite a number of them. A testing station will be made at Akron, and in this way a great deal of the detail work which would otherwise have to be looked after in Cleveland will be transferred to Akron.

The United States company has but three local exchanges. One has just been completed and put in operation at Portsmouth, and it is proving a great success. Another is at Akron, and one is at another small town in the state.

Other Telephone Notes from Ohio.

The Citizens' Telephone company of Circleville has been organized with the following-named officers: President, C. C. Chapplear; vice-president, Irvin F. Snyder; secretary, Dr. Holman; treasurer, Clarence Curtain. The company has 160 telephones subscribed for and will begin within a short time to build its new exchange.

The case of the City of Zanesville against the Zanesville Telephone company was argued in Supreme Court at Columbus, on October 3d. The constitutionality of the law allowing the Probate Court to fix the location of the lines in the streets and alleys of a town will be tested in this case, and it is therefore a very interesting one to the people who are engaged in the business.

The lines of the Mt. Vernon Telephone company will all be taken down and replaced with metallic circuits and copper wire. Other improvements are also to be made. Workmen will be sent from Columbus to reconstruct the plant. Manager Beam of the Columbus Citizens' Telephone company is president of this company. E. W. Breece, who has for some time been electrician for the company, has been promoted to the superintendency also, and Miss Margaret Dermody has been chosen cashier.

It is claimed that there are more telephones used in Akron than in any other city of its size in Ohio. Altogether there are 2,578 instruments in use, 1,500 of the Central Union and 1,078 of the Akron People's Telephone company.

The meat dealers of Piqua have discontinued the use of telephones in their stores because of the large number of small orders they received over them.

Frank B. Finney denies the rumor that he has resigned as president of the Portsmouth Telephone company. He says that other duties may take some of his time and attention, but that he has not severed his connection with the company.

George N. Stone, president of the Cincinnati Telephone company, has gone East on an extended visit.

The United States Telephone company is still having some trouble with the farmers along the line between Granville, Ohio, and Newark, Ohio. The farmers claim that the company is putting in poles only 30 feet high above the ground, whereas it was agreed that they should be 40 feet in height.

Noble C. Manner has been granted an injunction against the Farmers' Co-operative Telephone company in the courts at Mansfield, to prevent the transfer of the exchange at Bellville to a rival company. The plaintiff claims that he is the owner of five shares of the stock of the company, and he does not think it best to dispose of the Bellville exchange.

It is reported that war is on in earnest at Ravenna between the Central Union Telephone company and the Independent company there. New plants have been put in by both companies, but the Independent company induced the meat dealers, grocers and other merchants of the town to contract for its telephones and throw the other out. In turn the Central Union threatened to open a grocery and go into competition generally with the business men. This had the desired effect, and many of the local merchants have decided to use both services.

The Flushing Telephone company of Flushing, Belmont County, Ohio, has increased its capital stock from $3,000 to $10,000. O. D. Landon is the president and R. D. Judkins, secretary.

The Oil Belt Telephone company of Fostoria, Ohio, was incorporated Saturday by Kora F. Briggs, W. S. Wagner, John S. Hoyman, Thomas J. Martin and Roscoe L. Carles. The capital stock is placed at $10,000, and it is proposed to build exchanges at Rising Sun, Pemberville, Bloomdale, Prairie Depot, Bradner and Arcadia, with toll lines beginning at Rising Sun and ending at Woodville. O. M. C.

Telephone News from the Northwest.

The Northwestern Telephone Exchange company has brought suit against Hennepin County, Minn., and asks a restraining order to prevent any attempt at collecting a local tax. The company asks that its property in Minneapolis be declared exempt from local tax, and the county auditor be instructed to cancel the tax already levied. The company claims that it pays a tax into the state treasury under the provisions of the gross-earnings law. The tax complained of is on the company's building.

C. E. V. Draper of Mandan, N. D., has been granted a franchise for a local exchange in that city.

The Western Waucoma (Iowa) Telephone company plans extensive improvements and enlargements to its system, but will do nothing until after the election.

There are complaints over the slow progress which the Mississippi Valley Telephone company is making on its systems in Minneapolis and St. Paul, and the requests of the company for permission to build new pole lines and to place two and four subscribers on a single wire may be turned down, on account of the dissatisfaction. Joseph M. Dickson has brought suit against the company in St. Paul to recover $900, the amount representing 36 claims against the company for labor, which he bought from employes.

The work of installing a local exchange at Waupaca, Wis., for the Wolf River Telephone company has come to a standstill, and rumors are thick as to the reason. It is alleged that lack of funds, owing to inability to sell stock, is the cause.

The Mutual Telephone company of Des Moines, Iowa, has arranged to increase its capital stock to $90,000, and has also made increased rates for service. It is believed the company will find a way out of its difficulties by this change and will flourish hereafter. F. M. Hubbell denies the statement, which has been freely passed for some time, that he was planning to secure the ownership of the Mutual plant, and says he believes in the ultimate muncipal ownership of the plant.

The Standard Telephone company has begun laying cables in the conduits for its system in Dubuque, Iowa. About 5½ miles of cables is being placed now.

A telephone line is being constructed from Hoquiam, Wash., to Humptulips, giving communication to the latter place. Heretofore the communication has been limited to a bi-weekly boat and a tri-weekly mail.

The Chamberlin Independent Telephone company has filed articles of incorporation in Webster City, Iowa, with $20,000 capital stock.

The Inland Telephone company is stringing wires to connect with the Okanogan mining country in British Columbia. A line is being built north from Loomis, Wash., to the boundary line.

The Sunset Telephone company contemplates extending a line from New Whatcom, Wash., to Lynden, 14 miles.

A carpenter was arrested in Butte, Mont., for cutting the guy wire of a telephone pole, which interfered with his work. Cutting wires without the knowledge and consent of the owners is a grave offense, owing to the possibility of danger resulting from the wire coming in contact with a live wire.

The People's Telephone company of Chatfield, Minn., has filed amended articles of incorporation, adding $25,000 to its capital stock, making the total $75,000.

The Northwestern Telephone Exchange company and the Greene and Western Telephone company have made application to the council of Farmington, Minn., for franchises.

Thomas Owens, the superintendent of the Duluth and Iron Range railroad, has been granted a franchise at Ely, Minn., for a telephone system. It is understood the road is behind the enterprise. Work will be begun at once.

R. A. Hall of Cedar Rapids, Iowa, has been granted a franchise for a local exchange at Anamosa, Iowa.

A tar barrel caught fire in the building of the Rocky Mountain Bell Telephone company at Butte, Mont. The fire damaged the terminal board and threw the service out of order. The direct money loss was about $1,000. It took 24 hours to restore the system to working order.

The Mankato (Minn.) Citizen's Telephone company declared its regular quarterly dividend of three per cent. recently. The company has 477 instruments in use. The company has donated the use of a telephone to the Democratic and to the Republican headquarters until after election. R.

GENERAL TELEPHONE NEWS.

The Dunkirk Home Telephone company of Dunkirk, N. Y., was recently incorporated at Albany, with a capital stock of $100,000.

The Henderson (N. C.) Telephone company is extending its lines and establishing exchanges throughout eastern North Carolina.

The telephone company at Amory, Miss., has just bought a 100-drop switchboard of the Sumter Telephone Manufacturing company for the exchange at Amory.

At Jonesville, La., the Growt telephone and telegraph line, L. J. Growt, proprietor, will be extended about 100 miles; 150 instruments will be installed and other improvements made.

The annual meeting of the Southeastern Iowa Independent Telephone association is announced to be held at the parlors of the Ballingall Hotel in Ottumwa, Iowa, on October 12th and 13th.

The Streator Independent Telephone company of Streator, Ill., was incorporated on October 3d, with a capital of $40,000. The incorporators are Arthur A. Adler, Thomas F. Murphy and Clarence A. King.

The Michigan Telephone company will undertake a complete revision of the telephone construction work in Traverse City, Mich., at a cost of $16,000. New lines are being extended to Frankfort, Manistee and Ludington.

The trustees of the town of Evans, Colo., have granted a franchise to the Greeley Independent Telephone company. The company announces that it will run lines to all the important towns in Weld County, and will begin construction at once.

The new system which the People's Telephone company is putting in at Birmingham, Ala., is going ahead at a rapid rate, the company having 400 men at work. The exchange building is going up, and work has commenced on subways for the cables.

The New York Telephone company is making extensive improvements in Mount Vernon, N. Y. A $36,000, four-story, fireproof exchange is being erected in South Fifth avenue, and 10 miles of conduits are being laid through the principal streets, at a cost of about $10,000.

Through failure to deposit with the city of Kansas City, Mo., the $50,000 guarantee of good faith required by the franchise ordinance, the Missouri Interstate Telephone company, which proposed to compete with the local Bell monopoly, forfeited the franchise voted it by the City Council a short time ago.

The City and Suburban Telegraph association (Bell telephone) stockholders have received a circular letter calling a meeting at the company's office November 1st to act on the proposition to increase the capital stock, now $2,500,000, to $4,000,000. The old stock has been paying eight per cent. dividends.

The Sunset Telephone company has ordered that all telephones in Woodland, Cal., for which contracts expired on October 1st, be removed and discontinued from that date. The intention is to do away with all local service and maintain only long-distance communication. The reason ascribed for this radical change is excessive taxation by the county and city.

MANUFACTURERS AND DEALERS.

R. H. Leavitt of Capron, Ill., is receiving many orders for telephone cross-arms, pins and brackets. His factory is well equipped in machinery and facilities allowing prompt shipments.

The Western Electrical Supply company of St. Louis has recently taken the exclusive agency for the Western Telephone Construction company of Chicago for a very large territory. The apparatus thus secured embodies everything new and good in telephone and switchboard construction. The manufacturer claims that nothing in the switchboard line has ever been produced that will compare with its new Western express and multiple boards. The St. Louis company reports that its telephone department is filled with orders. It has been pushing this department of its business and using every possible means to keep strictly up to date on anything pertaining to the equipment, operation or maintenance of a telephone line or exchange. It is prepared to equip lines and exchanges with a complete equipment of construction material, telephones and switchboards from stock on short notice, guaranteeing prompt and satisfactory deliveries, the latter being an item of the utmost importance. The Western Electrical Supply company has one of the best telephone engineers in the country at the head of its telephone department. This gentleman will cheerfully answer any inquiries concerning the installation or operation of telephone lines and exchanges.

Dangerous Potentials in Alternating Current.

[From the London Electrician.]

Some time ago a dispute arose between Messrs. Brown, Boveri & Co. and the local authorities controlling the Stansstad-Engelberg and Zermatt-Görnergratt three-phase electric railways with regard to the pressure at which these lines should be worked. The contractors proposed 750 volts, but the authorities refused to allow more than 500 volts, owing to the alleged danger. Accordingly, the contractors engaged Professor H. F. Weber of Zurich to report as to the danger of pressures exceeding 500 volts, and to this end Professor Weber conducted a series of experiments on the physiological action of electric pressures on the human body, using his own corpus vile for the purpose—not without considerable risk. A description of the experiments undertaken and results obtained will be found in an article by Mr. William Rung, of the firm of Brown, Boveri & Co., in our Danish contemporary, the Civilengeener.

Two class of experiments were made, with a view to settle, first, the risk when both hands simultaneously touch both bare leads, or when both leads come in contact with a bare part of the body; and, secondly, the risk when a person standing on the railway or on a car touches one or other of the leads. Professor Weber investigated the first case by using an iron ring wound with 630 turns of wire carrying an alternating current at a frequency of 50 cycles. The voltage between the first and last turns was 210 volts, and connecting wires were soldered to each successive thirtieth turn, thus giving intermediate voltages, to which Professor Weber subjected himself in ascending scale.

With wet hands, the limiting safe pressure appeared to be 50 volts, this pressure causing instantaneous paralysis of all the muscles of the fingers, hands and arms. With dry hands, as high as 90 volts could be taken, though this pressure produced instantaneous paralysis of the hands. From these experiments Professor Weber infers that all pressures exceeding 100 volts are dangerous when contact is made with both poles of an alternating-current circuit; and, since this pressure produces muscular fixation, there is a decided risk of fatal consequences, the victim being unable to release himself. In the second class of experiment, Professor Weber, standing on moist gravel soil, subjected himself to gradually ascending pressures by touching intermediate points in a series of 20 glow-lamps, each taking 100 volts, and all well insulated. When the live conductor was slightly touched a pressure of 1,000 volts produced a stinging resembling a burn by a flame, but when the live conductor was firmly gripped a pressure of only 700 volts produced intense trembling of the fingers, hands, arms and ankle joints. It was therefore inferred that to touch a single pole is not dangerous, if the pressure does not exceed 1,000 volts. These experiments, it appears, were regarded as sufficient justification for running the two railways at 750 volts.

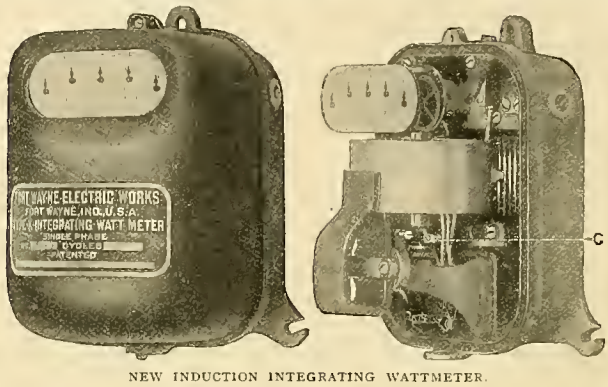
Although we cannot but admire the pluck which Professor Weber displayed in seeking to discover by his own body the danger limit of alternating electric pressure, we fear that his experiments are far from conclusive. In the first place, it is now fairly well established that pressures which to some individuals are highly dangerous, if not fatal, can be taken with impunity by others under precisely similar conditions. But Professor Weber's experiments are open to more searching criticism than this, for there is no evidence that they were conducted under conditions at all resembling those met with in practice in traction and overhead electric-lighting circuits. To investigate the mere pressure which the human body can stand is not sufficient. We ourselves have frequently been subjected to several millions of volts with impunity. The shock from a small Leyden jar, though produced by millions of volts, is quite harmless. Regard must therefore be paid, not merely to the pressure, but to the amount of horsepower at the back of it, as well as to the inductance and electrostatic capacity of the circuit from which the discharge is taken. In the first series of experiments, the danger limit would probably have been considerably lowered if, instead of a small choking coil carrying a comparatively weak current, the circuit of a large alternator of several hundred horsepower had been employed. In the second series of experiments, the risk would certainly have been enhanced and the danger limit would have been lowered by the introduction of a considerable electrostatic capacity or electromagnetic inductance into the circuit touched by one hand, for in either case, though the pressure might have been the same, the impulsive discharge through the body to earth would surely have been attended by greater danger. We regard it, therefore, as being by no means proven that all pressures between 100 and 1,000 volts are equally safe, and until the matter has been investigated under circumstances more resembling those in actual practice, it would be unwise to act on the incomplete evidence afforded by Professor Weber's experiments.

The borough council of Vineland, N. J., has awarded the contract for the construction of an electric-light system to the Buchana company of Philadelphia, for $20,000. W. Turner of Vineland was given the contract for erecting a power house, in which power will be generated both for lighting the town and furnishing the city water.

New Induction Integrating Wattmeter.

The extensive use of the induction wattmeter to register the energy of alternating-current circuits has created a demand for a meter that will render an accurate record of the true energy of the circuit, regardless of the power factor, and that has a permanent and reliable calibration, convenient to handle, install and repair, and covers the broad range of adaptability met in meter service. The meter illustrated, recently developed by the Fort Wayne Electric Works, is attracting considerable attention, and is said to meet the above requirements.

In the construction and operation of this instrument there are many features of interest and value. The case is of a compact, smooth and well-rounded design, dust, insect and moisture-proof. The rotating parts consist of a light aluminum cup, supported on a carefully designed sapphire-jewel spring bearing, and guided at the top by a loose-pin support. The force exerted by the shunt and series



NEW INDUCTION INTEGRATING WATTMETER.

coils on the aluminum cup or armature is at right angles to the plane of the shaft, thus preventing any destructive effect on the jewel bearing by the action of the magnetic field. The rotating parts of the meter can be easily taken out by removing the top bearing and the bracket supporting the registering mechanism, making access easy to the entire construction of the meter.

The meter is provided with a device for overcoming the static friction. It consists of a small starting coil wound upon a laminated iron core and placed within the main shunt coil inside the armature. This small starting coil is provided with a screw adjustment, by means of which it may be given an angular movement relative to the main shunt coil, so that a very fine adjustment is possible.

It is asserted that the accuracy of this meter on one per cent. of load is not affected by a variation of 25 per cent. in the voltage; in other words, a 100-volt meter is said to retain accurate calibration on any voltage from 75 volts to 125 volts. This result certainly marks a distinct advance in meter design, as it is believed to be impossible to accomplish this result by any other method at present employed in overcoming the static friction of a meter.

An important feature is an arrangement for adjusting the meter for any frequency. This is quickly accomplished by the soldering or unsoldering of one joint and correcting the speed of the meter by the use of the permanent magnet.

The dial is made of porcelain, and is dull finished, giving it the advantage of clearness and eliminating the reflection of light, which often is responsible for inaccurate readings being taken. No constants are used, and the amount of energy registered is read directly from the counter.

The torque is high, which insures that the meter will remain in calibration for a long time. The weight is less than 13 pounds, and the meter can be installed in a space 6¾ by 8¾ inches.

Power Development Proposed for Altoona.

It is said that City Engineer H. S. Linton of Altoona, Pa., has designed a large plant for street-railway and electric-lighting purposes, and that the plans will be put into operation by a company of Philadelphia capitalists. Mr. Linton's idea is to build a dam in Bedford County 25 miles from the city, 100 feet in height, and so located that it will gather the water from 82 square miles of territory. The reservoir will cover an area of about 140 acres and the water will have a fall sufficient to develop the required power. Mr. Linton thinks that there will be water enough in the dryest seasons to develop 1,800 horsepower and in the fall and winter 5,000 horsepower. It is the intention of the promoters to build an electric line from Hollidaysburg to connect with the Huntingdon and Broadtop road, making a continuous line from Altoona to Everett, a distance of 31 miles. A company has been incorporated to develop the waterpower, and is now negotiating with Mr. Linton for the plans and the lands.

Mr. Guarini of Belgium is soon to test his system of wireless-telegraph repeaters between Brussels and Antwerp. A repeater will be stationed at Malines, half-way between the two cities.

Electric Power Transmission on the Pacific Coast.[1]

By A. M. Hunt.

In a district where the cost of fuel is so high as on the Pacific Coast, it is not surprising to find that great attention has been and is being given to the development of waterpowers, and the transmission of the energy so developed to more or less distant points by means of electricity.

Few people, however, realize the extent of this development, present and prospective. At the present time there is already utilized, or in process of construction, a capacity approximating, if not exceeding, 50,000 horsepower. In addition to this, numerous other projects are in the promoter's hands, which will largely increase this.

Nature has provided a never-failing source of power in the rapid flowing streams of the Sierras, and with the advances made in late years it has become possible to deliver this power at a distance of a hundred miles or more with comparatively small loss. This has done much to stimulate the mining industry in localities where cost of power has been a serious handicap. A plant is now being completed which is to furnish power to permit the exploration of the lower levels of the mines on the Comstock Lode, and it is quite possible that the next few years may see a revival of the days when the Comstock was a name to conjure with.

In the state of Washington the Snoqualmie Falls plant is supplying power to Seattle, Tacoma and the surrounding districts, and is unique in the fact that the machinery is located in a subterranean chamber, which is excavated in the solid rock, the water being brought to the waterwheels through large pipes carried down a vertical shaft. It is contemplated that this plant will eventually have a capacity to exceed 30,000 horsepower.

The Yuba Electric Power company has in operation a plant on the North Yuba River, which will have an ultimate capacity of 15,000 horsepower, or more, and which distributes, or is to distribute, power over lines which reach points as widely separated as Oroville, Sacramento and Oakland.

The Standard Electric company, utilizing the waterpower of the Blue Lakes company, is installing a plant that is to supply power along the Mother Lode, in Stockton, Oakland and San Jose, with the intention of extending its lines to the city of San Francisco. This will be by far the longest transmission line ever operated commercially.

Sacramento is supplied with electric power from three different waterpower plants.

Los Angeles is supplied with two waterpower transmission plants, with others in contemplation.

San Francisco is at present supplied entirely by steam-driven plants, and its position seems to warrant the belief that at least the bulk of the electric power used in this city will always be so generated.

The use of electric power is doing much to aid in the development of manufacturing on the Coast, and within the past few years it has been used in pumping water for irrigating purposes, thus permitting the utilization of land otherwise valueless. That this application is destined to increase largely, seems certain.

The Pacific Coast, and particularly California, is in no way behind any other portion of the country in applications of electric power, and while Niagara is always cited when electric transmission is spoken of, California, in number of plants, in daring engineering and distance of transmission, leads the world.

Death of G. T. Thompson.

George Treadway Thompson, president of the Denver Consolidated Gas and Electric company, which furnishes electricity and gas throughout the city of Denver, died on October 1st. Mr. Thompson had been a resident of the city only a comparatively short time. When he lived in St. Louis he suffered from lung trouble, and he came to Denver for his health in March, 1899. He was selected by the McMillin syndicate to be the president of the company formed by the union of the gas and electric-light companies of the city. Mr. Thompson was born in St. Louis and was 31 years of age. His father was president of the Laclede Gas Light company. He was an expert in all matters relating to gas and was considered one of the best authorities in the country. He was president of the Western Gas association in 1899 and was identified with the principal gas associations in the United States. Personally, he was highly esteemed in Denver, especially by his business associates. He had been unable to attend to business during the last two months. He retired to a sanitarium for consumptives in Denver, where his death occurred. The remains were taken to St. Louis for interment.

A. W. Keasley, owner of the electric-light plant at Boonville, Miss., is now planning to erect a similar plant at Amory, Miss.

1. From the San Francisco News Letter.

Pignolet Pocket-size Voltmeter and Ammeter.

The accompanying illustration shows a type of pocket-size, continuous-current voltmeter, ammeter and volt-ammeter that is now being exploited by Louis M. Pignolet, 78 Cortlandt street, New York. These instruments are of the permanent-magnet type and are dead beat. Each is calibrated individually for horizontal position and its scale made by hand. A mirror is provided to secure accuracy in making readings. The magnets are of special steel from one of the best foreign makers, and are carefully treated to insure permanency. The instruments are constructed in a thorough manner, with jewel bearings and carefully ground and hardened steel pivots. The case is handsomely polished and nickeled, and is of a size that can be easily carried in the pocket or tool bag. The volt-ammeters have a wide range of usefulness, being adapted not only to testing batteries, but to a large variety of tests and measurements and to locating faults in telephone, annunciator and other battery circuits, for each instrument can be used either as a voltmeter or as an ammeter.

PIGNOLET POCKET SIZE VOLTMETER AND AMMETER.

The voltmeter, reading from 0 to 4 volts in tenth-volt divisions, is specially adapted to testing single cells of storage battery. These instruments are well made. Defects, if any, will be repaired without charge if the instrument be returned within six months from date of purchase with seals intact.

Electric Canal-towage Experiment.

Some interesting experiments in boat towage by means of electric locomotives were recently made on behalf of the Prussian government by Siemens & Halske of Berlin. The scene of operation was a short length of the Finow Canal, which forms a portion of the waterway between Berlin and Stettin and is traversed every year by about 25,000 to 26,000 boats each way. The craft used are, in the main, barges, some 132 feet long by 15 feet six inches beam, carrying 150 to 175 tons. There are also a few steam barges employed, which carry about 150 tons and can tow a second barge. The traffic to Berlin, says Richard Guenther, United States consul-general at Frankfort, is much heavier than toward Stettin, and, as a consequence, three-fourths of the barges return light from the metropolis. Traction is generally effected by horses, there being a towpath on each bank, but on the down journey man towage is not infrequently relied on. In any case, the speed is low and, including stops, does not average more than 1¼ miles an hour.

The section of canal used for the experiments was selected owing to its physical difficulties, presenting, as it does, several curves, in one of which, with only 328 feet radius, the waterway is spanned by a railway bridge. The line laid down for the towing engine was of one-meter (3.28 feet) gauge, the outer rail weighing 18.2 pounds per yard, while the inner, which was fixed on the inner edge of the towpath, weighed 9.1 pounds per yard. These rails, which were of the flange type, were laid partly on sleepers ballasted with gravel and partly on blocks of concrete, weighing 220 pounds each in the case of the heavier principal rail, and half this in case of the other rail. This arrangement costs more per mile than the sleepers, but has been found less expensive to maintain. Though no wharf actually existed on the length of canal experimented on, the arrangements necessary were fully tested. At one point, the line was raised to a height of nine feet six inches above the level of the towpath, being carried on posts and brackets. The carrying posts were 12 inches in diameter, and were spaced at 18 feet eight inches. A cap piece spanned the gap between posts, and the principal rail was laid directly on this cap piece, while the other was carried by a stringer, supported at each post on brackets.

The conductor for the current was supported on pine posts 23 feet long, located 35 to 44 yards apart. It consisted of eight-millimeter wire, carried by porcelain insulators. The principal rail served as conductor for the return current. The source of power was a 15-horsepower portable engine, driving a nine-kilowatt dynamo, and a large storage battery was also provided. The extreme dimensions of the towing locomotive were six feet 10 inches in length by four feet 10 inches wide. Its total weight was two tons, but the motor was so placed that only one-fifth of this total came on the accessory rail. The motor provided was much more powerful than necessary for the work in hand, as it was capable of working at the rate of 14 to 15 horsepower. Since, however, these experiments were merely preliminary ones intended to test the possibilities of electric traction for large barges, the excess power was supplied intentionally, and the resistance requisite to call forth the full powers of the motors was in some of the experiments provided by rafts. These experiments, Mr. Guenther concludes, showed the system to be capable of meeting all needs, working, as it did, with safety and economy.

BOOK TABLE.

ELECTRICITY MADE SIMPLE. By Clark Caryl Haskins, A. I. E. E. Chicago: Clarence Macdonald. 1900. Pp. 223 (five by 6¾ inches), with 108 illustrations. Price, in cloth, $1; paper, 50 cents.

This work is not intended for the instruction of experts, but treats the subject-matter in a manner suitable for those whose opportunities for study have been limited. Indeed, the writer dedicates the book to his "many friends in blouse and overalls." Mr. Haskins is a man of wide reading and years of practical experience in electrical work. He was, therefore, well fitted for the task which he set himself. Beginning with six chapters on static and atmospheric electricity, the reader is introduced to the principles and commercial applications of voltaic currents, electromagnetism and electromagnetic apparatus, especially as adapted to light and power. The chapter devoted to "Force, Work, Energy" makes especially clear to any reader the nature of, and the distinctions between, those factors, so frequently confused. A chapter is devoted to the application of electro-chemistry, the processes of plating, galvanizing, purification of ores, etc., as industrially applied. The subject of alternating currents and their machinery is necessarily treated briefly, yet concisely, and the principles of the rotating field are made admirably simple. Throughout the book the reader is made familiar with the historical experiments of each branch of the art. The illustrations are really illustrative. The volume is one that almost any electrical man may read with pleasure and genuine profit.

Another Electrical Consumption "Cure."

Dr. George Benton Massey of Philadelphia claims the discovery of a new method of treating tuberculosis, and he says he has effected two absolute cures. In speaking of the new method the doctor said:

"My process includes an enforced sterilization of the affected part. This is accomplished by the production of the electrolytic salts of mercury in the midst of the germ colony. The salts are then radiated through the surrounding diseased tissue from a gold electrode by a mild current of electricity. This operation must be repeated at least twice a week. A small puncture is made in the skin of the neck, under a cooling spray, which deprives that portion of the body of all sensation. The opening is made with a sharp needle directly over the enlarged gland. Through this opening a tiny gold tube is inserted, and through the tube, which is in reality a hollow needle, a drop of quicksilver is injected. This quicksilver is immediately changed into electrolytic salts of mercury by the application of a very slight electric current, which is passed through the needle. The salts are an antiseptic and by the action of the electric current are radiated through the diseased area. This treatment will usually effect a cure within six weeks. A desirable feature of this method of treatment is the fact that patients are not obliged to desist from their ordinary duties."

Effect of Heating Upon Hysteresis.

In a note before the Royal Society of London Mr. S. R. Roget describes some tests made on samples of soft Swedish iron for transformers, using the Ewing rotary hysteresis meter, after having maintained the iron for some time at certain temperatures. Below 40° C. there was no variation of hysteresis observed; between 40° and 130° the hysteresis increased in proportion with the time during which the iron had been heated; above 130° a maximum of hysteresis was obtained after a relatively short time, beyond which a continuation of the heating produced a marked diminution of the hysteresis. The greatest value of the increase of hysteresis occurred at 180° temperature. With higher temperatures, the hysteresis, although increasing more rapidly at first, does not reach so great a value, and diminishes more and more rapidly, tending, apparently, to a stationary condition, which is the lower as the temperature is higher.

Should the Use of Ground Wires in Connection with Fire-alarm Telegraphs Be Discontinued?[1]

BY MORRIS W. MEAD.

We all know how undesirable it is to have grounds, escapes or leakages of any kind, occurring to fire and police telegraph circuits, with the liability to troubles always existing from these sources, and any improvement or method that will tend to avoid these troubles will help to remove a portion of that anxiety always in the minds of the persons in charge.

One of the important questions in my mind refers to the matter of maintaining permanent ground connection in police and fire-alarm signal boxes, and whether it is desirable to have such boxes permanently connected with the ground, as has been the general custom.

Before the advent of heavy currents, such as electric-light and trolley currents, there were no objections to a good ground connection permanently maintained at all signal-box points of the kind indicated, but since the development of electrical currents of high voltage or in large quantities, it is certainly a very different matter, and I have come to the conclusion that it is far safer to fire and police systems to be without a permanent ground connection at such points.

Of course, we all understand the convenience that a ground connection furnishes when testing a fire or police signal system or when an "open" occurs, and I do not mean to convey the idea that ground wires are not desirable under certain conditions, but while I recommend having a good ground-wire connection at all box points, I also believe it is not desirable to connect this wire permanently, but instead to have it so arranged that it may be conveniently connected to the circuits when it is necessary to do so for any purpose.

One of the principal uses of a permanent ground connection at all signal boxes was to protect the box from lightning discharges, but the system now in general vogue of having fuse protection on all circuits, and grounded bars or plates at headquarters, it seems to me, furnishes satisfactory protection in that particular respect, and therefore a ground-wire lightning arrester is not really necessary to protect the system at such points, as was the case in former times when fuses were not so generally used as now.

Investigation on my part has led me to believe that very serious trouble has very frequently been introduced into fire and police telegraph circuits because of ground wires permanently connected at box points, and trouble has been introduced into the system because of leakages from trolley or other heavy current, or escapes existing in water or gas mains, and has caused very serious harm.

I am told that upon several occasions fire-alarm circuits have been found supplied with considerable current in that way although entirely disconnected from the battery operating such circuits, and undoubtedly this outside current has been brought into the circuits through the ground connection at the box points. This illustrates only one of the dangers occurring from such methods of construction. Another serious danger likely to ensue from these permanent ground connections is the possibility of heavy current wires coming in contact with fire and police wires, and, owing to the faulty causes at the ground plate in the signal box, grounds or partial grounds have been left and serious burnouts have occurred on that account to the system in use in such places. It is quite difficult to keep the spark-gap space thoroughly insulated between the ground plate and the main-line terminals on the lighting arrester used, and in that way frequent harm has been caused.

I understand that quite a number of fire-alarm superintendents have given this matter very careful consideration, and have very much improved the security of their respective systems in adopting the plan suggested herein, and that since this plan has been used, troubles that heretofore were of frequent occurrence have been entirely removed.

1. Paper read before the International Association of Fire Chiefs at Charleston, S. C. Mr. Mead is the superintendent of the Bureau of Electricity at Pittsburg.

Electricity a Cause of Rheumatism.

Sir James Grant, M. D., of Ottawa, Ont., who is engaged in making original investigation in the uses of electricity as applied to human ailments, says that for many years he has been in the habit of treating cases of supposed muscular rheumatism by the insertion of small (No. 8), fine, steel needles, the number varying according to the extent of the affected parts, and, as a general rule, the seat of pain will indicate the precise place and extent to which the needles should be used. They remain stuck into the muscles for one or two minutes. The previous hard, tense condition, approximating one of tetany, relaxes and the patient is able at once to use the muscles. Experiments point to "an abnormal storage of electricity" in the tissues. It is said that electricity may be "stored" as a result of sudden draughts and cold. When the inserted steel needles are touched, the electrical accumulation is simultaneously discharged, passing through the body of the operator without any serious result. There is almost immediate relief in lumbago from this acupuncture.

CORRESPONDENCE.

London Letter.

London, September 25.—The new electricity works of the corporation of Glasgow were formally opened last week by Bailie Maclay, convenor of the electricity committee, who employed a handsome gold key which had been presented to him for the purpose. In a neatly turned speech, Bailie Maclay welcomed the guests to the inspection of the works. The works were not yet complete, he said, but they had done what they could during the last two or three days to make them presentable. The new station would be for many years to come the chief electricity works of the city. The ground was purchased in the beginning of the year 1898, and immediately thereafter operations were commenced to clear the ground and excavations were made. The buildings were started in March, 1898, and were now completed so far as the first section of the building was concerned. The present building covered 1½ acres of ground, and was only one-third the size of what they hoped the station would ultimately be. Already excavations had started for the second section of the station. Coal was delivered by the canal opposite the works, where it was lifted by a conveyor to the coal store or into the coal tanks over the boilers. The boilers erected were 10 in number, of the Babcock & Wilcox make, each being capable of supplying steam to 1,000 horsepower of engines. Each boiler, when workng at full load, would use about one ton of coal an hour. The boiler house was 220 feet long by 81 feet broad, and had one chimney stack in the middle, which was 220 feet high by 11 feet inside diameter. The engine room was 220 feet long by 56 feet broad and 38 feet high to the gallery crossing the engine room. At present there were engines erected in it making a total of 7,000 horsepower. This building, however, was large enough to hold over 10,000 horsepower, and this amount would be installed before next year. The current from this station would supply for some time to come the greater part of the city.

On the subject of the proposed electrical tramway for the Cumberland Lake district, which has evoked strong opposition among the landed proprietors en route, Mr. Stephen Sellon, C. E., engineer of the British Electric Traction company, tells me that there is not the slightest intention of disfiguring the highways. He said: "We shall make the poles that support the wires as ornamental as possible and our cars will be as handsome as can be manufactured. But we do think it will be of advantage both to passengers and inhabitants of the district to be able to travel those six miles for fourpence, instead of having to pay a shilling." The County Councils in the district are supporting the scheme, as they consider it will bring money to the neighborhood and improve the conditions of trade.

At the recent meeting of the British Association, Professor Silvanus P. Thompson revived an old, but most important and interesting, proposition, viz., the erection for long-distance transmission of electrical generating plants at colliery pitheads. In general terms, the suggestion is that the collieries, instead of sending their coal an expensive journey in railway trucks to be converted into mechanical energy in local and more or less imperfect plants, should deliver power to distant industrial centers in the form of electrical energy, generated on the most scientific and economical principles by generating plant installed on the spot where the coal is brought to the surface. Such a scheme is not new. It was first mooted some eight or nine years ago, and set out in elaborate detail by Messrs. James Swinburne and H. B. Thwaite. It attracted a good deal of attention at the time, though regarded, in the main, as visionary, and a short calculation of the cost of the copper wire by even a short transmission plant effectually killed the project. But since then conditions have changed materially. Electrical pressures then deemed impossible in practice are now in every-day work. Professor Thompson, however, is right in stating the capital required would be very large, and that is the chief difficulty. The field is practically an untried one and the removal of at least a large proportion of existing steam-power plants would be necessary to the success of such an installation.

An extensive system of new electrical tramways is projected to join up Greater London, if parliamentary sanction is forthcoming next session. The London United Tramways propose to extend their existing lines to St. Pancras, Marylebone and Fulham, and across the Thames to Putney, and also northward to Willesden and Southall and westward to Sunbury. The Surrey extensions will include a length of over four miles, connecting Putney with Richmond, which will proceed into Middlesex over a new bridge across the Thames. Another line will be from Hammersmith bridge, and there will be an extension from Kew bridge to Richmond. In Middlesex the scheme will comprise, among others, connections with Hounslow, Cranford, Brentford and Kempton Park—all dependent, of course, on the probably strong opposition of some of the local authorities being overcome. The projectors of the schemes will undoubtedly go to the United States for their plant, but, in view of the strenuous efforts the British manufacturers are making to secure the contracts, American firms should lose no time in getting into communication with the promoters.

W. H. B.

New York Notes.

New York, October 6.—All street work of the Metropolitan Street Railway company has been finished for this year. The entire cost for construction work has been about $5,500,000 for the fiscal year just ended, expended for the most part on power houses and motive-power changes. Nine miles of Lexington avenue and 6½ miles of Columbus avenue have been electrically equipped; 10¼ miles of the Broadway road has had new rails set, and the street surface repaved, and three crosstown lines have been reconstructed. While this is not the largest year's work ever done, President Vreeland says that it is the most intricate and difficult. There is no intention of operating the present cable line by electricity until next spring, by which time Mr. Vreeland hopes to abolish the whole cable service on the Metropolitan lines.

A notice has been sent out by Major E. H. Ruffner of the United States corps of engineers in reference to a public hearing on the proposed bridge across the East River between Long Island and Ward's Island at Hell Gate, and the approaches thereto over Bronx Kill and Little Hell Gate. The Major's statement says that the New York Connecting Railroad company of 55 Broadway has made application to the Secretary of War for the approval of plans for the proposed bridge, and that the chief of engineers has ordered a public hearing at which every interested person will be privileged to express his views. The hearing will be held by Major Ruffner at Room No. 8, Army building, 39 Whitehall street, at 12 noon on October 23d.

The Manhattan Railway company will equip all its stations along the four elevated lines with telephones, which are in part to supplant the telegraph for official business. The superintendent denied that the telegraph was to be entirely abandoned, and said that for some purposes the telegraph was indispensable.

The Brooklyn Rapid Transit company has reorganized the elevated system, making six divisions instead of three, each under the control of a superintendent. They will be known as the Fulton Street, Brighton, Fifth Avenue, Broadway, Ridgewood and Brooklyn Bridge divisions. Superintendent George N. Edwards will have general supervision. It is expected that the change will result in the improvement of the service.

The Brooklyn Rapid Transit company is considering a plan for a readjustment of bonds to gain the advantage of the premium on some of the issues. The profit to the company should the plan succeed would be in the neighborhood of $300,000. The company owns about $9,000,000 of bonds issued by the various companies in the system. The securities are partly held in the treasury of the company.

The American Steel company has begun large shipments of the steel work for the subway in New York. About 2,000 tons has already been shipped, and the material is now being sent in at the rate of nearly 100 tons a day. The total contract comprises about 80,000 tons of structural material, which is manufactured at the Keystone plant of the American Bridge company.

The Automobile Club of America has just taken a suite of half a dozen rooms in the Astor Court building. The new quarters are not to be permanent, for the members are ambitious to own their own clubhouse at an early date. The active list of membership now contains 225 names, and there is a big waiting list for action at the next meeting. The annual meeting of the club will be held on Tuesday evening, October 23d.

M. L. G.

New England News.

Boston, October 5.—Charles A. Morss of Cambridge has sold to the Simplex Electrical company of that city the land and buildings occupied by the concern for $97,000. Mr. Morss is one of the stockholders in the Simplex corporation, and the plant was leased from him prior to this recent purchase. The capital of the company has been increased to $350,000.

The Charlestown Improvement association is taking measures to have Bunker Hill monument illuminated with a crown of electric lights.

The Boston Elevated Railway company is erecting near the Chestnut Hill car house of the road, in Brookline, a two-story brick building for an accumulator station. It will contain a large installation of storage batteries. There will be 270 cells, arranged in double tiers, to keep up the current steadily in the long feeder lines. When travel is light, as is the case at certain hours of the day, the battery will be connected with the feeder system and charged with surplus current. Then when travel is heavy, the battery will automatically feed its stored current to the trolley wires, thus reducing the extreme demands at the power station.

One of the survivals of olden times, the horse-railway line in the Back Bay, this city, said to be the only horse railway in operation hereabouts at the present time, appears to be doomed to extinction. It is owned and operated by the Boston Elevated Railway company, and when the electric system supplanted the old lines elsewhere, a petition for the retention of the horse cars on Marlboro street, through which they run, was granted. Now the Elevated company seeks permission from the railroad commissioners to abandon its tracks in that section. No remonstrants appeared, and the horse cars will probably soon be a thing of the past in Boston.

B.

Canadian Intelligence.

Ottawa, Ont., October 6.—The Renfrew Electric company of Renfrew, Ont., is making arrangements to develop additional waterpower, erect an addition to its present power house and generally to increase its plant.

The city of Kingston, Ont., is making arrangements to take over the electric-light and gas plants now operated by a private corporation in that city.

M. F. Beach of Iroquis, Ont., has applied to the Ontario government for a lease of waterpower near that town, his intention being to develop the power for electric purposes, and for the operation of an electric railway between Iroquois and the city of Ottawa.

The Brantford Electric and Operating company of Brantford, Ont., is building a new power house, of brick, with concrete foundations; waterpower will be used, the capacity being 1,200 horsepower.

The street-railway company of Sarnia, Ont., at a recent meeting of the shareholders, appointed a committee to secure tenders for changing the road to an electric system.

The Cataract Power company of Hamilton, Ont., has made application to the Township Councils of Barton, Saltfleet and Grimsby for right-of-way for an electric railway from Hamilton to Grimsby, Ont.

The Rimouski Electric company (La Compagnie Electrique de Rimouski) has been formed, with a capital of $100,000, at St. Germain de Rimouski, Que., to furnish electric power to operate factories, etc. Thomas Lebel of Fraserville, Joseph Norbert of St. Germain, and D. Caron and A. C. Landry of St. Octave de Metis are the promoters.

Mr. F. P. Brothers, manager of the Demerara Electric company, has returned to Montreal from Georgetown, British Guiana, where he has been engaged in superintending the building of the electric street railway there. The company has already constructed 12 miles of electric railway, and it is expected that the line will be in operation by October 10th. The Demerara Electric company also has control of the electric lighting, and, in fact, all the electric power and plant of the city, which contains about 70,000 people.

Circulars have been issued to the shareholders of the Canadian General Electric company of Toronto, Ont., calling a meeting for the purpose of considering the proposal of the directors to acquire the plant of the Canada Foundry company of the same city. Up to the present time, the Canadian General Electric company has been purchasing its castings from foundries in different parts of the country, and owing to the industrial activity of the past year or two, considerable difficulty has been experienced in securing deliveries of goods. This difficulty the directors intend to overcome by the purchase of the stock of the Canada Foundry company and enlarging the foundry premises and plant.

At intervals for several years past, the directorate of the Toronto electric street railway has tried to buy out the Metropolitan electric railway, which also operates in the city of Toronto and environs. Negotiations are now under way again, with good prospects of a successful issue. If the Metropolitan railway is acquired by the Toronto Street Railway company, the former road will be extended at once to the shores of Lake Simcoe, Ont. An official announcement of the completion of the negotiations may be expected at any time, and those in a position to know say that there is very little doubt as to the acquisition of the Metropolitan. This will give the Toronto company and its allies, the Mimico and Scarboro electric railways, control of the three trunk roads leading out of the city, east, west and north. The extension of these roads, as now contemplated, will make 120 miles of radial electric railway tributary to Toronto.

The town of Westmount, a suburb of Montreal, will soon have a mountain electric railway. At the last meeting of the Town Council it was unanimously decided that the sum of $2,000 per annum, for a period of 10 years, be granted to the Montreal Electric Street Railway company, on condition that it shall construct and operate at its own expense, obtaining all its own right-of-way, such a line of street railway. The offer is subject to ratification by the town.

At a recent meeting of the water committee of the city of Montreal specifications were considered for the proposed erection of the new electric motor, for pumping water, at the low-water reservoir of the city. By economy, this year, the committee is in a position to set aside $30,000, by which this apparatus can be put up. The committee decided, therefore, that tenders should be called for at once, on the specifications. Canadian and American firms are expected to send in tenders. It will be arranged so that electric power may be obtained from any of the electric-power companies in Montreal.

During the summer months many improvements have been made in the mining and metallurgical department at McGill University, Montreal. One large machine, a Wetherill magnetic separator of considerable capacity, is especially designed to be capable of application to a great number of ores of varying degrees of magnetism. This machine is a very recent invention, but it is already in use in certain places in the United States and Australia, with remarkable results. Experiments are already being made at McGill University to test its utility in the treatment of Canadian ores and to discover if any modifications are necessary for its general use in the Dominion. Several instruments from Germany and England have been added to the chemical labora-

tories. Notable among them are the German electric furnaces for experiments on a small scale in electro-chemistry, the capillary electrometers and some chemical balances, which weigh to one-twentieth of a milligram or one-thirteen-hundredth part of a grain.

The annual meeting of the Standard Light and Power company of Montreal, Que., was held in that city a few days ago. The annual report showed the company to be in a prosperous condition, it having declared for the year an eight per cent. dividend. During the year a new station was erected. Two rotary converters have been installed, and they are converting alternating, three-phase current from the Lachine Rapids Hydraulic and Land company to direct current, for use in the city. A steam plant of boilers, manufactured in Glasgow, has been installed, capable of developing over 2,000 horsepower, and two of the latest type Westinghouse compound engines erected. The statement was made that the Standard company is the only company in the city of Montreal to-day which has an absolutely fireproof station, operated by current produced by waterpower, and having a steam reserve at its command. The shareholders present considered the report highly satisfactory. The following-named directors were elected: W. McLea Walbank, J. H. Burland, Peter Lyall, S. Finlay, W. S. Evans, L. H. Henault, R. Wilson-Smith. Officers were elected as follows: President and managing director, W. McLea Walbank; vice-president, J. H. Burland; secretary, E. Craig. A. V. W.

From the Buckeye State.

Columbus, Ohio, October 6.—It has developed that the franchise asked for by Hon. V. A. Taylor in Summit County is in the interests of the Portage Lake Traction company, which is trying to extend its lines and get into Cleveland over the tracks of the Akron, Bedford and Cleveland road. Mr. Taylor asked for a 50-year franchise, but the commissioners will grant but 25, and it is likely that he will accept that.

The Akron, Bedford and Cleveland Electric Railway company has asked the commissioners of Summit County for a franchise to build double tracks on its line in the county. It pays an annual rental of $60 a mile for single track, and asks that it be allowed to use double tracks at a rental of $100 a mile. The commissioners are inclined to put the price up on the company. It runs along the highway the entire distance.

The threatened strike of the motormen on the Springfield (Ohio) city railway has been called off. The men will continue to receive 17½ cents an hour for their work, but their hours per diem were reduced from 11½ to nine.

The Cleveland, Medina and Southern Electric Railway company has had its franchise renewed by the commissioners of Medina County, with the understanding that it will be in operation by one year from this time. A bond of $10,000 was given to insure its completion.

The right-of-way has nearly all been secured for an electric line from Lima to Findlay, Ohio. It will parallel the Lake Erie and Western railroad.

While in Cleveland a few days ago the writer was assured by the officers of the Cleveland, Elyria and Western Railway company that they would soon begin the construction of a line from Berea to Medina, a distance of 17 miles. This will be the southern extension of the road which is now in operation. The line has already been surveyed to within a few miles of Medina. It passes through a county which has no railroad connection with Cleveland, and the prospects for a good patronage are therefore very bright. This company has just completed its branch to Puritas, an outing place and summer resort, and it will have the branch connecting Oberlin and Wellington completed and in operation by January 1st. This will give the system 65 miles of road. F. F. Pomeroy is the manager of the road.

The Zanesville (Ohio) Street Railway company will extend its line upon several of the more important streets of the town which its cars do not now reach.

Will Christy of Akron is interested in another big electric-railway company which will be incorporated within a short time. It will be known as the Western Ohio Electric Railway company, and will be a close relative of the Northern Ohio Traction company and the Southern Ohio Traction company, in both of which Mr. Christy is interested. The capital stock will be $500,000. The new company will build a line from Lima to Wapakoneta, and will be 29 miles in length.

H. W. Kline, J. C. Whitla and H. M. Estep of Pittsburg were in Alliance, Ohio, a few days ago and held a conference with the local stockholders of the Alliance, Sebring and Salem Electric Railway company. It is understood that they made arrangements to begin work on the line at an early date.

It has been discovered that the Cincinnati Edison Electric Light company has been swindled out of a large sum of money by two men who contracted with customers of the company to look after their meters and "fix" them every month before they were read. Robert T. Smith has been arrested.

The Columbus, Mechanicsburg and Urbana Electric Railway company has changed its route into Columbus so that it will miss the objectionable points and strike the loop which it will use.

There is a rumor that the Cincinnati Street Railway company will purchase the incline leading to Price Hill.

The lights used for illumination at the fall festival at Cincinnati, on both Race and Vine streets, will be made permanent. The merchants have agreed to bear the expense, and the Edison company has been given a permit to operate the lamps. This will add greatly to the beauty of the two streets.

All the stock and franchises of the Youngstown Lighting company, Youngstown, Ohio, have been transferred to Penhale & Fisher of New York and Devitt, Trimble & Co. of Chicago, the consideration being $500,000. These two firms have also purchased the right-of-way and the franchise of the Youngstown and Sharon Electric Railway company. The contract for the construction and equipment of the road has been awarded to Park & Hamilton. The work will be done under the personal supervision of Harry Hamilton.

The Chillicothe and Hillsboro Traction company has given a mortgage of $1,300,000 in favor of the Produce Exchange of New York, in order to secure funds to build the line from Chillicothe to Hillsboro and Bainbridge.

Citizens of Fostoria, Ohio, are up in arms against the Fostoria Heat and Light company because of an increase in the price of lighting.

There is a big fight at Fremont over the awarding of the city lighting to the Fremont Electric Light and Power company at $70 per lamp when there were a number of lower bidders. An attempt will be made to annul the contract.

The Sunbeam Incandescent Lamp company of Elizabeth, N. J., is looking for a location in some Ohio town. It is not known what inducements the company will ask to secure the industry.

J. H. Wilson of Chicago has been negotiating for the purchase of the franchises and right-of-way of the Chillicothe, Mount Sterling and Columbus Electric Railway company.

The Sandusky and Interurban Railway company is now working at three points along its route between Huron and Lorain. When this road is completed, connection will be made with Cleveland over the Lorain and Cleveland road, now in operation. O. M. C.

Northwestern Notations.

Minneapolis, October 6.—The state board of equalization of Minnesota has increased the assessment on the property of the Twin City Rapid Transit company in Minneapolis from $1,500,000 to $2,400,000; in St. Paul from $1,250,000 to $2,100,000, and on the Minneapolis, St. Paul and Suburban from $25,000 to $100,000; a total of $4,600,000.

Ballard, Wash., is installing meters for electric-light consumers.

The Electric Light company of Colfax, Iowa, will make a number of changes and improvements to the plant. A new boiler to cost $1,800 and a dynamo costing $2,000 have been ordered.

The power from the new power plant at Apple River Falls, Wis., has been turned on for the electric-light system in St. Paul, and is transmitted over 25 miles of wire. There are two cables to carry the power, to be prepared for accident. There is also a steam plant in St. Paul, in case of both cables being disabled. There are four transformers at the transforming station in St. Paul, and within two months seven new ones will be added.

The Chicago Municipal Construction company has secured a 90-day option on the plant of the Wausau (Wis.) Electric company, valued at $75,000.

The Berlin (Wis.) Light company has decided to sell its plant to the city for $12,000.

The council of Des Moines, Iowa, has passed an ordinance allowing the Edison Electric Light company $1.66 a light a month more to induce the company to put its wires underground.

Arrangements are being completed at Oskaloosa, Iowa, to form a new company to absorb the street-car line and equip it for electric traction and extend it.

John Croskey will establish an electric-light plant at Beresford, S. D.

The Seattle (Wash.) Electric company has started work on a car shed and machine shop, to cost $25,000.

A committee from the council of Manitowoc, Wis., recommends the purchase of the electric-light plant.

W. H. Walker, of the Walker Milling company, Alden, Minn., has been granted a franchise for an electric-lighting system.

W. D. Jones, who has been manager of the board of trade office of the Western Union in Duluth, Minn., for a number of years, has become manager on the Duluth board of trade for George H. Daggett & Co. of Minneapolis.

The Benevolent Order of Street Railway Employes of Sioux City, Iowa, has been formed among the employes of the Sioux City Traction company.

Fred E. Sanders is an applicant for a franchise to operate a street-railway line on Puyallup avenue in Tacoma, Wash. The Tacoma Railway and Power company claims an exclusive franchise on that street. Sanders is interested in the projected line between Seattle and Tacoma and wants to secure an entrance to Tacoma on Puyallup avenue.

The mayor of Tacoma, Wash., vetoed the ordinance which attempted to regulate the number of passengers over its seating capacity which street cars should carry.

The electric-lighting company of Marshalltown, Iowa, has expressed its willingness to submit to the passage of an ordinance reducing its rates, rather than engage in litigation. The council passed an ordinance making rates which the company claimed to be absolutely below cost of operation, and the Federal Court has been appealed to in order to prevent the council from enforcing them.

The Duluth (Minn.) Street Railway company has ceased operating the Woodland line, on account of the bad condition of the tracks, especially the curves, which result in frequent derailments. The line is owned by the Woodland company, which offers to lease it to the street-railway company for 10 years, for $1 if the lessee will repair the tracks. The street-railway company insists that the owner put the tracks in repair, and on account of this difference the line has been closed down.

The Great Northern Railway company's tunnel through the Cascade Mountains is nearly completed. It is to be lighted by electricity and trains are to be propelled through the tunnel by electric motors.

The city engineer of Seattle, Wash., suggests that the city construct subways for wires in the business section and rent them to corporations desiring them.

The Street Railway company of Tacoma, Wash., proposes to make improvements to its system which will put it in much better shape. The Fourth of July accident suits will be settled as soon as possible and on an equitable basis. Seven suits have been filed on account of the accident for over $70,000 damages.

Arthur Bigelow and Thad Rose have sued the Seattle Electric company in Seattle, Wash., for $10,000 damages each. They were formerly in the employment of the company and were accused of stealing a large amount of copper wire, on which charge they were arrested and held. On preliminary hearing they were discharged for lack of evidence.

The Albert Lea (Minn.) Electric Light company has filed amended articles of incorporation limiting its indebtedness to $100,000 and extending the scope of commercial enterprises in which the company may engage. R.

Cleanings from Colorado.

Denver, October 5.—The Citizens' Light, Heat and Power company, recently organized in Colorado Springs, has made application for a franchise in Colorado City. The company agrees to furnish the city with electric arc lights at $85 a year, provided that at least 30 are used. The company agrees, as a consideration for the granting of the franchise, to pay for the first five years one per cent. of its gross earnings, and two per cent. every succeeding year during the life of the privilege.

In a short time the electric division of the Colorado Springs and Cripple Creek District railway will be running to Goldfield in the district. A branch is to be built from Midway to Altman, and another from Cameron to Gillett, so that all towns in the district will be connected by trolley lines.

The Colorado Springs Electric company, in a recent advertisement, announces that, "beginning with December 1st next, our price for electric light will be 12½ cents a kilowatt-hour. The old rate is 20 cents a kilowatt-hour. This gives Colorado Springs cheaper electric light than any other town in the country where similar conditions exist. * * * Colorado Springs will also be distinguished by having the best electrical generating station west of the Mississippi River, and one unexcelled by any in the world."

The Rocky Mountain News, commenting on a paper which described the competition of trolley lines with steam railways in New England, suggests the adoption of such a plan in Colorado. It says: "Public policy is not well served by placing obstacles in the way of the cheaper and cleaner transportation—a system which connects dozens of villages with each of the manufacturing towns and cities, enabling the people to travel at will, with marked comfort and very little cost. It does not require a vivid mind to picture what the introduction of the electric-trolley system would mean for Denver. Imagine the commercial, social and esthetic effect of a main depot in our business center, with lines direct to Colorado Springs, Palmer Lake, Littleton, Golden, Morrison, Boulder, Longmont, Berthoud, Fort Collins, Evans and Brighton. What an impetus would be given to both trade and travel, adding profit and comfort to the lives of thousands. Yet this is not empty speculation. What is being accomplished daily in New England can easily be duplicated here." The suggestion is interesting, but it will be many years before such a plan is in any sense practicable. In the list of towns mentioned, there are only two having over 5,000 inhabitants, and the country between the towns is sparsely populated.

John Baudy, an oiler in the power station of the Denver Tramway company, went to sleep on a belt connecting an engine and a generator. The machinery was started by the engineer, who did not know the perilous position of Baudy. The latter was carried to the pulley and was badly crushed from his waist down, but it is said that he will recover. J. W. D.

PERSONAL.

Mr. Charles P. Platt is now general sales agent of the Sun Electric Manufacturing company, Philadelphia, Pa., designer and manufacturer of telephone switchboards and supplies.

Mr. George G. Ward, the vice-president of the Commercial Cable company, who is now in Germany, has received from Emperor William the Or-

der of the Crown of the Second Class. Mr. Ward was a guest at the recent banquet given in Berlin by the German Atlantic Cable company to commemorate the opening of its direct cable to the United States.

Mr. C. E. Stratton, manager of the exchanges of the Colorado Telephone company at Canon City and Florence, has been appointed the company's manager at Trinidad. During Mr. Stratton's period of service in the two towns named the number of subscribers has been greatly increased. The new manager of the company at Canon City and Florence will be Mr. Philip Hamlin, who has been special agent at the Denver office of the company.

Louis K. Comstock, a well-known Chicago electrical man, formerly in the construction business for himself and more recently superintendent of the construction department of the Western Electric company, with headquarters in Chicago, is now electrical engineer for the George A. Fuller company at the New York office of that company. This well-known contracting and building concern has for a long time felt the necessity of having an electrical department with a trained engineer at its head. It has now on its books contracts for building construction amounting to nearly $20,000,000, six per cent. of which work is electrical.

ELECTRIC LIGHTING.

An electric-light plant is being erected at Cass Lake, Minn.

The Kinsolving power plant of Corsicana, Texas, has been blown up, causing a loss of $1,500.

The Southern Electric company is to install a 500-light plant for the Avalon Cotton Mills at Mayedan, N. C.

The Gowanda Electric Light and Power company of Gowanda, N. Y., has been incorporated for $10,000, by C. E. Sipple, C. P. Dean and G. B. Pratt.

The Broad Albin (N. Y.) Electric company was incorporated at Albany recently, to furnish light, heat and power for the village of Broad Albin. Its capital stock is $25,000.

Bids will be received until October 16th for machinery, appliances and materials, and for the erection of an electric-light plant at Kirkwood, Mo. J. G. Hawken is the city clerk.

The Venice Electric Light and Power company of Venice, Ill., has been incorporated for $40,000, by G. A. Niemann, M. Niemann and F. Kohl. The company will erect and operate an electric-light plant.

A large power house is to be erected on Little River, 2½ miles from Radford, Va., by the Electric Light and Power company of Radford, of which G. W. Miles is president. About $20,000 will be expended.

The Consumers' Heat and Electric company of Bloomington, Ill., was recently incorporated for $75,000, by G. P. Davis, E. Thorp and G. S. Hanna. The company will furnish steam and electricity for all purposes.

Fuller & Co. of Chicago have purchased $25,000 worth of land from the town of Kinston, N. C., together with the electric-light plant of the town. The lighting system will be extended to the new portions of the town.

The Olney Electric Light and Power company of Olney, Ill., has been incorporated, with $28,000 capital, to operate an electric-light, power and heating plant. The incorporators are H. F. Hughes, Ed. S. Hughes and W. Bower.

It is proposed to erect an electric power plant at Belvidere, N. J., to use the waterpower of the Delaware River, at Big Rift, a few miles below Belvidere. The plan is to furnish electric power for the lighting of Phillipsburg, Washington, Hackettstown, Belvidere and other nearby places.

The present annual cost of lamp-trimming at Hartford, Conn., where one trimmer with horse and wagon takes care of 500 lamps, is calculated to be $2 per lamp, as against $8, which was the cost a lamp when the open-air arc was used. The cost of carbons per lamp per year was $1.50 against $5.84 previously paid for open-air arcs.

At Montgomery, Ala., a consolidation has been effected between all of the local street railways and electric companies, involving a combination of over $3,000,000 of capital. The combination includes the Montgomery Light and Power company, representing $1,500,000, the Montgomery Street Railway company and the waterpower companies of Montgomery, representing $1,250,000 capital. The bonded indebtedness of the combination will be $2,100,000.

ELECTRIC RAILWAYS.

The Cincinnati Street Railway company is planning to build a new line through Norwood, Ohio.

At a meeting of the council of Ann Arbor, Mich., on October 8th, the ordinance committee submitted an ordinance granting a franchise to Messrs. Hawkes and Angus for the proposed electric railroad from Jackson to that city.

The capital stock of the Collinsville (Ill.) and East St. Louis electric railway has been increased from $20,000 to $100,000.

The stockholders of the Collinsville, Caseyville and East St. Louis Electric Railway company have decided to increase the capital stock to $100,000.

A new street-railway company has been organized in Jackson, Mich., with $300,000 capital stock, to operate a street railroad from Jackson to Grass Lake.

C. L. Lindsay of Chapel Hill, N. C., is interested in a proposed 12-mile electric line to Durham, N. C. It is stated that the matter will soon be laid before the city of Durham.

The contract for building the Grand Rapids, Grand Haven and Muskegon electric railway has been let to Westinghouse, Church, Kerr & Co. at a sum exceeding $1,000,000.

W. S. Erwin and J. H. Hicks of Clarksville, Ga., are planning the construction of an electric street railway between Clarksville and Nacoochee Valley, taking in Porter Mills.

The Indianapolis and Martinsville Traction company has signed a contract for the construction of its electric road, to cost nearly $1,000,000. The power house will be located at Mooresville, Ind.

The Acme Magnetic Traction company has been incorporated at Tacoma, Wash., with a capital of $100,000, by A. H. Honey of Seattle and C. S. Barlow, A. H. Honey and E. S. Steere of Tacoma.

The Board of Trade of Washington, Pa., is interested in the construction of an electric line from that city to Charleroi, a distance of 25 miles. William I. Berryman of Pittsburg is one of the principal financial backers.

The Peninsular Traction company, a new Michigan organization, has asked for a franchise to come into the corporation limits of Battle Creek. The company has already secured the right-of-way for an electric road from Battle Creek to Grand Rapids.

The Traction and Power company of Bay City, Mich., which recently accepted an ordinance granted by the council of that place, has filed articles of incorporation, with $50,000 capital stock. The owners are the stockholders of the Consolidated Street Railway company.

The Rockland County Traction company of New York has been incorporated, with a capital stock of $300,000, to build an electric road, extending from Upper Nyack to Rockland Lake, about 30 miles. C. W. Reeve of 150 Nassau street, New York, is the director of the new company.

The St. Johns and Crystal Lake Railway company was organized on September 30th, for the purpose of building an extension of the Lansing, St. Johns and St. Louis railway from Maple Rapids to Crystal, Montcalm County, Mich. E. P. Waldron of St. Johns is president of the new company.

A trolley party of 27 persons recently made the run from Boston to New York, by way of Springfield and New Haven, a distance of 267 miles. The party spent one night at Springfield, the next at New Haven, arriving at New York at five o'clock on the third day. Several times during the trip the party was compelled to travel by steam railroad or carriage.

The Chicago and Western Indiana railroad, which is owned by five of the roads centering in Chicago, is considering the advisability of hauling all passenger trains into the Dearborn station with electric motors in place of engines. This is with a view of abating the smoke nuisance. If the scheme proves successful on passenger trains it will be extended to the freight service.

C. C. Campbell of Fairfax County, Va., and ex-Senator Henderson of Missouri are the chief promoters of a company which has been organized with a capital stock of $300,000, for the construction of an electric railway from Washington, D. C., west and northwest through Alexandria, Fairfax and Loudoun counties, Va. A power house, to cost $60,000, will be erected on the farm of Mr. Campbell, about eight miles west of Washington.

The second branch of the Metropolitan underground road of Paris was opened on September 29th. It taps the main line at the Arch of Triumph and runs to the Trocadero. Another line running north and south, connecting the Latin Quarter with Montmartre and passing under the river, will be opened next spring. The line from Vincennes to the Bois de Boulogne was completed within 16 months after the first blow of a pick in the work of excavation.

As a result of the collapse of the Montgomery Banking and Trust company at Montgomery, W. Va., the Kanawha Traction and Electric company has gone into the hands of receivers, George S. Couch, of Charleston, and George S. Wallace, of Huntington, being appointed to the trust. The stockholders of the bank were interested in this company, and it is charged that they were using the funds of the bank to build the line, which was to extend through Fayette County. The officials of the bank, however, state that the depositors will all be paid in full. The receivers have been ordered to sell the property of the electric road.

The elevated railroads of Chicago made comparatively small percentages of gain in traffic in September. The South Side line carried an average of 65,062 passengers daily during the month, as against 59,585 in the corresponding month last year. The increase figures 9.19 per cent. The daily average of passengers carried by the Metropolitan Elevated in the month was 82,000, as against 76,184 in the corresponding month last year. The increase was 7.63 per cent.

The Chicago Union Traction company on October 4th declared a dividend of 1¼ per cent. on the preferred stock, payable on October 25th to stockholders of record on October 5th. Books closed on October 5th and will reopen on October 25th. The former officers of the company were re-elected: President, John M. Roach; chairman of the board of directors, Jesse Spalding; vice-presidents, R. A. C. Smith, Walter H. Wilson; secretary, Markham B. Orde; treasurer, James H. Eckels; auditor, F. S. Smith.

The Metropolitan West Side Elevated Railroad company of Chicago has inaugurated a new service to relieve the congestion of the morning and evening rush hours in the manufacturing district between Halsted street and the river. During these hours alternate trains on the four branches of the system will be run only to Canal street, instead of around the downtown loop. Faster time is now made on all lines, and trains are run every five minutes, from 9 a. m. to 5 p. m., instead of every six minutes, as formerly.

The Chicago Union Traction company has commenced work with a large force of men on the construction of a large car barn on the North Side, near the southern boundary of Rogers Park. The barn, which will be of brick and stone, with a mill-constructed roof, will be 128 feet wide and 1,000 feet long. It will have about two miles of track and has been designed to accommodate 250 of the long 40-foot cars operated on the Evanston line. The new car barn will be on the west side of Clark street about 600 feet north of Devon avenue.

Within six weeks the New York, New Haven and Hartford Railroad company will have completed a 3,000-horsepower electric plant in New Haven, which will mark the beginning of an important extension of the electric branch roads of the Consolidated company in that vicinity. The plant will be used at first simply for purposes of lighting the local station and railroad building, but it will ultimately be used for supplying electric power for a third-rail line that will be established between New Haven and Derby.

The Boston and Maine railroad has filed a petition with the New Hampshire state Supreme Court asking for authority to build an electric railroad from Concord to Nashua. This is to be a standard electric branch railway, with modern equipment, from Concord through Pembroke, Suncook, Allenstown, Hooksett, Manchester, Goffes Falls and Litchfield to Hudson, connecting with the Nashua street railway, at Lowell street, in Hudson, and the Concord street railway. It is intended to be built under the provisions of the Concord and Montreal lease to the Boston and Maine railroad.

AUTOMOBILES.

Members of the Automobile Club of Great Britain and Ireland started on their autumn tour on October 5th. This run generally covers a week's time. One day's stop was made at Monmouth, where the club was entertained by Lord and Lady Llangotock. During November there will be several century runs and trial races.

Inspired by the example of William J. Bryan, M. J. Harrington, a Republican candidate for the New York State Senate, has begun an automobile campaign which he intends to keep up until election day. Besides its sidelights, the machine he uses has a powerful headlight and two clusters of electric lights displayed on poles, one on each side. It bears a banner on which is inscribed, "Harrington for Senator."

The Automobile Club of America made a run on Saturday, September 22d, from the club headquarters at the Waldorf-Astoria to the Larchmont Yacht Club, where a clambake was given. The motorette and quadricycle of the De Dion-Bouton Motorette company, operated by C. J. Field, vice-president and general manager of the company, and Frank Craven, respectively, came in first and second, the first making the run in one hour and five minutes from the Waldorf. The distance traveled was about 23 miles. There were 15 machines in the run.

A number of prominent business men of Washington, D. C., have arranged to hold a show in that city during the week of December 10th, which will be known as the National Automobile and Sportsman's Exhibition. Convention Hall, a building having a floor space of 36,000 square feet, has been secured

for the show, and will be divided in such a manner as to provide for 110 spaces. A track 16 feet wide and an eighth of a mile in length will also be constructed in the building, where practical demonstrations of the efficiency of the various vehicles exhibited can be made. This will be the first automobile show to be held at the national capital.

PUBLICATIONS.

A well-printed catalogue of 60 pages has been sent out by the American Blower company of Detroit, Mich., illustrating dry kilns and blowers. The "A B C" moist-air dry kiln is designed with the view of drying the interior of lumber and wood products before the pores on the exterior have been closed by the heat. The catalogue carefully explains the theory and working of this process, and shows heaters, ventilator fans and engines, for every application of heating and drying.

TELEGRAPH.

The quarterly report of the Western Union Telegraph company for the quarter ended September 30th shows net revenues of $1,600,000. This estimate is based upon nearly completed returns for July, partial returns for August and estimates of the business for September.

The Western Union Telegraph company has received word from Colombia that that government has put a ban on all private messages to and from the country. Only government and diplomatic messages will receive attention. The period during which this law will be operative is indefinite.

Word has been received at Seattle, Wash., that the steamer Orizaba, engaged in laying a government cable between Nome and St. Michaels, went aground on an uncharted reef near the latter place on September 17th. General Greely, chief signal officer, who was on board the Orizaba at the time of the wreck, says that the vessel will be saved unless a sudden storm should intervene.

Repair work at Galveston is progressing rapidly. The Western Union Telegraph company has finished laying a 19-conductor cable across the bay, together with a new cable from the bay to the Galveston office. The Postal Telegraph company has picked up its cable across the bay as far as to Bolivar Point. The other end is embedded in 25 feet of sand and will have to be dragged out.

The first telegram from Skagway was received at Seattle, Wash., on October 3d, marking an epoch in the history of business between Alaska and the outside world. The time occupied by the message in transit was seven hours, which will, however, be reduced. The line over which it passed to Vancouver is that which the Canadian government has been engaged in constructing for the last four months.

Consul Norton of Harput, Turkey, calls attention to the bids for supplies for the construction of a new telegraph line which are to be presented this month to the director of the Turkish postal and telegraphic service. One of the leading Constantinople firms is desirous of securing quotations from a first-class American house to use in this competition. The articles required include galvanized-iron wire, insulators and poles.

POWER TRANSMISSION.

It is reported that the E. A. Perkins Electrical company of Torrington, Conn., is negotiating for the purchase of the water privileges of Falls Village one of the best water privileges in that state, which is now owned by the Falls Village Power company. The company has in view the development of an electrical power scheme which will affect all of Northwestern Connecticut. The plant will be established for the purpose of conveying the electricity to Torrington, a distance of 20 miles, Sharon and other places in the county, where the electricity is to be used both for power and lighting purposes.

Sir William Preece and Messrs. Strain & Robertson, civil engineers of Glasgow, are interested in a project for establishing on or near the coalfields of West Scotland several great central stations for generating electrical energy. The scheme, which has been under consideration for a considerable time, is a comprehensive one, and includes large districts in the counties of Lanarkshire, Ayrshire, Renfrewshire, Stirlingshire and Dumbartonshire. The promoters of the scheme propose to supply the electrical energy in bulk for power, traction and lighting purposes to corporations and county councils and other large consumers. The agents for the promoters are Messrs. Wright, Johnston, MacKenzie & Roxburgh, solicitors of Glasgow.

The Fort Miller Power company has completed a survey of its property, located in Fresno County, Cal., and is said to be about to begin the construction of a flume and power house, 22 miles northeast of Fresno. The project contemplates the leading out from the upper reaches of the San Joaquin River of a large body of water which will be carried by a wooden aqueduct for more than 10 miles, and given a fall of 800 feet. It is estimated that a volume of water amounting to 43,000,000 cubic feet a day will pass through the flume and be utilized in the generation of electricity, the energy of which will equal 45,000 horsepower. The board of directors of the new company consists of Walton Saunders, Fulton G. Berry of Fresno, Thomas O. Carter, M. F. Saunders and Alfred J. Morganstern.

It is said that the General Electric company's contract with the sultan of Johore calls for an electric plant, costing between $700,00 and $800,000, to transmit power from a cataract to the gold mines belonging to the government, a distance of 98 miles. The company is sending nine of its experts to Johore for the purpose of setting up the plant. They are under contract to remain in the employ of the sultan for a term of years until his own subjects have learned the business. The agents of the sultan are now contracting for the rest of the machinery, which will cost in the neighborhood of $250,000.

SOCIETIES AND SCHOOLS.

A graduate course in naval architecture and marine engineering has been instituted at the University of Michigan, with Prof. H. C. Sadler, B. S., late assistant professor of Glasgow University, in charge of the department. The course of instruction in naval architecture will be commenced at the second semester of the senior year and continued to the end of the fifth year. The students may receive the degree of bachelor of science in engineering at the end of the senior year and that of master of science at the end of the fifth year. The work will consist of lectures, drawing and visits to shipyards, and will in general be similar to the course given at Glasgow.

MISCELLANEOUS.

An ordinance has been passed in Portland, Ore., regulating the uses of electricity in that city, and requiring companies using electricity to provide and put in use such appliances as will confine the currents to their own wires and prevent them from damaging pipes and other structures.

In the new residence of Isaac S. Rice on Riverside drive, New York, electricity will be used for lighting, heating, cooking, washing, ironing, drying clothes, ventilation, driving phonographs and kinetoscopes, etc. In addition, an automobile room is furnished with facilities for charging storage batteries.

The Baltimore electric-wire conduit is almost completed, and, according to the terms of the city ordinance, all wires are to go underground, except the feed wires of the United Railway and Electric company. The companies using the conduits are: United Electric Light and Power company, the United Railway and Electric company, the Postal Telegraph-cable company and the Western Union Telegraph company.

The council of Peoria, Ill., is now considering a proposition for providing the city with a steel car, on which is to be mounted a very efficient fire-fighting plant. Advantage can then be taken of the tracks to move a powerful water-throwing plant to any part of the dangerous district. On this car will be placed a regular fire steamer, which can be taken from the car and used from the ground. There is also to be a modern water turret, and an extension ladder, with fixed hose equipment and nozzle.

In response to an official inquiry, the city attorney of San Francisco has advised the street supervisors that the use of the public streets for overhead wires does not constitute a permanent encroachment in the meaning of the charter, and that electric-railway poles are, under a Rhode Island decision, "to be regarded not as incumbering the streets, but as ministering to their uses." He further advises the board that, as the charter of the railway company neither expressly nor impliedly forbids overhead wires, the supervisors "may grant or withhold such privilege as they may think best, or limit or control or regulate such privilege either as to manner of use or time of use."

The new Majert accumulator is now being manufactured by a Paris firm. The construction of the positive plate is the main characteristic of this battery, which is of the Planté type, being of solid lead, upon which a layer of peroxide of lead has been formed. This form is considered as more solid and will permit of discharging at a greater rate, while at the same time a great capacity is obtained. With the plate made by the Majert process, for a battery of one to three hours' discharge, the grooves are about two-fifths inch deep and one-fiftieth inch wide, separated by one-fiftieth inch. In the Majert process a traveling cutter is used, of special form, which cuts the required groove in the plate. An arrangement is used to take out the shaving perpendicularly at each cut.

A new electrolytic process has been patented for the extraction of nickel, copper, silver, mercury and other metals that have hitherto offered almost insurmountable difficulties to their economical extraction in the wet way. The process consists of the electrolysis of a brine solution in such a manner that, while the sodium ions are set free at the cathodes with the immediate formation of caustic soda, the chlorine ions are liberated in the anode section containing the matte and immediately form a chloride solution of the metals present. These chlorides can be directly treated for the contained metals by electrolysis or chemical methods. It is claimed that the entire cost of the process will be fully met by the value of the caustic soda and other by-products.

TRADE NEWS.

The Chicago Mica company of Chicago has certified to an increase in capital stock from $75,000 to $200,000.

The Pumpelly Storage Battery and Electric Motor company of Chicago has changed its name to the National Vehicle Battery company.

The Versailles (Ky.) Electric company has been incorporated. The incorporators are Edward Gunster, C. E. Steginaier and John D. Farnham of Pennsylvania. The capital stock is $18,600.

The Chicago Die and Electric company was incorporated on October 3d, with a capital of $5,000, for manufacturing machinery, dies and electrical appliances. The incorporators are Francis W. Maxstadt, Charles D. Cole and John Lyle Vette.

The United States engineer at New London, Conn., announces that sealed proposals will be received at his office until October 21st, for delivering two five-horsepower motors and three 3½-horsepower motors. Specifications will be furnished upon application to Major S. S. Leach.

The Hamilton Electric Supply and Construction company, with a capital stock of $40,000, has been incorporated at Toronto, Canada, with its head office at Hamilton. The provisional directors are E. E. Cary, G. A. Powell, N. L. Henderson, S. F. Washington and W. E. Boyd, all of Hamilton.

The Pacific Electrical Works, with principal place of business in Los Angeles, Cal., has been incorporated with a capital stock of $250,000, divided into 2,500 shares, of which amount $500 has been subscribed. The directors are Monroe Markham, G. L. Hardison, H. E. Carse of Los Angeles, L. W. Andrews of Ventura and Frank Taylor of Brookline, Mass.

The John A. Roebling's Sons company of Trenton, N. J., has received for its exhibit at the Paris Exposition two grand prizes and two gold medals, the highest honors within the gift of the exposition authorities. The Roebling display at the exposition consists of two exhibits. One shows the product of the company's electrical department, the principal feature being a full-sized model of a section of underground-trolley track, illustrating the communications with the conducting bars. In the wire exhibit of the company is shown wire 1-1,000 of an inch in diameter, one mile weighing a quarter of an ounce, and from this all sizes are shown, to cables used on the Brooklyn bridge. The second exhibit is in the department of metallurgy, and gives a comprehensive view of all the products of the Roebling works, with the exception of the electrical conductors. An exact representation of the famous suspension bridge surmounts the exhibit proper, and forms a most striking trophy.

The Manhattan Electrical Supply company of New York has purchased of the firm of Huebel & Manger of Brooklyn, N. Y., all of the latter's patents, trademarks, business, manufacturing plant and stock. Huebel & Manger will in the future have charge of the extensive manufacturing plant of the Manhattan company in Jersey City. The complete lines of electrical supplies heretofore manufactured by Huebel & Manger will be continued, and many articles will be added to the long list which the Manhattan Electrical Supply company is now manufacturing. This change in business will add about 100 employes to the payroll of the Manhattan Electrical Supply company, which, at the present time, disburses about $3,000 in weekly salaries at its factory. The Manhattan Electrical Supply company owns 10 city lots on Morris and Essex streets in Jersey City, and arrangements have been made for additional buildings. It occupies the entire building at 32 Cortlandt street, New York, where it sells at wholesale and retail the products of its factory. This concern started in business 12 years ago, with a capital of less than $1,000, and up to the present time no money has been invested, excepting the accrued profits, which have been reinvested in the business. The present capital stock of the company is $1,000,000.

BUSINESS.

The Electric Appliance company, Chicago, thinks that its increased sales of Gutmann wattmeters show a tendency in western lighting plants to do business on a meter basis.

The De Dion-Bouton Motorette company of Brooklyn, N. Y., is furnishing its French dry batteries to the trade. It is said that this battery will operate tricycles, quadricycles or motorettes for from 3,000 to 3,500 miles. The Motorette company is also furnishing a specially prepared lubricating oil for De Dion and other makes of motors.

The Mica Insulator company of New York and Chicago has produced an improved flexible micanite plate, known as "Style C." This plate has a breakdown strain of 1,500 volts as an insulator at a temperature of 100° C. It is said to remain flexible indefinitely, and retain its mechanical strength. It is manufactured in sheets 36 by 36 inches in size, and of any thickness from 0.01 inch upward. For insulating transformers, armature and field-magnet cores, armature slots and commutator shells, and for general insulating purposes it promises to be of much value.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 2, 1900.

658,792. Circuit-making and Breaking Device. Paul M. Lincoln, Niagara Falls, N. Y. Application filed October 19, 1898.

In a circuit-opening and closing device for electric circuits are combined a stationary terminal, a co-operating movable terminal, a solenoid and a core therefor, a rod or stem provided with tripping projections on opposite sides of the movable terminal and movable with the core, and means for retarding the outward or downward movement of the rod or stem.

658,808. Motor Wheel for Automobiles. Herbert Simmons, Wellston, Ohio. Application filed April 3, 1900.

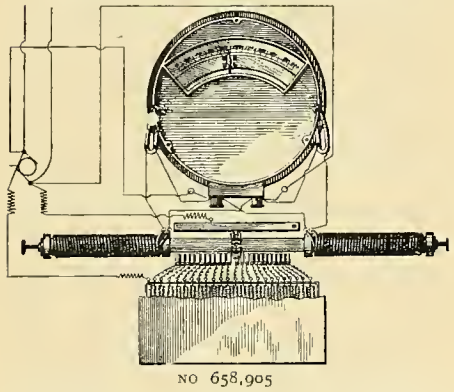
With a wheel having a runway and inner and outer hubs are combined an annular box on which the inner hub has its bearing, the axle spindle being loose in the annular box and fast to the outer hub, stops carried by the annular box, and a motor having driving wheels operating in the runway. The play of the motor is limited by these stops.

658,814. Means for Delicately Suspending Moving Parts. William Stanley and Herbert M. Smith, Great Barrington, Mass., assignors to the Stanley Instrument company of Massachusetts. Application filed May 1, 1900.

The invention consists of the combination of a rotatable shaft of magnetic material, a magnetic system producing a magnetic flux symmetrical thereto and a taut wire passing through the center of the rotatable shaft together with means for magnetically suspending the support.

658,815. Method of Producing Phase Displacement. William Stanley, Great Barrington, Mass., assignor to the Stanley Instrument company of Massachusetts. Application filed May 2, 1900.

This method of producing a flux of definite angular displacement from the electromotive force impressed upon a circuit consists in producing a flux of lesser angular displacement than that required, by means of a current in a simole coil of high inductance and of a fixed time constant and by such flux inducing secondary currents within a closed conductor differing in phase from the energizing currents and so located that the time of flow of such secondary currents cannot change the time constant of the energizing coil or coils. A resultant flux is thereby produced having the desired angular displacement.



NO 658,905

658,860. Cover for Battery Jars. Philip P. Nungesser, Cleveland, Ohio, assignor to the Nungesser Electric Battery company, Cleveland, Ohio. Application filed February 13, 1900.

A jar having an even, smooth interior surface about its top carries a jar cover having a relatively reduced annular lower portion seated therein with packing about the lower portion. A clamping ring bears against the bottom of this packing, and bolts pass through the cover threaded into the inner edge of the clamping ring to tighten the ring against the packing. Battery elements are combined in the jar, and connections therewith through the cover.

658,862. Telegraphone. Edward C. Paramore, Philadelphia, Pa., assignor of one-half to Howard T. Goodwin, Ridley Park, Pa. Application filed November 18, 1899.

In a recorder for sound-reproducing instruments, a flat torsion spring is secured at its ends in slotted posts, with setscrews to hold the spring in the posts, and a setscrew for adjusting the tension of this spring, in combination with a stylus arm attached to the spring. An arm carrying an armature is also attached to the spring.

658,865. Secondary Battery. Henry C. Porter, Chicago, Ill., assignor to Owen H. Fay, Chicago, Ill. Application filed December 27, 1898.

The invention relates to a secondary or storage-battery electrode comprising a grid which is composed of a plurality of bars having V-shaped grooves in the opposite faces thereof so as to form pockets between them. End bars connect the several bars of the grid, and are provided with perforations therein registering with the spaces between the grooved bars. The active material is packed within the grooves and in the openings in the end bars.

658,891. Electrode and Electrode Connection. Henry Carmichael, Malden, Mass., assignor to S. D. Warren & Co., Boston, Mass. Application filed May 11, 1899.

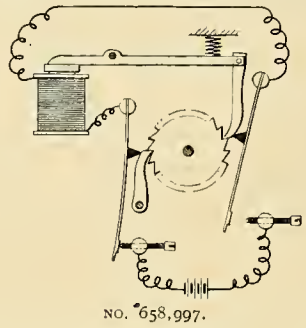
With the inclosing case of a cell for electrolytic or kindred purposes are combined a plurality of introductory conduits for electrode connections, each of these conduits consisting of a tube of insulating material closed at one end, passing through the inclosing case, and having its open end outside and its closed end inside the case. A pin or non-corrodible conducting material passes through, and is sealed in the inner end of the insulating tube, and protrudes from the wall of the tube both inside and outside. An electrical conductor is in contact with the inner end of the pin, and leads through the open end of the tube. Wires are strung between the exposed ends of the several pins.

658,892. Canal-boat Propulsion. Justus B. Entz, Philadelphia, Pa. Application filed February 10, 1900.

A vessel adapted to traverse artificial and natural waterways is to be connected mechanically to a land tractor, and be furnished in addition with a propeller. An electric generator is adapted to be connected electrically with the motor of the tractor, together with a prime mover, and means are provided to couple the prime mover with the propeller or the generator at will.

658,900. Battery Fluid. Gennaro Romanelli, New York, N. Y. Application filed January 13, 1900.

The battery fluid consists of one part by weight of chloride of sodium in solution, and one-half to three-fourths of a part by weight of cupric chloride mixed with sulphate of sodium in the proportion of about 30 per cent. of sulphate of sodium. The chloride of sodium is to be combined in solution with acetic acid. The solution of cupric chloride and sulphate of sodium is to be in contact with the negative electrode, and the solution of chloride of sodium in contact with the positive electrode.



NO. 658,997.

658,905. Electric-current Regulator. Daniel Watkins, Davenport, Iowa, assignor of two-thirds to C. J. Ruymann, Davenport, Iowa. Application filed March 28, 1900.

A movable volt indicator having a pair of pins at the side adapted to be electrically connected by contact with the indicator is combined with a rheostat, an electromagnetic device connected with the pins and adapted to be energized upon the closing of the circuit by the indicator. There are in addition a rheostat switch and means for moving the switch controlled by the magnetic device. (See cut.)

658,924. Electrical Fitting. William T. Pringle, Lansdowne, Pa. Application filed February 12, 1900.

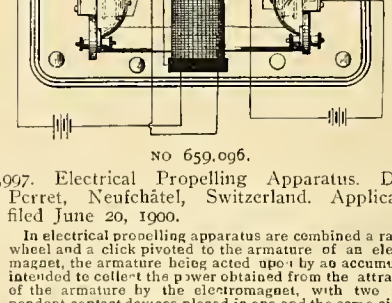
The device is an article of manufacture consisting of an electrical attachment plug formed of ceramic, comprising a member provided with insulated seats for the respective terminals of an electric circuit, a handle member in integral relation with the seat member, and a conductor passageway opening through the handle member and terminating in a lateral opening between the handle and the seat member.

658,925. Electric Switch. Nathaniel D. Rand, Watertown, Mass. Application filed February 10, 1900.

In an electric switch are combined a base and contact points secured to the base, a portion only of which are provided with binding posts. Means are supplied for grounding the points, together with movable switch arms, each provided with means for completing a different circuit through the contact points.

658,929. Electrical Semaphore System. Judson Shoecraft, Topeka, and Charles C. Gardiner, Bradford, Kan.; Shoecraft assignor to Gardiner. Application field June 30, 1899.

This signal system comprises a number of signals, each having an operating mechanism, each mechanism comprising a motor for actuating the signal, and a locking magnet for holding the signal against movement. A source of electricity is supplied, with which the motors are connected in multiple, and a separate source of electricity with which the magnets are connected in series, the circuits of the two sources of electricity including a common conductor and a relay for opening and closing the common conductor. This relay has its winding terminals connected with opposite insulated rails of a trackway, while a battery for the relay has its terminals connected with the rails. A circuit-breaker is in the local circuit of each motor, this circuit-breaker being operated and held operative by that portion of the mechanism which is held by the locking magnet. By this means, when the locking-magnet circuit is broken at the relay, the circuit-breaker will be released to close the local circuit of the motor.



NO 659,096.

658,997. Electrical Propelling Apparatus. David Perret, Neufchâtel, Switzerland. Application filed June 20, 1900.

In electrical propelling apparatus are combined a ratchet wheel and a click pivoted to the armature of an electromagnet, the armature being acted upon by an accumulator intended to collect the power obtained from the attraction of the armature by the electromagnet, with two independent contact devices placed in one and the same circuit. One of these contact devices is intended to cause the inducting of the electromagnet, and consists of two fixed insulated terminals, to one of which is fixed a spring, bearing an insulated tooth, operating a click gearing into the ratchet wheel, and bearing against a fixed contact piece. The flexion of the spring alone causes a slight sliding at this contact, and the other contact device, intended to stop the electromagnet, consists also in two fixed and insulated terminals, to one of which is attached a spring pressing the click into gear with the ratchet wheel by means of an insulated tooth. The other terminal forms the fixed contact piece, against which the flexion of spring alone causes the slight gliding at the contact point. (See cut.)

659,012. Automobile. Otto V. Bachellé, Chicago, Ill. Application filed October 2, 1899.

The invention combines in an automobile motor, a driver, a train of gears, one of which is connected for driving the driver, a shaft to which the other of the gears is secured, and a flexible blade having its ends loosely connected with the shaft and motor respectively.

659,080. Supporting Frame for Motors of Electric Carriages. Charles A. Lindstrom, Chicago, Ill., assignor to the Hewitt-Lindstrom Motor company, Chicago, Ill. Application filed May 5, 1899.

In an electric vehicle are included two corresponding longitudinal side bars or perches, the forward ends of which converge toward each other, and are independently swiveled to the front axle; their rear ends are loosely mounted on the rear axle of the motors. Means are provided for imparting the motion of the motors to the rear axle, and casings are shown within which the motors are housed, the casings having their rear ends independently supported on the rear axle, and their forward ends supported by the side bars or perches.

659,096. Combined Relay and Repeater for Telephone Lines. Edward C. Paramore, Philadelphia, Pa., assignor of one-half to Howard T. Goodwin, Ridley Park, Pa. Application filed November 18, 1899.

In a relay and repeater are combined two telephone lines, two repeating magnets arranged to be actuated one by each of the telephone lines, two microphones arranged to be actuated one by each of the repeating magnets, an induction coil, a first primary on the induction coil connected with one of the microphones, and a second primary on the induction coil connected to the other of the microphones. Batteries are in circuit with each of the primaries, and a secondary on the induction coil has each of its free ends connected to one of the telephone lines. (See cut.)

659,121. Appliance for Automobiles. Edward W. Ayres, Washington, D. C. Application filed June 16, 1900.

The inventor describes a motor, a source of motive supply for an automobile, connections between the motor and supply, a movable device under the control of the driver and arranged in one position to interrupt the connections, and an auxiliary movable device located so as to be accessible to the passengers, and so constructed as to interrupt the connections in one position, and thereby stop the vehicle.

659,134. Self-closing Valve for Steam Pipes. Frank W. Churchouse, Tacoma, and Henry O. Benedict, Seattle, Wash. Application filed January 25, 1899.

The device embraces a self-closing valve comprising a globe-shaped case, a rotatable shaft mounted in the case and having a lever arm fixed to the outer end thereof. A swinging gate is in the case, and carried by the shaft. There are in addition a ratchet wheel with which the lever engages, a toothed arm pivotally mounted near its center and engaging the ratchet wheel, and electrically operated means for tripping the toothed arm.

NO. 659,142.

659,142. Crossing for Suspended Electric Conductors. John Floyd, Washington, D. C. Application filed February 2, 1900.

In a crossing for suspended electric conductors is an angular plate supporting two blocks intermediate to the main conductor, these blocks having slots and grooves therein. Sliding rods mounted in the grooves have lugs projecting across the slots, and similarly curved arms are pivoted at their centers in the apex of the angular plate, the arms being reversed with respect to each other, and having flanges at one end and slots at the other end, adapted to engage the lugs through the slots and to operate the sliding rods, the arms being raised and lowered by the trolley. (See cut.)

659,169. Mechanism for Supplying Electric Power to Railway Cars. George F. Gale, Boston, Mass. Application filed March 21, 1899.

In a mechanism for operating cars by electric power is a pivoted contact disk in the roadbed having more than two contact points. There is also a contact point so arranged that a partial revolution of the disk shall make and break contact therewith, and a third rail with which the disk is in electrical connection so arranged that a projection on the car may engage the rail and operate the disk.

659,178. Electric-railway System. Edmund C. Morgan, Chicago, Ill., assignor to the Morgan Electric Machine company, Chicago, Ill. Application filed January 2, 1900.

An electric-railway system is described, embracing track rails, a truck, supporting wheels therefor, arranged to operate on the rails, a traction rack arranged parallel with the track rails, and supporting stringers for the rack. The rack is arranged between the stringers, and a propelling gear is mounted on the truck and arranged to enter the space between the stringers to engage the rack. The motor is carried by the truck for operating the propelling gear.

659,179. Combined Third and Traction Rail for Electric Railways. Edmund C. Morgan, Chicago, Ill., assignor to the Morgan Electric Machine company, Chicago, Ill. Application filed January 2, 1900.

A combined third and traction rail for electric railways comprises plates having openings formed through them to receive the cogs of the traction gear or wheel, and tongues formed at the ends of the openings to form a bearing for the cogs.

REISSUE.

11,859. Electric Railway. Justus B. Entz, Philadelphia, Pa., assignor to the General Electric company of New York. Application filed August 3, 1900. Original No. 619,287, dated February 14, 1899.

Means are provided for operating motor cars from each end of a train which comprise a train-conductor circuit or system and identical controllers on each motor car provided respectively with devices for arranging the motors and train-conductor circuit, or system, in fixed combination on the rear car, and with devices for cutting out the train-conductor circuit, or system, and reversing the motors on the front car.

Western Electrician.

EVERY SATURDAY.

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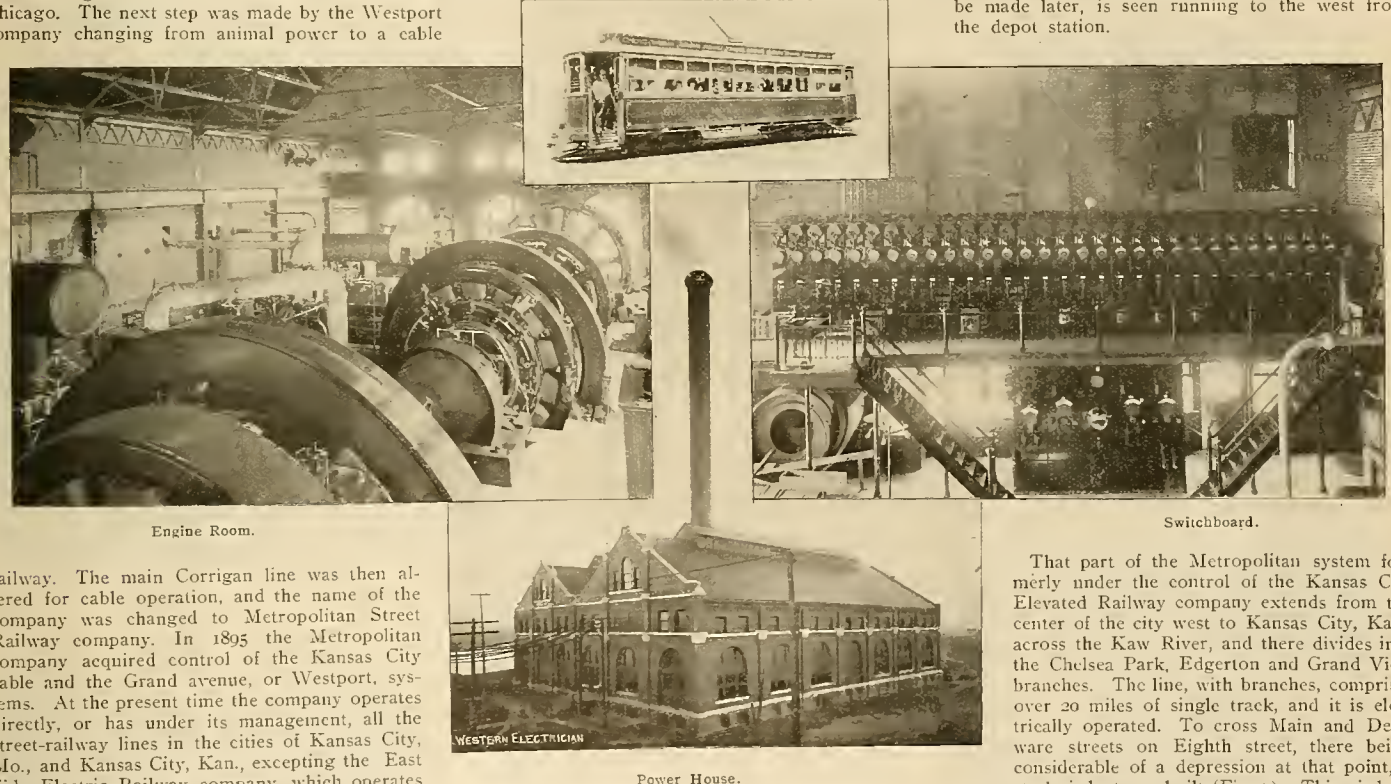
Metropolitan Street-railway System of Kansas City.

The street-railway lines in Kansas City that are now consolidated into one system and controlled by the Metropolitan Street Railway company represent a development from two horse-car systems. One of these systems was operated by what was known as the Corrigan Consolidated Street Railway company. The other line, running south on Grand avenue, was controlled by the Westport and Kansas City Horse Railway company. On June 16, 1885, the first cable railway in Kansas City was opened up for travel. It ran from the Union depot over Ninth and Eighth streets to the corner of Eighth street and Woodland avenue, passing over the Ninth street incline, the route being practically the same as is used to-day for the Union depot cable line. This cable road, which was known as the Kansas City cable railway, is said to have been the third system built in this country, the earlier ones having been installed in San Francisco and Chicago. The next step was made by the Westport company changing from animal power to a cable railway. The main Corrigan line was then altered for cable operation, and the name of the company was changed to Metropolitan Street Railway company. In 1895 the Metropolitan company acquired control of the Kansas City cable and the Grand avenue, or Westport, systems. At the present time the company operates directly, or has under its management, all the street-railway lines in the cities of Kansas City, Mo., and Kansas City, Kan., excepting the East Side Electric Railway company, which operates what is known as the Heim line in the northeastern part of Kansas City, Mo.

The lines of the Metropolitan Street Railway company ramify from the business center of the city to all the principal residence and park districts and also reach the wholesale business and stockyards portions of the two cities. A suburban road runs east to Independence, Mo. Up to about four years ago practically all the lines in the city were operated by cable, there being a few miles of horse and electric railways. Since that time changes have been making rapidly. Many of the old cable roads have been supplanted by electric lines, the animal-power lines have been electrically equipped and extensions have been added. As it stands to-day the Metropolitan system comprises 160 miles of single track in daily use. Of this trackage 113 miles is electrically operated, the remaining 47 miles still being driven by cable. Work is now progressing on the overhead construction of two cable lines, and before the year is over it is expected that they will be changed to electric roads. The two lines referred to have a mileage in single track of nearly 11 miles, and when in operation, they will bring the mileage of the electric system up to 124 miles. Other important changes are being contemplated by the company, but as yet no definite plans have been decided upon, except that it is understood in a general way that eventually all of the lines will be electrically operated, save probably the Ninth street incline, which, on account of its steep grade, will probably be handled by a cable for some time to come.

Kansas City is located on the western boundary line of Missouri, at the juncture of the Kansas or Kaw River with the Missouri River. The city lies wholly south of the Missouri River and on both sides of the Kaw River, the state line between Kansas and Missouri, which runs south from the confluence of the two rivers, dividing the city into Kansas City, Mo., and Kansas City, Kan. The retail business and residence portions are situated on a bluff or a series of hills south of the Missouri River. In the lowlands or East and West Bottoms are located many manufacturing plants and the stockyards. The general plan of the city may be seen from the map shown on the next page. This map also shows the street-railway lines of the Metropolitan Street Railway company (solid black lines), the East Side Electric Railway company or Heim line (broken line) and the beginning of the Kansas City-Leavenworth Railway company at Grand View (dot and dash line).



Engine Room. Power House. Switchboard.

FIG. 1. METROPOLITAN STREET-RAILWAY SYSTEM OF KANSAS CITY.—KAW RIVER ELECTRIC PLANT.

Physical Features and Track Construction.

Situated as the city is at quite an elevation above the river bottoms, and being broken up throughout its whole surface with hills, both short and steep and long and rolling, the engineering problems of a system of street-railway lines that must cover or reach all parts of the city are necessarily varied, and many of them of rather difficult solution as compared with ordinary street-railway construction. One of the most interesting sections of the road is what is known as the Ninth street incline, shown in Fig. 3, in the group of illustrations on page 245. This incline extends from the street-railway station at the Union depot to the top of the bluff on Ninth street. It is 1,200 feet long and about two-thirds of the structure has a grade of 18½ per cent., the highest grade traveled by any street car in the city. The main supports of the structure are of steel, while the floor and railings are of wood. The incline has a double-track cable line and lands passengers at the Union depot on a station about 35 feet above the street level.

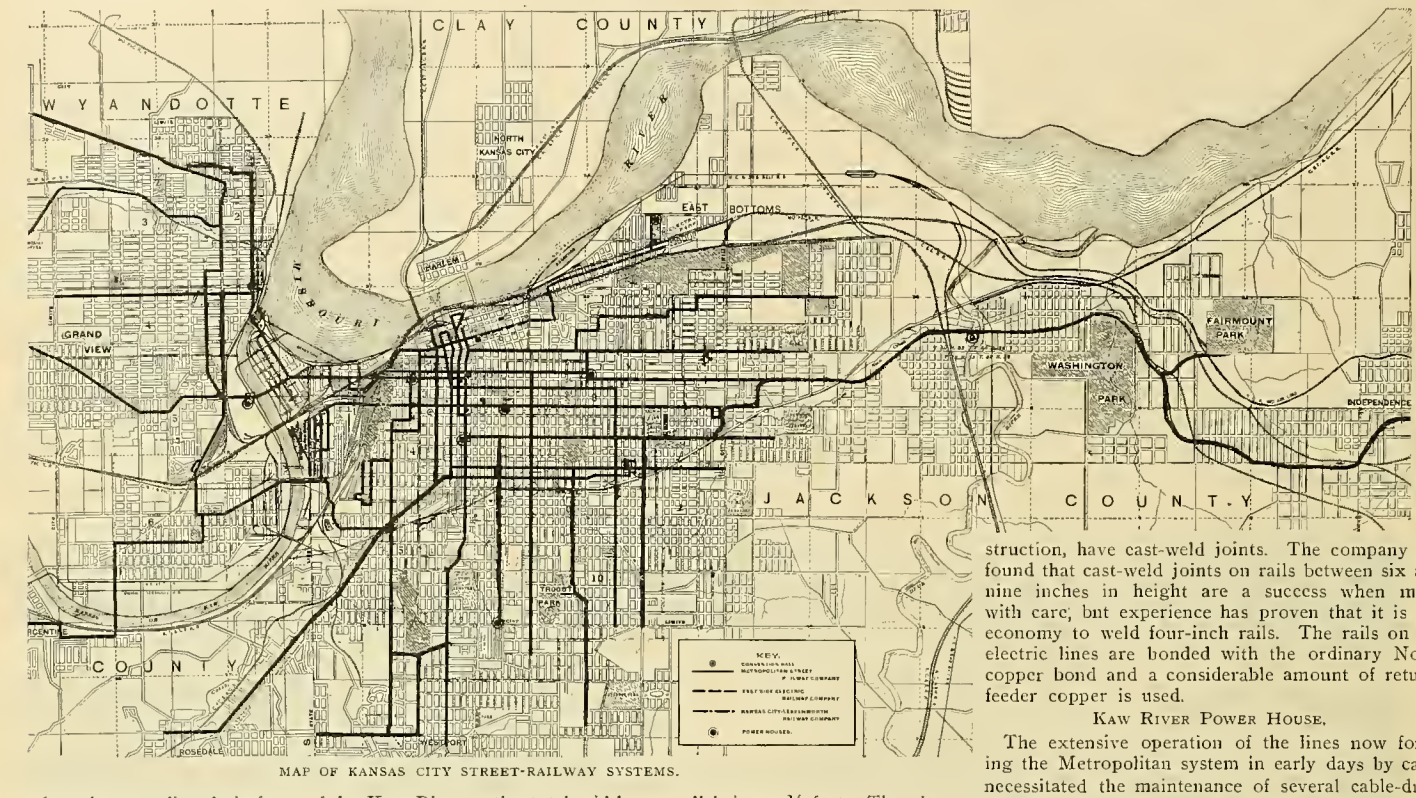
On the Twelfth street cable line there is an incline, 1,300 feet long, extending from Lincoln street on the bluff to Mulberry street on the bottoms. Of the inclined structure about 600 feet is on a grade of 12¼ per cent. This incline (Fig. 4) runs on to a viaduct, as does the Ninth street incline, to cross over the tracks and yards of the steam railroads which enter the Union depot. A double-track cable road is operated over the structure, but a change of motive power to electricity is under consideration. In Fig. 8 is given a view of the West Bottoms looking west from the bluff. The picture shows the Twelfth street incline at the extreme left and the Union depot and Ninth street incline at the right. The elevated electric railway, of which mention will be made later, is seen running to the west from the depot station.

That part of the Metropolitan system formerly under the control of the Kansas City Elevated Railway company extends from the center of the city west to Kansas City, Kan., across the Kaw River, and there divides into the Chelsea Park, Edgerton and Grand View branches. The line, with branches, comprises over 20 miles of single track, and it is electrically operated. To cross Main and Delaware streets on Eighth street, there being considerable of a depression at that point, a steel viaduct was built (Fig. 7). This viaduct, which is used exclusively for street-railway purposes, extends from Walnut to Wall street, a distance of 800 feet. The structure is all of steel, with creosote-wood ties embedded in asphalt, and was erected at an expense of $75,000 by the Metropolitan company. The maximum elevation, that at Delaware street, is 19 feet, while the maximum grade is six per cent. A station has been built at Main street near the center of the viaduct. In Fig. 6 is shown the "Junction" of Delaware and Main streets at the center of the city, the elevated structure crossing Main street being seen at the right.

Instead of going over the steep bluff at Eighth street, as is done at Ninth and Twelfth streets, a tunnel was cut through the limestone hill. This tunnel is faced and arched with brick and has a grade of 8½ per cent. It is 700 feet long, 22 feet in width and has a height of 22 feet to the center of the arch. The vertical distance from the roof of the tunnel to Penn street at the top of the bluff is 60 feet. Leading from the west entrance of the tunnel is a viaduct to the Union depot station over the steam-railroad yards. This elevated structure is extended straight west from the depot station on Central avenue

through the packing and stockyards district to Riverview in Kansas City, Kan. The elevated structure, which is mostly of steel construction, with standard ties and 60-pound rails, is about 1½ miles in length. It crosses the Kaw River by means of a 600-foot, double-deck, steel bridge, the lower deck being used by vehicles and foot passengers. Stations with waiting rooms are placed at convenient distances along the elevated railway. Fig. 2 shows the west entrance of the tunnel, and the beginning of the elevated structure, while Fig. 9 (on this page) is a view of the east end of the tunnel. As the elevated road passes directly in front of the Kaw River power house, the electrical feeder cables distributing from this station are carried both ways on the elevated structure. Twelve of the positive feeders leading east pass through the Eighth street tunnel, 10 being supported on brackets at the side and two overhead, as shown in Fig. 9. The two trolley wires are carried through in troughs.

Another road connecting the two Kansas Cities is the Fifth street electric line. This road also runs to the Union depot and is built on the surface throughout, except where it crosses the railroad tracks on Bluff street by means of a 60-foot viaduct.



MAP OF KANSAS CITY STREET-RAILWAY SYSTEMS.

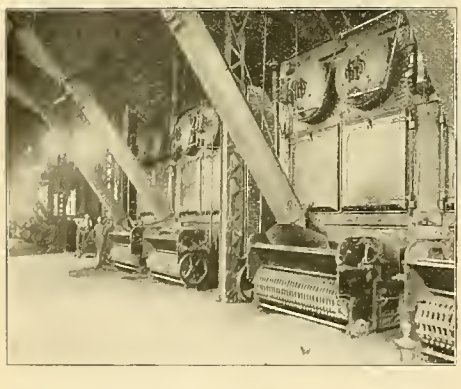


FIG. 10. METROPOLITAN STREET-RAILWAY SYSTEM.—BOILER ROOM OF KAW RIVER POWER HOUSE.

Of suburban lines, the Metropolitan company has a line running through Armourdale, in Kansas City, Kan., to the suburb of Argentine, a distance of six miles from the Junction, and a line to the suburb of Rosedale (four miles in length), along Southwest boulevard. On the east is the interurban line running to Independence, a distance of 10 miles from the Junction, of which mention will be made later. The Argentine line crosses the Kaw River twice, over 600-foot bridges. In all, the Metropolitan system has four crossings of the Kaw River.

Where the Metropolitan's Northeast electric line, formerly the Central electric railway, crosses the Agnes avenue gorge on Lexington avenue a modern steel viaduct is being erected, to take the place of an old wooden trestlework. The structure of this new viaduct has been erected, as seen in Fig. 5, but the roadbed is not yet complete. The viaduct is of steel plate-girder construction, supported by latticed posts resting on 30 to 36-foot concrete piers, the piers being placed on the natural limestone bedrock. It has a total length between abutments of 385 feet and consists of five spans, each 65 feet between bents, and two 30-foot towers. The total weight of steel used is 1,300,000 pounds. The maximum depth of the gorge below the viaduct is 100 feet. There will be a wagon track 25 feet wide, two car tracks taking up a width of 20½ feet and a 7½-foot walk, the total width over all being 55½ feet. The abutments are of concrete and contain 1,500 cubic yards of that material. The railway tracks will be laid 10 feet three inches between centers and will be protected by a double set of guard rails. Steel side poles will be used for supporting the trolley wires and an ornamental steel railing will be placed at the sides of the tracks. Eighty-five-pound, standard T-rails will be laid on wooden ties. For the vehicle and footways the flooring will consist of concrete arches covered with asphalt. As the Agnes avenue viaduct will eventually be a portion of the city's boulevard system that is now being constructed, the structure was designed with that idea in view. It was built solely by the Metropolitan company, under the approval of the park commissioners, and, when completed, will have cost about $80,000. The construction of this solidly built viaduct where a less expensive one might have sufficed is an example of the enterprise and public spirit of the Metropolitan company.

Another good piece of engineering work constructed by the company is at a point on this same Northeast line a few rods farther east, where Gladstone boulevard crosses Anderson avenue. Here an open steel arch has been erected over Anderson avenue, with a 60-foot span. The arch has a concrete, arched flooring, covered with asphalt paving and native-stone abutments. Two electric-railway tracks pass through the arch, the height in the clear being 12 feet. The opening extends the full width of the boulevard, 80 feet.

In the way of track equipment, the company is doing away with all its old side-bearing rails and is putting in girder rails. A contract was recently let for the reconstruction of the Main street loop on the Eighteenth street line, the motive power being changed from cable to electric. On this line the rails will be laid by what is known in Kansas City as the "concrete-trench" construction. This consists in having the rails embedded in a trench filled with concrete the entire length of the rails. Center-bearing girder rails, weighing 103 pounds to the yard and nine inches in height, will be used. It is intended that all urban track construction will eventually be of this concrete-trench construction, which thus dispenses with all ties and other perishable material, making the life of the track dependent only upon the durability of the steel in the rails.

Two classes of rails are used in the city for new construction. One of these is the girder rail described above, and weighing from 103 to 109 pounds, while the other has been recently adopted for tie-rod construction. The latter is a modification of a type of center-bearing rail made by the Lorain Steel company, the weight being increased from 82 to about 90 pounds to the yard. The rail has a five-inch base, a total height of 6 9-32 inches and a 2¼-inch wearing face. The rails are 60 feet in length and have tie-rod holes six feet apart. All deep rails, and especially those in the trench construction, have cast-weld joints. The company has found that cast-weld joints on rails between six and nine inches in height are a success when made with care, but experience has proven that it is not economy to weld four-inch rails. The rails on the electric lines are bonded with the ordinary No. 0 copper bond and a considerable amount of return-feeder copper is used.

Kaw River Power House.

The extensive operation of the lines now forming the Metropolitan system in early days by cable necessitated the maintenance of several cable-drive power houses in different parts of the city. As the change to electricity progressed some of these cable stations were abandoned, to some was added electrical generating machinery and two exclusively electric power houses were erected. The largest of these two new power houses and the one which is by far the most interesting of all the eight stations, both cable and electric, now operated by the Metropolitan company, is the Kaw River power house, or, as it is sometimes called, the Central avenue power house. This station is located on the west bank of the Kaw River, in Kansas City, Kan., just south of the elevated railway on Central avenue. It supplies electric current to practically all of the Metropolitan lines on both sides of the river outside of the Kansas City and Independence interurban line, which receives its current from the other new electric power house on the Blue River, east of the city.

FIG. 9. METROPOLITAN STREET-RAILWAY SYSTEM.—EAST ENTRANCE TO EIGHTH STREET TUNNEL.

The Kaw River power house (Fig. 1, page 243) is built of brick, with Phœnix limestone trimmings and has a steel framework. It is divided into an engine room and a boiler room, side by side, with a brick wall between. The foundations rest on the sand-bed of the river, 25 feet below the surface of the ground. The engine room has dimensions of 144 by 63 feet and the boiler room is 144 feet long

and 51 feet wide, both rooms having a height of 33 feet seven inches from the top of the foundations to the under side of the bottom chords of the roof trusses. An unloading coal shed, 41 by 20 feet, is located on the east or boiler-room side of the building. Starting with the mechanical equipment in the boiler room (Fig. 10), there are installed six 250-horsepower Babcock & Wilcox high-pressure boilers, with wrought-steel headers, and two 500-horsepower Cahall, Babcock & Wilcox double-deck boilers, with flowed-steel headers. All these boilers are tested for 250 pounds' working pressure. The first six boilers are equipped with Babcock & Wilcox chain-grate stokers, while the Cahall boilers, which have furnaces 10 feet wide, are equipped with chain-grate stokers furnished by the Green Engineering company. A 75 by 50-foot brick addition now being built on the south end of the boiler room will contain four 500-horsepower Cahall boilers, similar to those already installed. With this addition is being erected a 180-foot steel stack, 100 inches in diameter and similar to the present steel stack. The boilers are connected to the stacks by brick flues. They are supported by steel I-beams resting on the masonry foundations. The flooring of the boiler room is of concrete, covered with granatoid.

Coal is dumped from the cars into the unloading shed and is shoveled by hand into receiving hoppers, from which it is carried by means of a Hunt conveyor, operated by a small engine, to large coal bins, holding 1,000 tons of coal, above and in front of the boilers. From these bins the coal is fed by gravity through pendulum chutes to the stoker hoppers of the boilers. Two bins, located centrally between the coal bins and in front of the stack, are used for ashes. The same conveyor that is used for the coal carries the ashes, which are loaded by hand, to the ash bins above, from which the ashes are conveyed by gravity through chutes to cars outside the building. The coal and ashes are handled manually only in filling the hoppers of the conveyor. Cherokee slack coal, mined in the southern part of Kansas and in Indian Territory, is used at this and all the stations of the Metropolitan company. It costs $1.40 a ton on the car at the station, and has an equivalent of about 10,000 heat units to a pound.

The feed-water for the boilers is supplied by two Worthington Admiralty steam pumps. The water is heated by being passed through a 3,000-horsepower Berryman heater, the steam for which is supplied from the auxiliary units, such as boiler pumps, compressor, etc., through a 16-inch exhaust main. The supply of steam from these auxiliaries is sufficient to heat all the water to 175° or 180° Fahrenheit. The boilers are connected to a 16-inch main steam header supported on brackets on the partition wall between the engine and boiler rooms. Each boiler is connected to this header by reverse-bend sweeps, to allow for expansion and contraction. Extra heavy gate valves, with by-passes of the Crane type, are used throughout the station. All the steam piping is extra heavy, with flowed-steel flanges, shrunk and riveted. A peculiarity of the steam-pipe line is its simplicity and the small amount of it. The piping has been used constantly for four years without a single leaky joint occurring. A four-inch auxiliary pipe line is connected across all the boilers from which the auxiliary units are supplied with steam. The overflow from the condensers is carried through a 12-inch pipe into a hot well or tank beneath the boiler room from which the feed pumps draw their water. Additional water to supply the loss through evaporation, etc., is taken from the city water mains, being automatically trapped into the tank as needed.

In the engine room (Fig. 1) are four Reynolds-Corliss compound-condensing engines built by the Edward P. Allis company. Engine No. 1, the first one, beginning at the north end, is a tandem-compound engine, with cylinders 30 and 60 inches in diameter and a 48-inch stroke, running at 80 revolutions a minute. It is connected to a Wheeler surface condenser with 3,000 square feet of cooling surface. The air and circulating pumps for this unit are of the well-known Reynolds vertical type, the air pump being operated by a Corliss cylinder (14 by 18 inches) and valve gear. Directly connected to this engine is a 1,200-kilowatt, 550-volt, direct-current Walker generator, having an overload rating of 50 per cent. for six hours. The second unit consists of a cross-compound engine (28 by 56 by 60 inches), with similar condenser and Blake combination air and circulating pump, directly connected to a 1,200-kilowatt generator, a duplicate of the first, except that its overload rating is for only three hours. The next engine is a 22 by 44 by 48-inch tandem-compound, revolving at 90 revolutions and connected to a condenser with 1,800 square feet of cooling surface, operated by a Blake pump. It is directly connected to a 550-kilowatt, 550-volt General Electric generator, having an overload rating of 50 per cent. for three hours.

Engine No. 4, the farthest one seen in the illustration, is a cross-compound, with cylinders 36 and 72 inches in diameter, a 60-inch stroke and 75 revolutions. It is connected to a Wheeler surface condenser, having 5,000 square feet of cooling surface. The air pump is of the Allis vertical type, 42 inches in diameter. Circulating water is pumped by a vertical Allis pumping engine, equipped with Corliss cylinder and valve gear. This pump has a capacity of 5,000,000 gallons a day. The generator connected to this engine is one of the largest railway generators now in operation. It was constructed by the General Electric company and is nearly a duplicate of the large machine recently installed in Cleveland. It is a 22-pole, 1,550-kilowatt, 550-volt, direct-current generator, and has an overload rating of 50 per cent. for three hours. This unit was installed only last August. All the generators are directly connected and are compounded for a 10 per cent. rise of voltage at full-load current.

All of the engines have a working steam pressure of 165 pounds. The station is equipped with open-air exhaust, so that any engine can be run non-condensing in case of failure of the water supply. Water for the condensers is taken through two 20-inch pipes from the Kaw River, the overflow returning through a 48-inch tunnel. A gravity oiling system is installed in the station, the oil being taken from a tank in the basement by oil pumps and forced to overhead tanks in the engine room, whence it is piped by gravity to sight-feed oil cups on the engines. After passing over the bearings, the oil is caught in receptacles and piped back to Turner oil filters, and thence to the tank in the basement. The system is a continuous and automatic one. A 32-ton, 63-foot-span, hand-power traveling crane, made by the Brown Hoisting and Conveying Machine company, is used for handling heavy machinery in the engine room. This power station was designed by D. W. Dozier, the mechanical engineer of the Metropolitan company, and he may justly be proud of its economical operation, as shown by the tables referred to later in this article.

The switchboard, also illustrated in Fig. 1, is double-decked, the feeder panels being placed on a steel gallery. This gallery and the stairs leading to it have ornamental railings, which make a very pleasing effect. Of the five panels on the ground floor, the center one is a wattmeter panel and contains a 5,000-ampere Thomson recording wattmeter. The other four are generator panels, three of 3,000-ampere capacity and one of 5,000 amperes,

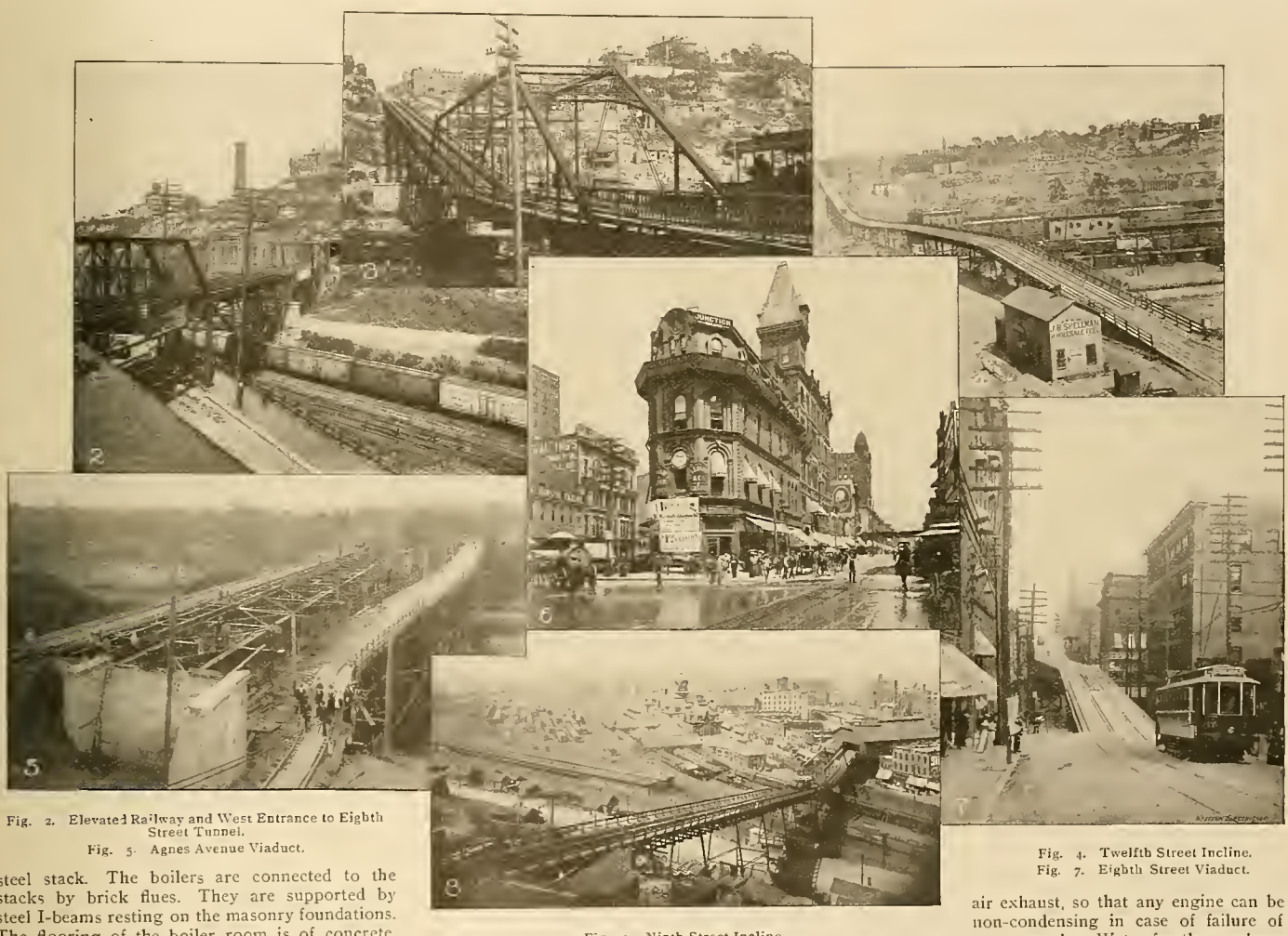


Fig. 2. Elevated Railway and West Entrance to Eighth Street Tunnel.
Fig. 5. Agnes Avenue Viaduct.

Fig. 4. Twelfth Street Incline.
Fig. 7. Eighth Street Viaduct.

Fig. 3. Ninth Street Incline.
Fig. 6. The Junction.
Fig. 8. West Bottoms, Showing Ninth Street Incline and Union Depot.
VIEWS OF THE METROPOLITAN STREET-RAILWAY SYSTEM OF KANSAS CITY.

and each contains a form-K circuit-breaker, a Weston illuminated-dial ammeter, two quick-break switches, a rheostat and switch for the field coils of a generator and a lightning arrester. At present there are installed 30 feeder panels, varying in capacity from 500 to 800 amperes. Each panel contains one form-K automatic circuit-breaker, a lamp bracket with shade, a Weston round-pattern ammeter, a quick-break switch and a lightning arrestor. On the feeder panels are mounted 13 recording wattmeters to measure the power consumed by the different electric lines of the railway system. For all of the generator panels there are two 750-volt Weston illuminated-dial voltmeters, supported on a hinged frame, one to measure the line potential and the other the potential of any generator. The switchboard is also provided with a 750-volt recording voltmeter and a 3,000-ampere recording ammeter of the Bristol type. Each feeder and generator panel is provided with a lightning arrester, terminating in a ground plate 72 square feet in size of No. 16 gauge sheet-copper, buried on sand 16 feet below the basement floor.

Thirty feeders leave the switchboard, one from each panel, for distribution to the various sections on the different lines. They are carried from the panels to and along the north wall on porcelain insulators, then through the openings in the wall, where they leave the building, and on iron poles to the elevated-railway structure, at which point they branch for the various roads. Twenty of these cables are carried to the east, 12 of them passing through the Eighth street tunnel. With the completion of the Main and Eighteenth street electric line, four additional feeder panels and cables will be added. The feeders vary in size from 300,000 to 1,000,000 circular mils, and have a total area (including the four new feeders) of 21,459,200 circular mils. There are four 1,000,000-circular-mil and one 650,000-circular-mil return or negative cables, which are carried along the elevated structure to the power house, entering the basement of the building through an underground duct. They then pass up in brass tubes through the engine-room floor to the negative bus-bar of the switchboard. Four other 1,000,000-circular-mil return cables tap on to the rails and the elevated structure. The aggregate length of all the electrical feeder cables used on the system is nearly 175 miles, 25 miles of which is composed of negative cables. The longest feeder carrying current from the power house is to the east end of the Northeast line, which transmits power to cars 32,100 feet from the power house.

As a result of the careful design of the Kaw River power house, its location near the river, the cheap fuel used and the economical working of the plant, the station has established for itself a record for economical operation that is probably equaled by few, if any, other steam plants in this country. In the tables on this page and the next are shown the operating expenses of the station for the first seven months of 1899 and 1900. It will be noted that in but one month during the two periods, that of January, 1900, did the operating cost for a kilowatt-hour exceed one-half of a cent, and that was occasioned by an extra large amount of coal being purchased during that month, while the kilowatt output was small. On the other hand, during April of this year the cost ran as low as 0.3309 of a cent. The average cost of operating the station for the seven months noted in 1899 was 0.4248 cent a kilowatt-hour, while that for the corresponding period in 1900 was 0.4115 cent.

Cable Power Houses.

Excluding the Blue River power house on the Independence electric line and the Kaw River plant, the other six power stations of the Metropolitan company all operate cable machinery. Three of the six have some electrical equipment. As a typical cable station may be taken that at the Fifteenth street and Grand avenue plant. This building, shown in Fig. 11, besides the cable plant, contains the general offices of the Metropolitan company. An interior view of the engine room is given in Fig. 12. This station operates two cables on the Fifteenth and Walnut street line, and until the recent change to electric power, drove a cable on the Grand avenue and Westport system. There are two simple Reynolds-Corliss engines, 36 by 48 and 32 by 48 inches in size, one of the engines being held in reserve. The cable-winding gear was manufactured by Poole & Hunt of Baltimore. Four 200-horsepower Babcock & Wilcox engines, fed by hand, are located in the boiler room. The engine room also contains a General Electric generator driven by a high-speed Armington & Sims engine for lighting the offices and building.

FIG. 11. METROPOLITAN STREET-RAILWAY COMPANY'S BUILDING AND CABLE STATION AT FIFTEENTH STREET AND GRAND AVENUE.

Another exclusively cable-driving plant is located at Twelfth and Charlotte streets. Two ropes from this plant operate the Twelfth street cable line, one cable running east and the other running west to the stockyards and passing over the Twelfth street incline. The ropes are driven by two 28 by 60-inch Hamilton-Corliss engines, only one being used at a time. The cable machinery, made by the Walker Manufacturing company of Cleveland, is located in the basement under the engine room. There are three 200-horsepower Babcock & Wilcox boilers. At this station are also located the principal shops of the company, including the machine, woodworking, paint and electrical shops, and also the offices of the electrical engineer and master mechanic. The shops are equipped with improved machinery for doing all repair work, rebuilding old cars and making all kinds of repairs to the electrical machinery and apparatus. The machinery in the shops is driven by a 30-horsepower motor. Electric current for lighting, testing and power purposes is received over a feeder wire from the Kaw River power house. Trolley wire is in place over all the tracks, and all motors and car equipments are tested before being turned out for service. Cars are also stored here for the division point. Other car barns are located on the Southwest Boulevard line, on the Northeast line, at an old cable power house at Tenth and Euclid streets, and at four of the present cable plants. The largest car barn of the company is a new one located on the elevated railway in Kansas City, Kan., where provision is made for storing 200 cars.

The Eighth street and Woodland avenue plant operates four ropes, comprising 95,000 feet of cable. Poole & Hunt winding gear is used. The cable machinery is driven by one-half of the Reynolds-Corliss quadruple-compound engine, that was in use in the Machinery building at the World's Fair in Chicago. The original unit was split up and the portion used at this station is operated as a tandem-compound, high-pressure, non-condensing engine. The cylinders are 26 and 40 inches in diameter, the stroke is 72 inches and the engine makes 40 revolutions a minute on 170 pounds' steam pressure. The flywheel of the engine, 32 feet in diameter and weighing 160,000 pounds, is one of the largest wheels in the country. The station also has a 28 by 48-inch Wright engine belted to a 300-kilowatt, 550-volt General Electric generator, which is used in helping out the electric lines

Operating Expenses of Kaw River Power House for Seven Months in 1899.

Month.	January.		February.		March.		April.		May.		June.		July.	
Output of kilowatt-hours	471,394 Kilowatt-hours.		433,291 Kilowatt-hours.		487,122 Kilowatt-hours.		399.766 Kilowatt-hours.		447,109 Kilowatt-hours.		435,789 Kilowatt-hours.		454,914 Kilowatt-hours.	
Cost of operating	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.
Engineers, firemen, oilers and other workmen	$ 486.57	$.001032	$ 519.97	$.001201	$ 508.69	$.001044	$ 554.16	$.001386	$ 499.95	$.001118	$ 536.91	$.001232	$ 554.40	$.001218
Repairs to engines and machinery	27.31	.000058	15.25	.000036	29.95	.000061	49.05	.000123	12.75	.000029	58.51	.000134	85.98	.000188
Oil and waste	55.58	.000118	59.30	.000137	30.05	.000063	65.44	.000164	31.21	.000070	34.93	.000081	28.09	.000062
Fuel	1,458.39	.003094	1,310.64	.003025	1,403.30	.002880	984.03	.002462	1,247.03	.002789	1,064.28	.002442	1,146.90	.002522
Water	20.90	.000044	28.24	.000063	30.40	.000062	26.12	.000065	25.09	.000056	35.85	.000082	47.99	.000105
Generator and switchboard, attendance and repairs	......	......	......	......	9.25	.000019	24.26	.000061	59.80	.000134	21.25	.000048	27.33	.000061
Miscellaneous	13.23	.000028	10.79	.000025	14.10	.000021	7.20	.000018	7.63	.000017	8.81	.000020	16.97	.000037
	$2.061.98	$.004374	$1,944.19	$.004487	$2,025.74	$ 004150	$1,710.26	$.004279	$1,883.46	$ 004213	$1,760.54	$ 004039	$1,907.66	$.004193
Coal and oil used	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.
Coal, number of tons	1,151 900/2000 tons	4.885 lb.	1,077 200/2000 tons	4.971 lb.	1,190 tons	4.885 lb.	1,019 850/2000 tons	5.1 lb.	1,123 950/2000 tons	5.025 lb.	972 tons	4.46 lb.	1,010 tons	4.44 lb.
Cylinder oil, number of gallons	103 gals.	*2.2 gals.	108½ gals.	*2.5 gals.	51⅓ gals.	*1.1 gals.	123½ gals.	*3.08 gals.	70 gals.	*1.56 gals.	90 gals.	*2.1 gals.	80 gals.	*1.77 gals.
Engine oil, number of gallons	157 gals.	*3 gals.	104½ gals.	*2.4 gals.	100 gals.	*2.1 gals.	200 gals.	*5.002 gals.	100 gals.	*2.23 gals.	100 gals.	*2.3 gals.	100 gals.	*2.22 gals.

*Number of gallons per 10,000 kilowatt-hours.

FIG. 12. METROPOLITAN STREET-RAILWAY SYSTEM.—ENGINE ROOM OF FIFTEENTH AND GRAND AVENUE STATION.

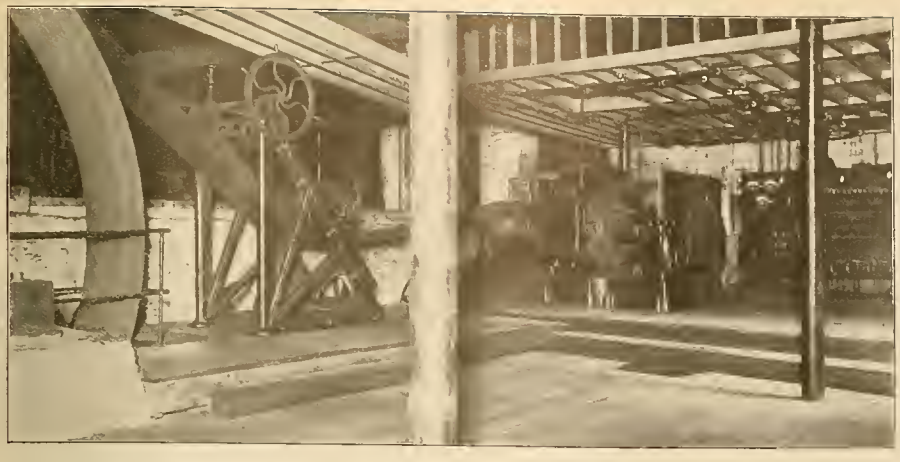


FIG. 13. METROPOLITAN STREET-RAILWAY SYSTEM.—MOTOR-DRIVEN CABLE PLANT.

in times of accident or heavy load. The switchboard consists of a 3,000-ampere generator panel and four 300-ampere feeder panels. Four of the well-known Babcock & Wilcox boilers are used. They are of 400 horsepower each and are equipped with chain-grate stokers.

Two cables are driven by one of twin engines, at the Eighteenth and Olive street station. The engines, which are of the Hamilton-Corliss type, also drive a 125-kilowatt, 550-volt belted Westinghouse generator, that furnishes current for the Vine street and Prospect avenue electric lines. The cable-winding gear is of the Walker type. There are also two generators, driven by Armington & Sims engines, that are used in case of emergency. The boilers, three in number, are of the Babcock & Wilcox type, each of 200 horsepower.

At the Holmes street station, corner of Thirty-first street, one cable for the Holmes street line is driven by a 24 by 48-inch Reynolds-Corliss engine. Belted to the same engine is a 125-kilowatt, 550-volt Westinghouse railway generator for emergency use. Two 175-horsepower Babcock & Wilcox boilers are installed here. This and the Eighteenth and Olive street power houses feed the Vine street and Prospect avenue electric lines, independent of the rest of the system.

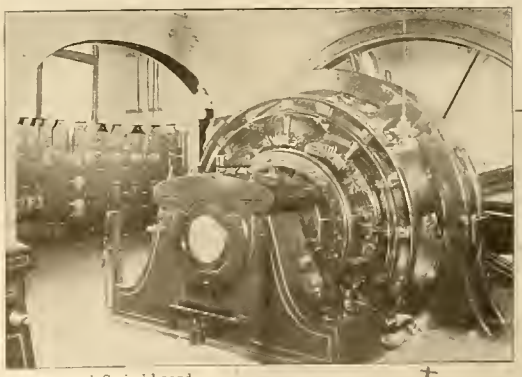
The most interesting cable plant is that at Ninth and Washington streets, where the cable machinery for the Summit street cable line is driven by an electric motor. This cable line consists of 2.17 miles of double track, with grades running as high as 10 per cent. The ropes were originally driven by a steam plant. That the change to electric drive was an economical one, is shown by the fact that the present operating expense is considerably less than one-half what it was under steam operation. Another beneficial result, it is said, is that the speed of the cable is more uniform and that there is less jerk to the cars than when operated by an engine. As the motor installation is in duplicate, the description of one side of the plant will suffice. A 300-kilowatt, 550-volt, four-pole, direct-current motor (Fig. 13) drives the cable machinery by means of a 36-inch belt, the stretch of the belt being taken up by an idler pulley. Each of the motors was formerly a General Electric generator. The two-panel slate switchboard, shown at the right in the picture, was designed especially for the motor. It contains the following-named instruments: Two round-pattern Weston ammeters, an automatic circuit-breaker, a Weston voltmeter, a 600-ampere, double-pole, double-throw reversing switch, two 600-ampere main switches, 48 50-ampere starting switches, a field switch, a main starting rheostat and a lightning arrester.

As the necessity of making repairs or the putting in of a new cable demands that the speed of the motor be varied between 10 and 380 revolutions a minute, a special starting rheostat had to be installed. This apparatus consists of 12 separate white-pine boxes, each containing 680 feet of No. 9 galvanized-iron wire, wound in spirals two inches in diameter and placed in zig-zag shape, with glass partitions between them to prevent electrolytic action. Water is piped to each box and a continuous stream is passed through and around the coils to keep the iron wire cool when the rheostat is used in operating the motor at a very low speed. Each box has four points of resistance in series which are connected to quick-break switches on the switchboard, the 12 boxes being connected in parallel. This arrangement of resistance coils gives from 50 to 1,080 amperes at 500 volts for any desired length of time. The rheostat is connected in on the negative side of the motor, to prevent a leakage through the water connections. The severe loads on the cable line cause a variation in the operation of the motor, the load running as heavy as 650 horsepower at times, while at other times, when the cars are bunched on the decline of the road, the motor has been operated as a generator, developing as much as 20 horsepower, which is fed back into the Kaw River power house, whence the motor normally receives its current. The average load is 146 horsepower. The driving of the cable and motor, including friction, without any cars on the line, requires 117 horsepower.

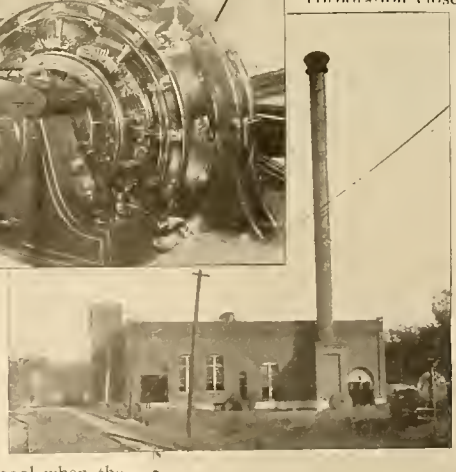
Independence and Fairmount Park Line.

The Metropolitan company's main suburban railway runs from Fifteenth and Askew streets in Kansas City east to Independence, the county seat of Jackson County, Mo., the eastern end of the line being about 10 miles distant from the Junction. The road passes close by Washington Park, and a 1½-mile branch has been constructed to Fairmount Park, which is now regarded as the best park in or near the city. The road, which is double-tracked, has a single-track mileage of 16.8 miles. This line was originally owned by the Kansas City, Independence and Park Railway company, and was operated with steam-dummy engines. In 1895 the road was changed to an electric line, the overhead trolley and feeders being erected without interfering with the train service. Fairmount Park (about 100 acres in area) has a number of beautiful natural features and has been further adorned by an artificial lake. Connected with the park are a number of summer cottages, and during the summer season many of them are occupied by some of the wealthy citizens of Kansas City. At a high elevation, on a bluff overlooking the Missouri River, is one of the best natural springs in the neighborhood. No admission fee is charged to the park, it being maintained by the Fairmount Park Amusement company, a corporation closely allied with the Metropolitan company. The park company receives a percentage of the street-car fares. The round-trip rate is 25 cents, 10 cents of which is paid on the connecting city lines.

The power house of the Independence line is located at Sheffield, on the Blue River, and is known as the Blue River power house. The building, shown in Fig. 14, at the left, is



Generator and Switchboard.



Blue River Power House. Motor Cars.

FIG. 14. METROPOLITAN STREET RAILWAY SYSTEM.—INDEPENDENCE BRANCH.

OPERATING EXPENSES OF KAW RIVER POWER HOUSE FOR SEVEN MONTHS IN 1900.

Month	January.		February.		March.		April.		May.		June.		July.	
Output of kilowatt-hours.	539,000 Kilowatt-hours.		572,187 Kilowatt-hours.		746,084 Kilowatt-hours.		812,789 Kilowatt-hours.		894,415 Kilowatt-hours.		878,604 Kilowatt-hours.		960,589 Kilowatt-hours.	
Cost of operating	Total Cost.	Cost Per Kilowatt-hour.	Total Cost	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.	Total Cost.	Cost Per Kilowatt-hour.
Engineers, firemen, oilers and other workmen	$ 559.89	$.001038	$ 581.75	$.001016	$ 607.72	$.000814	$ 627.08	$.000772	$ 694.93	$.000777	$ 770.51	$.000876	$ 783.23	$.000815
Repairs to engines and machinery	42.58	.000079	35.77	.000063	14.83	.000019	32.70	.000040	39.71	.000044	122.12	.000139	61.83	.000065
Oil and waste	8.10	.000015	71.85	.000126	42.09	.000056	56.33	.000069	69.88	.000078	48.03	.000054	115.77	.000121
Fuel	2,100.33	.003896	1,610.33	.002815	2,052.42	.002759	1,879.92	002312	2,300.88	.002572	2,356.08	.002682	3,004.27	.003127
Water	66.29	.000124	66.53	.000115	59.90	.000090	53.10	.000065	42.77	.00048	46.12	.000053	49.26	.000052
Generator and switchboard, attendance and repairs	103.53	.000193	98.84	.000173	59.99	.000091	29.79	.000037	139.97	.000156	102.85	.000117	117.79	.000122
Miscellaneous	51.45	.000095	4.00	.000007	.68	.000001	11.36	.000014	.48	.000001	6.40	.000008	18.14	.000018
	$2,932.17	$.005440	$2,469.07	$.004305	$2,837.63	$.003830	$2,690.28	$.003309	$3,288.62	$.003676	$3,452.11	$.003929	$4,150.29	$.004320
Coal and Oil Used.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.	Total Quantity.	Quantity Per Kilowatt-hour.
Coal, number of tons	1,684 tons	6.23 lb.	1,339 tons	4.68 lb.	1,855 tons	4.8 lb.	1,973 tons	4.85 lb.	2,208 tons	4.93 lb.	1,857 tons	4.22 lb.	2,250 t's	4.86 lb.
Cylinder oil, number of gallons			200.5 gals.	*3.5 gals	152 gals.	*2.3 gals.	151.5 gals.	*1.86 gals.	300 gals.	*3.35 gals.	100 gals.	*1.74 gals.	402.6 gals.	*1.19 gals.
Engine oil, number of gallons			300 gals.	*5.24 gals.			95 gals.	*1.17 gals.	152.5 gals.	*1.7 gals.	200 gals.	*2.27 gals.	250 gals.	*2.6 gals.

*Number of gallons per 10,000 kilowatt-hours.

100 by 150 feet in ground dimensions. In the engine room are located two direct-connected units. One of these is a 24 by 48-inch Reynolds-Corliss engine, driving a 250-kilowatt, 550-volt, multipolar General Electric generator. The other engine is a 28 by 48-inch Wright automatic, and is connected to a 450-kilowatt, 550-volt General Electric generator. The engines are run condensing, the steam being taken from five 66-inch by 16-foot return-tubular horizontal boilers of the John Mohr make. Both of the generators, one of which is shown in the group illustration (Fig. 14), are compounded for a 10 per cent. rise in voltage at full-load current. The switchboard, which is built on a curve, in an alcove of the engine room consists of a wattmeter panel, two generator and seven feeder panels, with the necessary instruments mounted thereon. The cars operated on this line are 40-foot, double-truck, high-speed cars, with a double equipment of either No. 1,200 or No. 57 General Electric motors. The cars are stored in a barn at the western end of the line.

Overhead Construction.

In the overhead construction of the Metropolitan lines the side-pole suspension construction has been used throughout. Some of the poles in the suburbs are of cedar, but the majority of them are of steel, some costing as high as $70 each. The limit of spacing that has been adopted for the poles is 100 feet, the average distance being 90 feet. No. 0 trolley wire is used, and some of the old lines are provided with guard wires, but in the newer construction the guard wires are omitted. All the trolley crossings are insulated, and there are besides over 30 section insulators on the different lines. There is only one tower wagon in use on the whole system, and that does service for construction, as well as repair, work. Very little repairing is necessary on the overhead equipment. This is due to the excellent construction of the line and to the use of a specially designed trolley harp, which is self-lubricating and has no projections to catch on the trolley wire. The electrical construction and equipment of the system is under the supervision of Charles Grover, electrical engineer of the Metropolitan company, and the plan for the reconstruction of the old lines and the improvements has been made under his supervision. All the line material used is manufactured by the Ohio Brass company, under designs of the Metropolitan company.

Rolling Stock.

The Metropolitan company has a total of 814 cars, 333 of which are electric. Of the electric cars 112 are 40 feet in length and have double trucks. Eighty-five of these used on the Westport line are equipped with four motors and air brakes. On the elevated line there are operated 38 double-truck, 35-foot cars. Of the remaining 183 electric cars, 135 are 30-foot single-truck, 43 are of miscellaneous and smaller types and five are 50-foot open cars, seating 56 people and made by splicing two short cars. Five different styles of General Electric motors are used on the cars. Brill, Peckham and Dupont trucks are in service, while the cars include the Brownell, Stephenson, St. Louis, Laelede and American makes. All of the electric cars are vestibuled and equipped with the Goodrich safety gate, controlled by the motorman, and the boarding of the cars while in motion is forbidden. Wheel hand-brakes are used on the electric cars, the cable cars having the ordinary double-brake equipment. The conductors on all the cable lines are provided with portable fare registers, stationary registers being provided on the electric cars. Additional rolling stock of the company includes 15 electric McGuire snow sweepers and eight cable sweepers.

General Details and Personnel.

About 1,000 trainmen, including motormen, conductors and gripmen, are employed by the company. Other employes, outside of the office force, include 65 trackmen, 93 flagmen, placed at intersections of lines, nine rope men and 250 miscellaneous employes. The cable men receive 17 cents an hour for the first year, 18 cents for the second, 19 cents for the third and 20 cents after five years. The trainmen on the electric lines are arranged on two scales, receiving 16, 17, 18 and 19 cents and 15, 16, 17 and 18 cents, respectively, for the periods mentioned above.

Charles Grover, Electrical Engineer. D. W. Dozier, Mechanical Engineer.
W. E. Kirkpatrick, Secretary and Treasurer. W. H. Holmes, President. C. F. Holmes, General Manager.
Edward Butts, Civil Engineer. W. A. Satterlee, General Superintendent. J. W. G. Becker, Master Mechanic.

OFFICERS OF THE METROPOLITAN STREET RAILWAY COMPANY OF KANSAS CITY.

Nearly a universal transfer system is in vogue on the lines of the company. A little booklet, giving the transfer points of the system, has been issued recently. By lines or divisions there are listed 124 transfer points, the actual number of stations and intersections where transfers are accepted being 61.

The Metropolitan Street Railway company has a capital stock of $5,586,800, but it is proposed to increase this considerably in a short time. About $4,000,000 will be raised immediately by the sale of preferred and common stock for the improvements that are contemplated. These improvements will include, in a general way, the equipping of all the cable lines, except the Ninth street incline, with electricity, building a central electric power house, and the probable installation of alternating-current transmission, with sub-stations. The company's franchises are of 30 years' duration, and will expire in 1925. Besides the transforming of existing cable lines, the company has in contemplation a franchise to extend construction next year over 10 miles of new double-track electric railway, on Indiana avenue, from Eighteenth to Thirty-first street, on Thirty-first from Main to Indiana, on Twenty-seventh from Prospect to Cleveland, on Walnut from Thirteenth to Nineteenth, and several shorter extensions. The gross earnings of the Metropolitan company for the last five years were as follows:

June 1, 1895, to May 31, 1896	$1,780,940
June 1, 1896, to May 31, 1897	1,774,891
June 1, 1897, to May 31, 1898	1,949 605
June 1, 1898, to May 31, 1899	2,094 378
June 1, 1899, to May 31, 1900	2,353,266

The officers of the Metropolitan Street Railway company, the portraits of all but one of whom are shown in the accompanying group, are the following-named gentlemen: President, W. H. Holmes; vice-president, L. E. James; secretary and treasurer, W. E. Kirkpatrick; general manager, C. F. Holmes; general superintendent, William A. Satterlee; civil engineer, Edward Butts; mechanical engineer, D. W. Dozier; electrical engineer, Charles Grover; master mechanic, J. W. G. Becker. Mr. Daniel B. Holmes, of Holmes & Perry, is chief counsel for the company, while Pierce, Richardson & Neiler of Chicago are consulting engineers.

Electric Railways in Italy.

According to a report of the inspector-general of the Italian railways, just published, there were on the first of January, 1900, 3,180 kilometers of electric railways in operation in the whole of Italy. Of these lines 136 kilometers were owned by the state, while 1,978 kilometers were the property of and worked by provincial authorities, 721 kilometers by municipal authorities, and 345 kilometers by private companies. The province of Lombardy possessed most of the lines—1,053 kilometers. Then followed Piedmont, with 904 kilometers, Emilia with 447 kilometers, Venezia with 242 kilometers, Toscana with 198 kilometers, the Island of Sicily with 101 kilometers, Apulia with 65, Campania with 61, Latium with 57, Liguria with 38, the Island of Sardinia with 11, and Umbria with 4.27 kilometers. It may be mentioned that the Mediterranean Railway company, whose headquarters are at Milan, has been granted a concession by the Italian government for the construction of an electric railway from Sampierdarena to Rome. A powerful electric central station will be erected for this purpose at Sampierdarena, and it is further said that the company will soon be in the market for 23 electric locomotives for this new road.

The imports of electric machinery into Italy are steadily increasing. In 1899 they amounted in value to 9,037,720 lire (about $1,807,400), as against only 4,856,890 lire ($971,200) in 1898. American manufacturers' share in this trade is still very unimportant, the chief countries of origin being Germany, Austria-Hungary and Switzerland.

Street Railway Accountants' Association.

The annual meeting of the Street Railway Accountants' association is to be held simultaneously with that of the American Street Railway association at Kansas City this week. The following-named papers and reports are upon the programme: "What Does the General Manager Want to Know from the Accounting Department?" by C. D. Wyman of Boston, lately general manager of the New Orleans City Railroad company; "The Routine of a Street-railway, Electric and Gas-lighting Company," by C. O. Simpson, auditor of the Augusta Railway and Electric company of Augusta, Ga.; report of committee, "Is a Standard Unit of Comparison Practicable?" by the chairman, H. C. Mackay, comptroller of the Milwaukee Electric Railway and Light company of Milwaukee, Wis.; "Department Accounts," by H. L. Wilson, auditor of the Boston Elevated Railway company, of Boston; "Material and Supply Accounts," by W. M. Barnaby, accountant of the Brooklyn Rapid Transit company, of Brooklyn, N. Y.; report of the standing committee on "A Standard System of Street-railway Accounting," by the chairman, C. N. Duffy, auditor of the Chicago City Railway company of Chicago.

American Street Railway Association.

The programme for the nineteenth annual meeting of the American Street Railway association this week is an interesting and varied one. As this issue of the Western Electrician is prepared several days in advance of its date, the convention must be treated here as a future event, although the meeting will be in full swing by the time this number is in the hands of most of the readers. The sessions of the association are to be held in Convention Hall, Kansas City, the large structure herewith illustrated, which so rapidly replaced an older building, destroyed by fire, in order to be ready for the Democratic national convention. The hall is at Thirteenth and Central streets, and also contains the extensive display of street-railway exhibits, a diagram of which is shown. The programme is arranged as follows:

DANIEL B. HOLMES.

TUESDAY, OCTOBER 16TH.

11 a. m. Meeting called to order by John M. Roach, president.

Address of welcome.

Calling of the roll.

Invitation extended to join the association.

Address of the president.

Report of the executive committee.

Report of T. C. Penington, secretary and treasurer.

Paper—"Consolidation of Street Railways and Its Effect Upon the Public," by Daniel B. Holmes. Mr. Holmes is counsel for the Metropolitan Street Railway company of Kansas City, a member of the law firm of Holmes & Perry, and one of the leading attorneys of Kansas City.

8:30 p. m. Reception at the Midland Hotel.

CONVENTION HALL AT KANSAS CITY.

WEDNESDAY.

Convene at 10 a. m.

Paper—"A Comparison of the Various Systems of Electrical Distribution for Street Railways," by C. F. Bancroft. Mr. Bancroft is electrical engineer of the Massachusetts Electric Companies of Boston. He is a graduate of the old Edison General company and has done engineering work for the Royal Electric company of Montreal and the Lowell and Suburban Street Railway company of Lowell, Mass. He was appointed to his present position in May, 1899.

Paper—"Painting, Repainting and Maintenance of Car Bodies," by F. T. C. Brydges. Mr. Brydges is superintendent of car shops for the Chicago Union Traction company and is thoroughly well versed in the subject of which he treats.

Appointment of committee on nomination of officers and selection of next place of meeting.

2 p. m. Trip to Armour's meat-packing establishment.

8 p. m. Theater party.

THURSDAY.

Convene at 10 a. m.

Paper—"Double-track Cars: How to Equip Them to Obtain Maximum Efficiency under Varying Conditions," by N. H. Heft. Mr. Heft is an old steam-railroad man and president of the Meriden Street Railway company of Meriden, Conn.

C. F. BANCROFT.

Paper—"The Storeroom and Storeroom Accounts," by N. S. Hill, Jr., general manager of the Charleston Consolidated Railway, Gas and Electric company of Charleston, S. C.

Election of officers for ensuing year.

1:30 p. m. Trip to Fort Leavenworth, Kan., over the Missouri Pacific railroad.

FRIDAY.

The entire day is to be given to the examination of the exhibits which are shown to members and visitors by the supplymen.

Friday is also ladies' day. The ladies will be taken to the principal stores and other points of interest.

7 p. m. Annual banquet at the Coates House. The installation of the officers-elect will take place at the banquet.

OFFICERS AND COMMITTEES.

The officers of the American Street Railway association for 1899-1900 are: President, John M. Roach, president Chicago Union Traction company, Chicago; first vice-president, John A. Rigg, president United Traction company, Reading, Pa.; second vice-president, Herbert H. Vreeland, president Metropolitan Street Railway company, New York; third vice-president, Frank G. Jones, vice-president Memphis Street Railway company, Memphis, Tenn.; secretary and treasurer, T. C. Penington, treasurer Chicago City Railway company, Chicago; executive committee, president, vice-presidents and Charles S. Sergeant, vice-president Boston Elevated Railway company, Boston; Nicholas S. Hill, Jr., general manager Charleston Consolidated Gas and Electric company, Charleston, S. C.; Charles W. Wason, president Cleveland, Painesville and Eastern Railway company, Cleveland; John R. Graham, president Quincy and Boston Street Railway company, Quincy, Mass.; Walton H. Holmes, president Metropolitan Street Railway company, Kansas City.

F. T. C. BRYDGES.

Local committee on entertainment and banquet—W. H. Holmes, chairman, president Metropolitan Street Railway company; L. E. James, vice-president Metropolitan Street Railway company; D. B. Holmes, counsel Metropolitan Street Railway company; Frank Hagerman, counsel Metropolitan Street Railway company; J. K. Cubbison, attorney; Frank Walsh, attorney Metropolitan Street Railway company; W. E. Kirkpatrick, secretary and treasurer Metropolitan Street Railway company; H. W. Wolcott, general manager Kansas City-Leavenworth Railway company; A. A. Lesueur, managing editor Kansas City Times; H. Fleming, managing editor Kansas City Journal; A. M. Hopkins, managing editor Kansas City World; C. A. Snider, vice-president Evans-Snider-Buel company; U. S.

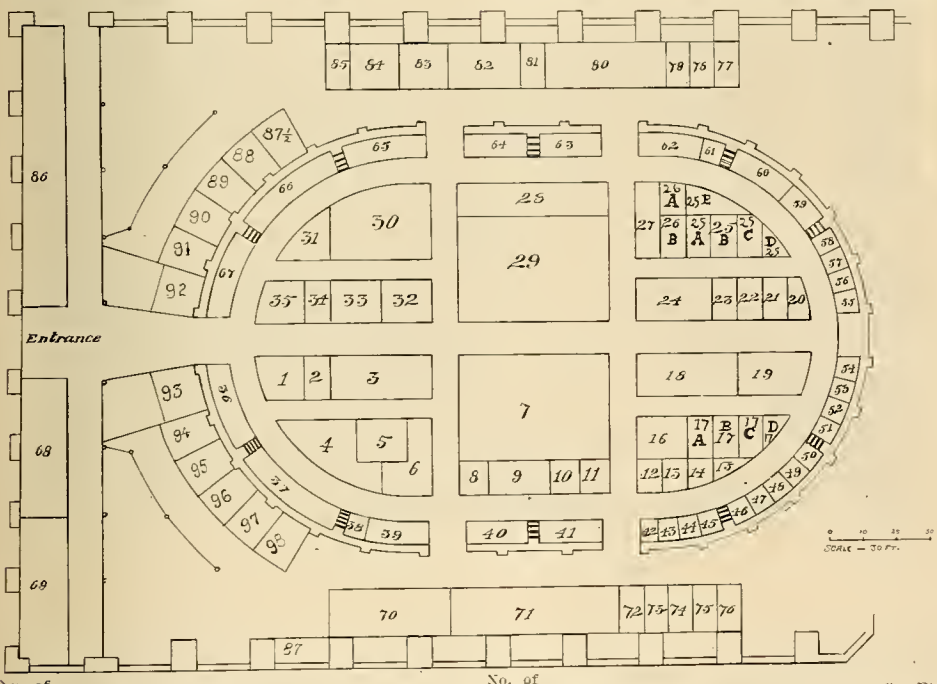


DIAGRAM OF EXHIBIT SPACES AND LIST OF EXHIBITORS AT KANSAS CITY CONVENTION.

No. of Space.	Name of Exhibitor.	Sq. Ft.
5	Adams & Westlake Company, Chicago	200
22	American Railway Supply Company, New York	100
28, 71	American Car and Foundry Company, St. Louis	1,200
13	American Brake Shoe Company, Chicago	100
32	American Steel and Wire Company, Chicago	150
16	Atlas Railway Supply Company, Chicago	200
17D	Auto Appliance Company	50
10	Bierbaum and Merrick Metal Company, Buffalo	100
66	B. R. Electric Company, Kansas City	120
18	Brown, Harold P., New York	400
45	Burnham and Duggan Railway Appliance Company	40
62	Chicago Mica Company, Valparaiso, Ind.	120
21	Chisholm and Moore Manufacturing Company, Cleveland	400
30	Christensen Engineering Company, Milwaukee	800
50	Compressed Air Company, New York	500
32	Consolidated Car Heating Company, Albany	200
15	Continuous Rail Joint Company, Newark, N. J.	50
38	Cramer, J. W.	50
25A, 25B	Crane Company, Chicago	200
84	Creaghead Engineering Company, Cincinnati	200
6	Curtain Supply Company, Chicago	300
31	Cutler-Hammer Manufacturing Company, Milwaukee	150
12	Diamond State Steel Company, Wilmington, Del.	100
37	Dixon Crucible Company, Jos., Jersey City, N. J.	200
34	Electrical Review, New York	100
9	Garl Electric Company, Akron, Ohio	200
33	Garton-Daniels Company, Keokuk, Iowa	200
91	Garton, W. R., Company, Chicago	120
29	General Electric Company, Schenectady	1,500
19	Gold Street Car Heating Company, New York	300
26B	Griffin Wheel Company, Chicago	400
39	Ham Sandbox Company, Troy, N. Y.	120
17C	Heywood Brothers and Wakefield Company, Wakefield, Mass.	100
66	International Register Company, Chicago	200
3	Kansas City Car and Foundry Company, Kansas City	400
93, 94	Kinnear Manufacturing Company, Columbus, Ohio	270
26	Leschen, A., Sons Rope Company, St. Louis	100
86	Lorain Steel Company, Lorain, Ohio	1,600
85	Magann, G. P., Air Brake Company, Detroit	100
27	Manville Covering Company, Chicago	200
87	Cardell, J. R., & Co., Trenton, N. J.	120
24	McGill, Porter & Berg, Chicago	300
72, 73, 74, 75, 76	McGuire Manufacturing Company, Chicago	500
36	McRoy, John T., Chicago	160
95	Mercantile Lumber and Supply Company	120
83	Merritt Electric Air Brake Company, New York	200
26A	Meyer Cord Company, Chicago	70
23	National Lead Company, St. Louis	100
17½	Newcomb, F. H.	100
65	New Haven Car Register Company, New Haven	160
4	Ohio Brass Company, Mansfield, Ohio	400
79	Paige Iron Works, Chicago	100
8	Pantasote Company, New York	100
35	Partridge Carbon Company, Sandusky, Ohio	40
68, 69	Peckham Truck Company, New York	1,000
64	Phenix Metallic Packing Company	120
67	Pittsburg Reduction Company, Cleveland	160
59	Pomeroy & Fisher, New York	80
40	Ridlon, Frank, Company, Boston	120
54	Spiral Journal Bearing Company, St. Louis	50
11	Standard Underground Cable Company, Pittsburg	100
60	Star Brass Works, Kalamazoo, Mich.	120
1	Street Railway Review, Chicago	200
35	Street Railway Journal, New York	200
46, 47, 48, 49, 50	Sterling Manufacturing Company, Chicago	200
42, 43, 44	Tramway and Railway World, London	120
88, 89, 90	Walworth Manufacturing Company, Boston	360
14	Weber Rail Joint Company, Chicago	100
2	Western Electrician, Chicago	100
7	Westinghouse Electric and Manufacturing Company	1,500
82	Wharton, William, Jr., & Co., Philadelphia	300
81	Wheel-truing Brake Shoe Company, Detroit	100
41	Wood, Charles N., Boston	120

Epperson, manager George Fowler Packing company; Hugh C. Ward, attorney-at-law; James McGowan, manager Barber Asphalt Paving company; R. L. Gregory, president Gregory Grocery company.

Reception and ladies' committee—C. F. Holmes, chairman, general manager Metropolitan Street Railway company; John A. Brown, manager Equitable Life Assurance society; G. T. Stockham, manager Midland Hotel; C. F. Morse, general manager Kansas City Stock Yards company; W. H. Lucas, attorney-at-law; H. H. Meday, manager Kansas City Car and Foundry company; W. T. Osborne, manager Electric Supply company; John W. Speas, secretary and treasurer Monarch Vinegar Works; F. C. Peck, president Stewart-Peck Sand company; Henry Evans, president Evans-Smith Drug company; Robert M. Goodlett, broker; S. H. Velie, treasurer John Deere Plow company; James A. Reed, mayor; Lathrop Karnes, assistant to president of the Kansas City Electric Light company; Harry Friedberg, division superintendent of the Kansas City Electric Light company; Hugh McGowan, president Kansas City Gas company; Mrs. C. F. Holmes, Mrs. G. T. Stockham, Mrs. W. H. Holmes, Mrs. W. A. Satterlee, Mrs. J. H. Durkee, Mrs. A. M. Crow, Mrs. W. E. Kirkpatrick.

Exhibit committee—W. A. Satterlee, chairman, general superintendent Metropolitan Street Railway company; C. W. Waddell, manager Fairmount Park; J. P. Loomas, manager Convention Hall; H. C. Schwitzgebel, purchasing agent Metropolitan Street Railway company; R. E. Richardson, consulting engineer Kansas City Electric Light company and Metropolitan Street Railway company; F. M. Bernardin, B. & R. Electric company.

Information bureau committee—John O'Keefe, chairman, Metropolitan Street Railway company; J. A. Harder, assistant secretary and treasurer Metropolitan Street Railway company; E. R. Royer, B. & R. Electric company; J. W. Mason, manager Electric Supply company.

Chicago Street-railway Affairs.

A statement has appeared to the effect that a syndicate has applied to the Street Railway Commission of Chicago for a blanket franchise, covering all the territory now occupied by the Union Traction company and the Chicago Street Railway company. In return the city is said to have been offered a flat three-cent fare. Although the commission has at various times received numerous proposals for settling the traction problem, it has no knowledge of this alleged proposal, which seems to be merely a newspaper fabrication.

In an opinion which Mr. C. L. Bonney, general counsel of the Chicago General Railway company, has submitted to Corporation Counsel Walker, it is maintained that the City Council can grant at any time, to any responsible company, the right to lay tracks and operate the same on any street, irrespective of any preference for a particular company expressed by the property owners. As a practical solution of the Chicago traction situation, Mr. Bonney holds that it is not necessary to dispute the existing rights of the old companies. It is sufficient, he thinks, for the council to make the best terms possible with a new corporation, provided the city is not yet ready for municipal ownership.

The Metropolitan West Side Elevated Railway company of Chicago has issued a very creditable booklet entitled "Metropolitan Scenes and Service." Several typical boulevard, park and suburban views of the West Side of Chicago are presented, together with a statement concerning the growth of that district since the Metropolitan system has been in operation. The advantages of residing on the West Side are also pointed out. Under the heading "Metropolitan Location and Service" is given a popular and interesting description of the road and equipment, and the prospective extensions of the company. Instructions for reaching the depots, docks and principal buildings in the city from the Metropolitan company's lines are given in the back of the booklet.

President Roach of the Union Traction company of Chicago is quoted as saying that the company is ready to expend $1,000,000 in supplying its North Side lines with electric equipment, just as soon as the City Council sees fit to grant the necessary concessions. "The future of street-railway service," he said, "rests in electricity, and as soon as this fact is realized and put to a test street-car patrons will get the accommodations they are demanding." An electric equipment would mean a rearrangement of the downtown loops. In cases where poles are objectionable the span wires would be attached to ornamental hooks, fastened to adjoining buildings. Feed wires around the downtown loop would be placed under the elevated railway spans, feeding the entire circuit in this way. President Roach is of the opinion that an underground feeding system is not practicable in Chicago.

The Chicago Union Traction company has secured a permit to extend its West North avenue line from Fortieth to Forty-eighth avenue, and expects to complete the work within 30 days. A large number of laborers live in that neighborhood and have long needed better transportation facilities. Considerable difficulty was experienced in securing the consent of the council for the extension of the line.

The City Council of Matanzas, Cuba, is now advertising for bids for an electric-lighting and an electric-railway franchise.

East Side Electric Railway in Kansas City.

The history of the franchise owned by the East Side Electric Railway company of Kansas City, operating what is popularly known as the "Heim Line," is an interesting one. Part of the franchise, covering about 1¼ miles of the downtown section of the present road, was originally owned by a company which operated a horse-car line. About 1886 the line was converted into an electric railway, making it one of the earliest electric roads in the western states. Two horse cars were converted into trolley cars by placing on one platform of each car a generator changed to operate as a motor. The motor drove one of the car axles by means of a large sprocket chain. Current was taken from an overhead wire by means of a flexible cable attached to the top of the car, the upper end of the cable being connected to a small two-wheeled trolley which traveled on the trolley wire. The system was operated on a 300-volt circuit. The following year two more horse cars were fitted up for electrical operation, the motors in this case being suspended under the cars. These cars were operated for some little time, but they made so much noise and the service was so unsatisfactory that the city authorities took the matter in hand and declared the road a public nuisance. The company was then compelled to stop operating its line, nearly as much to the satisfaction of the management itself as to the public. When the electric cars were taken off a steam dummy was substituted, and this was operated at considerable loss until the fall of 1888, when traffic on the road was discontinued.

EAST SIDE ELECTRIC RAILWAY IN KANSAS CITY.—VIEW IN ELECTRIC PARK

A few years ago the Heim brothers, proprietors of the Ferd. Heim Brewing company, secured control of the original franchise and also a franchise for an extension of the old line, and organized the East Side Electric Railway company. The present road was then built. It extends from the City Market and City Hall at Walnut and Fifth streets over Fifth street, Lydia, Guinotte and Montgall avenues to Nicholson avenue in the East Bottoms, the general direction of the road being northeast. The line, which is double track and 3½ miles long, was opened for service on November 8, 1899. The route of the road is indicated on the map (page 999) by the broken line.

Electric Park, an amusement resort conducted by the Electric Park Amusement company, a corporation closely allied with the management of the East Side Electric Railway company, was the chief drawing card for the railway during the last summer. This park is situated at Rochester and Montgall avenues, near the end of the line. It is entirely an artificial park, but the grounds have been artistically laid out and ornamented with shrubbery and plants, the general effect being very pleasing, especially at night, when the park receives its greatest patronage. The accompanying illustration is a view of the grounds taken from the top of the park theater. In the foreground is seen an electric fountain, which is operated each night during the summer season. At the right in the distance can be seen some of the buildings at the entrance to the park on Montgall avenue. Besides the electric fountain and summer theater, where a vaudeville performance is given each evening during the season, the park contains a German garden, restaurant, bowling alley, vitascope theater, band pavilion and a number of other smaller park buildings. The entrance and grounds are brilliantly lighted at night with incandescent and arc lamps.

An admission fee of 10 cents is charged to enter the park, an additional charge being made for seats in the theater. During the summer season, from June 3d to September 9th, there were 273,700 paid admissions to the park. A total of 31,800 people paid for entrance to the grounds during the last week, the attendance on the last day being 6,650. Practically all these people were carried by the Heim line for a distance of over three miles in 14 cars, without injuring a single passenger. Since the road was opened last November the East Side company has had to pay out but $40 for damages resulting from the operation of the cars.

The large brick building shown in an illustration on this page is used as a car barn and power house, and it also contains the offices of the company. It is 85 feet wide and 120 feet long. The engine room and the boiler room are on the opposite side of the building from that shown in the picture. They have the respective floor dimensions of 68 by 35 feet and 37 by 37 feet. In the engine room, illustrated herewith, are a Siemens & Halske 200-kilowatt, 500-volt, direct-current generator directly connected to a 350-horsepower simple Corliss engine made by the St. Louis Iron and Machine Works, two D-62 80-kilowatt, Thomson-Houston dynamos, belted to a 200-horsepower Armington & Sims engine, and an old Siemens & Halske 90-kilowatt, L-H-21 machine and a 20-kilowatt Edison bipolar generator, both belted to another 200-horsepower Armington & Sims engine. The two generators last mentioned are 110-volt machines and are used to furnish current for lighting Electric Park. The boiler equipment consists of two fire-tubular boilers of 350 and 200 horsepower respectively, made by the John O'Brien Boiler Works of St. Louis.

The storage room in the car barn has four tracks and will accommodate 12 40-foot cars. The door opening over the tracks is 44 feet in width and is free from posts, the doors being hung on a track and sliding back side by side. Cars can be run in and out of the barn without removing the trolley arm from the trolley wire, as the top of the door is on a level with the wire. Wire conductors, looped over the tracks from which the doors are suspended, connect the trolley wires within and outside of the barn.

A frame building, 50 feet wide and 85 feet long, is situated in the rear of the car barn, and is used for storing some cars and also for general storage purposes. In one corner of this building is a sand drier, used to dry the sand used in the sand-boxes of the cars. The drier consists of a tall, rectangular box with a few coils of steam pipe near the bottom. In ordinary operation the wet sand is shoveled in at the top and drawn out at the bottom, the operation being repeated until the sand is thoroughly dried. This working over of the sand a number of times is necessitated by the fact that the steam coming from the wet sand in the vicinity of the steam pipes rises and keeps the sand above wet.

To obviate this difficulty, W. O. Hands, manager of the Heim line, devised a simple arrangement which consists in placing several pipes, open at both ends, vertically in the box, the lower ends resting on the steam coils, while the other ends protrude from the top of the box. By this device the wet steam passes up through the pipe flues and escapes, thus making it necessary to pass the sand through the drier but once or twice to dry it thoroughly.

The Heim line consists of seven miles of single track of standard gauge. The maximum grade on the road is 5¼ per cent. Johnson 82-pound girder

EAST SIDE ELECTRIC RAILWAY IN KANSAS CITY.—INTERIOR OF CAR.

rails are used. They are laid on wooden ties, which rest on three inches of broken rock, the remainder of the roadbed being filled with concrete up to within four inches of the top of the rail. The overhead construction consists of a No. 0 trolley wire and the ordinary span suspension with wooden poles. The feeder circuits consist of 1¾ miles of 400,000 circular-mil and three-fourths mile of No. 0000 weatherproof wire.

The rolling stock of the company includes what are said to be the handsomest and most expensive passenger motor cars used for regular daily service in the country. When the order was given to the St. Louis Car company for their construction no limitation was placed upon the amount that they should cost. The illustration on the next page gives but an imperfect idea of the richness of the interior of one of the cars. There are six of these closed cars, and each has a separate smoking compartment at one end. The decorations on the ceiling, partition and ends of the car are all hand-carved in graceful designs, the finish throughout being solid mahogany. French plate glass is used for the windows, as well as for the mirrors at the ends and along the sides of the cars. Light at night is furnished by three handsome five-light chandeliers, the lower lamp of each cluster being enclosed in a twist-bulb opalescent shade. The seats are covered with leather and are finished with brass trimmings. The cars cost $3,950 each. They are 40 feet over all and seat 40 passengers. During the summer some of the cars carried as high as 165 people with the platform gates closed. These gates are of the Goodrich safety type and are opened and closed by the motorman. Each car is equipped with two 35-horsepower, No. 49 Westinghouse motors, mounted on St. Louis maximum-traction double trucks. The brake is operated by a vertical hand-wheel, mounted in front of the motorman. This wheel, which is connected to the brake spindle by bevel gearing, Mr. Hands claims to have originated.

Additional car equipment consists of eight 30-foot open single-truck cars. These cars seat 40 people each, and are fitted with two 25-horsepower, No. 3 Westinghouse motors. During the summer season all 14 cars are operated on a schedule of 36 minutes for the round trip. On the winter schedule only five cars are operated, the time for the round trip being 45 minutes. Transfer facilities provide for transfers between certain lines of the Metropolitan street-railway system and the Heim line, the transfers being simply accepted by both managements as passes, without financial consideration.

The East Side Electric Street Railway company has an authorized capital stock of $250,000, and is officered as follows: President, Joseph J. Heim, president of the Ferd. Heim Brewing company; vice-president, Michael G. Heim; secretary and treasurer, Ferd. Heim, Jr.; purchasing agent and manager, W. O. Hands; chief engineer, W. J. Morgan; chief electrician, Harry Turner; master mechanic, Joseph Woods. The company is about to build an extension of four miles of double track east from the present terminus. A racetrack will be the drawing attraction at the eastern end of the new extension.

Rotary Converters for Mine Traction.

By Alton D. Adams.

It has been the custom to install at least two kinds of generators to supply the electric energy required in mines. Direct-current dynamos have been extensively used for lighting, stationary motors and electric cars. The voltages, at which these direct-current machines have operated, have usually been 125 or 250 on the lighting circuits, and 250 or 500 volts on the stationary motor and traction lines. As the radius of operation from electric plants in connection with mines has extended, the limits of 125 or 250 volts, arising from the use of incandescent lamps at about 110 volts, have tended to make direct-current distribution for lighting purposes uneconomical in point of copper.

To keep down the weight of lighting conductors over considerable distances, alternating-current service with transformers has come into quite general use in electric systems for mines. In some cases a part or all of the stationary electric motors in mines are being operated from the same two or three-phase alternating generators that supply the lamp circuits, while at other plants the direct-current equipment of stationary motors is retained wholly or in part. At all mines where the traction system is operated electrically, however, direct-current motors are in use on the cars or locomotives, because no satisfactory alternating motor has yet been developed for this class of work.

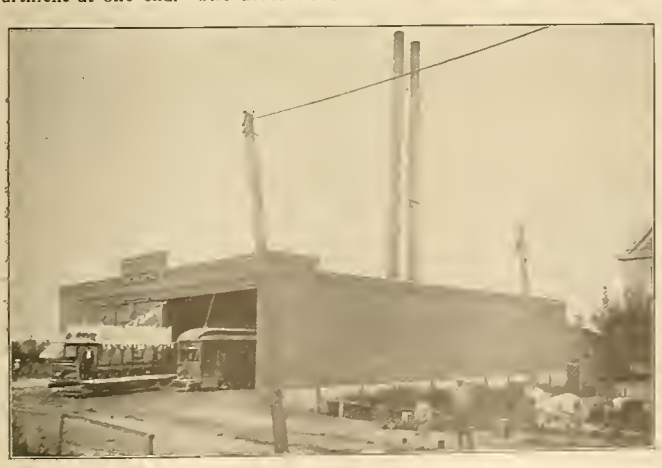
The several requirements just noted have generally been met by alternating dynamos operating at several thousand volts, for lighting, with or without stationary motors, and by direct dynamos of 250 or 500 volts for traction and perhaps stationary motors besides. Two particular disadvantages attach to this combined electric-generating equipment for mining plants. One of these is the fact that in no case can either the direct or alternating dynamos be shifted as to their respective loads or operated in multiple with each other. The other disadvantage arises from the necessary relation between distance and the pressure of operation on the one hand and the danger to life of high voltages for traction systems in mines on the other.

Plants for electric traction in mines have usually been installed for either 250 or 500 volts' pressure between the trolley line and its feeders and the rails, which form the return circuit. The lower of these voltages gives but little trouble so far as injury to persons or mules is concerned, while many serious and even fatal accidents have occurred where the higher pressure was in use. The peculiar liability to accidents from electric-traction circuits in mines is due to conditions as to head-room, which are such that the trolley wire and its feeders must often be placed within easy reach. As the trolley wire must be a bare conductor, and its feeders are uninsulated in many cases, the man or beast that touches either, while standing on the rails or earth, is subject to nearly the total voltage of the system.

The very material objection to the 250-volt pressure for traction work is that the economical radius of operation with it as to either loss of energy in the line or the first cost of conductors is about one mile from the generating plant. In the case of coal mines, where power is very cheap, an exceptionally large loss in conductors may in some cases warrant the extension of 250-volt traction service to more than one mile from the generating station, but another objection here arises because of the great variations of pressure at the motor terminals. All other factors remaining constant, the radius of economical distribution is four times as great for the 500-volt as for the 250-volt traction system, since the distance for the same amount of transmitted energy, loss and weight of conductors varies as the square of the voltage employed. These advantages of wide service area or low first cost of conductors have been quite effective for the introduction in mines of 500-volt traction systems.

In addition, however, to the dangers to men and animals, the difficulties incident to a fair working degree of insulation are not inconsiderable in mines where there is much moisture.

Rotary converters make it not only possible but practicable to avoid both the disadvantages incident to different classes of generating apparatus and those that result from a high working pressure on lines interior to mines. These desirable results are reached through the adoption of three-phase alternating dynamos for the entire electric-generating equipment at the power station. Such dynamos are operated in multiple, at a voltage suited to the area of distribution, and either of them can supply any part of the load of lamps, stationary motors or electric cars and locomotives. Lighting circuits in mines require only transformers to transfor their energy from the high-pressure lines of distribution. As induction motors are satisfactory for most stationary purposes and have some especial advantages for mine work, owing to the absence of commutators, they will generally be supplied through transformers, where the main generators are all of the alternating type. The traction motors must have the direct current, and here is the point at which the rotary converter makes the whole system possible. Just as transformers are located at or near the entrances to mines, for the supply of local lamp or stationary-motor circuits, so other transformers and with them rotary converters may be located to supply the electric-traction system with direct current at any desired voltage. The nearness of the rotary converters to their particular parts of the traction system renders a high voltage at their terminals unnecessary and 250 volts will usually give all necessary economy of conductors.



Car Barn and Power House.

Engine Room.

EAST SIDE ELECTRIC RAILWAY IN KANSAS CITY.

Western Electrician.

EVERY SATURDAY.

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CONVENTIONS AND EXPOSITIONS.

Automobile Show, New York, N. Y., November 10th to 24th.
Illinois State Electric association, Peoria, November 27th.
Roentgen Society of the United States, New York, N. Y., December 13th and 14th.

This number of the Western Electrician is issued a few days in advance of the usual time of publication and devoted largely to articles descriptive of the street railways of Kansas City in honor of the annual meeting of the American Street Railway association, held in that city this week. At this writing the convention has not been held, but it promises to rank with its 18 predecessors as a gathering making for instruction and usefulness. Following the association's sensible custom, only a few papers are to be read, but the topics for these are well selected, and they should elicit a valuable discussion. The exhibition of street-railway appliances held in connection with the meeting, and a very valuable adjunct to it, will be extensive and representative, and will show the new things and the improved apparatus of the year. The attendance promises to be large, although it is hardly to be expected that it will reach the 2,000 mark of last year. In all respects, a good convention is anticipated.

The far-reaching consequence of an apparently unimportant accident was demonstrated in a striking manner in Manchester, England, last month. Some repairs were in progress in the telegraph department of the Postoffice, and a workman was using a spirit lamp near the test board. The lamp burst, and in a moment the dry woodwork and the inflammable coverings of the wires were ablaze. The fire spread with great rapidity, and the firemen did not master the flames before the roof had fallen in and the telegraph instruments were so completely wrecked as to cut off the city from telegraphic communication with the rest of the world. The collection of wires erected over the building was, of course, dislodged from its supports, and a large number of lines were not merely interrupted, but absolutely destroyed. To some extent the telephone service was crippled also, for the English Postoffice does both a telegraph and a telephone business, and the fire originated at the point where all the wires converged.

Manchester is the telegraphic center for the North of England, and as the city is said to have been absolutely isolated from the rest of the world, telegraphically, for several days, the effect of the spirit-lamp fire was far-reaching. To add to the confusion, the chief electric-light plant of the town broke down on the evening of the day of the fire: but this, of course, was merely an unfortunate coincidence. In the case of the Postoffice fire the morals of non-wooden construction in switchboards, test boxes and the like, and of the avoidance of the use of the spirit lamp or gasoline torch in critical position, are, of course, obvious; but it may also be pointed out that if England had telegraphic competition, Manchester would not have been isolated. In the United States a similar accident could lead to no such serious results in any important city.

The Metropolitan street-railway system of Kansas City, despite the fact that it comprises several cable lines operated by separate power houses at a considerable loss in economy, has, as may be judged by the exhaustive description in this issue, many interesting features that command attention. The topographical characteristics of the city have presented many difficulties not commonly met with in ordinary street-railway construction, requiring competent civil engineering to build many of the lines where gorges and rivers were to be crossed and where steep bluffs were to be surmounted or tunneled. Electricity has only within the last four or five years begun to play any considerable part in the operation of the lines. The system is in the active stage of transition from cable to electricity, the electric lines now comprising over two-thirds of the present mileage. Current is furnished by two electric power houses, while six mechanical or cable plants are still operated in different parts of the city. A general plan is now under consideration by the management by which the remaining cable lines, excepting the one passing over the 18½ per cent. incline to the Union Depot, will be changed for electric operation. This transition will place over 160 miles of track under electrical operation, and additional generating plant will be required. It is natural to conclude that the present Kaw River power house will be continued in operation, while a new station will probably be erected on one of the rivers and as near the center of the city as possible. This centralization of power at two plants would result in decreasing the large amount of copper used in the present network of feeders, while a great economy in station-operating expenses would be effected.

The Kaw River power house of the Metropolitan Street Railway company was some time ago given the fifth place in the list of economically operated electric-railway plants. To-day it is doubtful if the record of the station is excelled by any railway plant in the country. During the last year its previous good operation has been improved upon, the average cost for a kilowatt-hour at the switchboard for the first seven months of this year being 0.4115 cent. This figure approaches very closely to what is generally accepted to be the most economical operating expense for a modern steam power house of considerable size. It is possible that by the installation of mechanical draft and fuel economizers the Kaw River station could be operated a trifle more economically, but beyond that point any further improvement in design or machinery would doubtless involve such a large increase in first cost that the wisdom of the investment would be questionable.

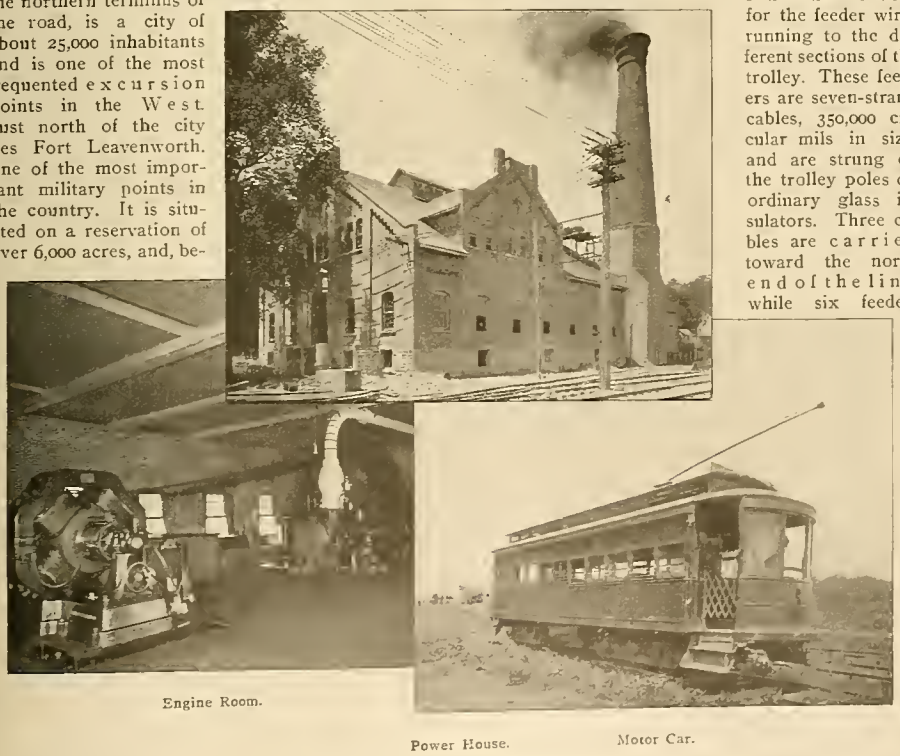
The use of electricity in agriculture falls into two distinct classifications—the transmission of power by electricity for farming operations and the application of electricity to stimulate the growth of plants. The former is comparatively recent; it dates from the common use of the electric motor and the spread of electrical ideas and electrical apparatus in connection with all kinds of work that is done or may be done by machinery. Only a few weeks ago the Western Electrician published an article based on the contributions of Mr. Paul Renaud to a French contemporary, in which the possibility of the displacement of much animal power by electrical energy on the farm, with examples, was considered. The subject is exciting more attention abroad than at home. A United States consul reports that in some parts of Germany considerable attention is paid to electrical appliances that can be used on the farm. Near Ochsenfurt, in Bavaria, a company composed of landowners and small farmers has been organized for the establishment of an electrical system for use on farms and in villages. The power is to be generated by steam and water and the current to be distributed from a central station to the places where it is wanted. Sub-stations are to be established at given points.

However, it will be noted that the idea that electric power may be made available on the farm is a characteristic of the present age, while the hope that electricity may be of practical value in stimulating plant growth has been the cause of experiment for a century and a half. The question is still undecided. A communication upon this subject made by a Russian engineer, V. A. Iyurin, before the St. Petersburg Electrotechnical society, contains some welcome information upon the work done in this direction in Russia by Mr. Sypeshneff and Mr. Krankoff. The former, repeating well-known experiments on electrified seeds, ascertained once more that such seeds germinated more rapidly and gave better fruit and better crops (from 2½ to six times greater) than seeds that had not been submitted to preliminary electrification. Repeating next the experiments of Ross—that is, burying in the soil one copper and one zinc plate, placed vertically and connected by a wire—he found that potatoes and roots grown in the electrified space gave crops three times heavier than those which were grown close by on a test plot; the carrots attained a quite unusual size, of from 10 to 12 inches in diameter. Spyeshneff's third series of experiments was more original. He planted on his experimental plot, about 10 yards apart, wooden posts provided at their tops with metallic aigrettes connected together by wires, so as to cultivate his plants under a sort of network of wire. He obtained some striking results, one of which was that the growth and ripening of barley were accelerated by 12 days. Quite recently Mr. Krankoff undertook a series of laboratory experiments upon boxes of soil submitted to electric currents. The temperature of the soil was raised by these currents; the moisture decreased first, but began to increase after a course of three weeks (the same increase of moisture was noticed years before by Fichtner); and, finally, the amount of vegetable matter in the soil was increased by the electric currents. With what is now known of the influences of micro-organisms upon vegetation, further research on similar lines is most desirable.

Kansas City-Leavenworth Electric Railway.

One of the most picturesque routes traversed by any electric railway in the West is that of the Kansas City-Leavenworth Railway company. This road, which was opened for traffic on January 16th last, runs from Grand View, at the western limits of Kansas City, Kan., in a generally northwestern direction, to the National Home for Disabled Volunteer Soldiers, about three miles south of Leavenworth. At the Soldiers' Home connection is made with a line of the Leavenworth Electric Railroad company (owned by practically the same interests as the Kansas City-Leavenworth company), over whose tracks the interurban company's cars are run to the center of the city of Leavenworth. The southern terminus of the road is reached from Kansas City, Mo., by the Grand View branch of the Kansas City elevated railway, operated by the Metropolitan Street Railway company. The Grand View cars, which are electrically operated, leave the corner of Grand avenue and Eighth street, in Kansas City, Mo., every half hour, pass through the Eighth street tunnel, over the elevated structure and across the Kaw or Kansas River, and thence through Kansas City, Kan., to Grand View, where a comfortable waiting room is maintained for patrons of the interurban line. The beginning of the Leavenworth line is indicated on the map (page 244) by a dot-and-dash line.

The ride on the Kansas City-Leavenworth line is a very pleasant one in summer time. Between Grand View and Wolcott, 12 miles distant, the road passes through a rich farming district and some of the largest apple orchards in Kansas. The road winds around wooded hills and through valleys, and at one point skirts the foot of a high sandstone cliff. Beyond Wolcott the line runs nearly parallel to the Missouri River for a distance of about three miles, affording a splendid view of that stream. A few miles further north at Lansing the line reaches the Kansas State Penitentiary, passing close to the main entrance. The next point of interest reached is the National Soldiers' Home, surrounded by grounds about 700 acres in extent. Leavenworth, the northern terminus of the road, is a city of about 25,000 inhabitants and is one of the most frequented excursion points in the West. Just north of the city lies Fort Leavenworth, one of the most important military points in the country. It is situated on a reservation of over 6,000 acres, and, besides the barracks, riding school and other fort buildings, contains the United States War College and the military prison. A new federal penitentiary, the first in the country, is building on the reservation. So, with all these points of interest along its route and with the two Kansas Cities to draw from, the advantages afforded by the Kansas City-Leavenworth railway may be easily understood.



Engine Room. Power House. Motor Car.

KANSAS CITY-LEAVENWORTH ELECTRIC RAILWAY.

When one considers the engineering features and the equipment of the road some interesting points present themselves. From the Grand View station in Kansas City, Kan., to the Soldiers' Home the line is 22 miles in length and consists of a single track. Six turnouts are provided at present, but it is the intention of the management soon to put in several long turnouts so as to give nearly a double-track service. A standard steam-railroad track construction has been adopted throughout. Most of the road has been rock-ballasted, and in a short time the rock ballasting will be completed over the entire track. There are many curves in the line and they are all constructed so that they can be taken by a car at a speed of 45 miles an hour. Standard American section of T-rail, weighing 60 pounds to the yard, is used throughout. The rails are laid on white-oak ties, with two-foot centers. Protected bonds are used, the rails being cross-bonded every half mile.

The overhead construction is of the bracket type, with wooden poles, except at curves, where side poles and span wires are used. The road is equipped with two trolley wires of the figure-8 type and No. 000 in size. All the overhead material, excepting the trolley wire, was furnished by the Ohio Brass company.

At Wolcott are located the company's power house, car barns and offices. The power house, shown in the accompanying illustration, is a large brick and stone building, and has been designed to accommodate considerable additional power equipment, as may be needed in the future. It is divided east and west by a partition wall, the south portion being occupied by the engine room, while the north portion is given up to the boiler room. Installed in the engine room, as shown in the picture, is a Hamilton-Corliss simple non-condensing engine, 32 by 54 inches in size and rated at 1,000 horsepower. It is belted to a shaft upon which are mounted two 300-kilowatt, 550-volt General Electric generators, one of which is shown in the illustration. Each of the generators is connected to the shaft by means of a Hill friction clutch. The flywheel of the engine is 22 feet in diameter and the belt is five feet in width and has a length of 140 feet. The company is now installing a 400-kilowatt, Siemens & Halske generator, which will be directly connected to a 28 by 48-inch Bates-Corliss engine.

A five-panel, black-slate switchboard at the south end of the engine rom consists of two generator and two feeder panels, with the necessary instruments and switches, the center panel being left vacant for wattmeters and additional instruments. Aluminum is used for the feeder wires running to the different sections of the trolley. These feeders are seven-strand cables, 350,000 circular mils in size, and are strung on the trolley poles on ordinary glass insulators. Three cables are carried toward the north end of the line, while six feeders are carried south. The picture of the power house shows the feeders. The cables are bare and the joints are made by means of a mechanical splice. They are said to have given excellent satisfaction thus far, and the officers of the company believe that, all points considered, they are better than copper feeders.

The boiler-room equipment consists of four Sterling water-tube boilers of 250 horsepower each, a Berryman closed feed-water heater and a Hoppes live-steam purifier. The boilers are connected to a 150-foot brick stack. The coal, which is fed into the boilers by hand, is delivered to the boiler-room floor by gravity from overhead bins. These bins are filled from cars that reach the power house by means of an inclined track built on a bank to the west of the building. The feed water is taken from a reservoir made by damming a nearby creek. It is filtered by passing through three courses of brick, and is then carried to the power house by gravity, the fall being four feet. A tank just outside the building serves as a pump basin to take the water hammer off the pipe line that runs to the dam. The water is pumped into the purifier, from which it is fed to the boilers by gravity. The steam-pipe line from the boilers to the engine includes a U-bend, which allows for expansion and contraction and makes unnecessary the use of an expansion joint. The steam line is provided with an automatic drip apparatus connected with an Anderson trap.

The rolling stock of the road comprises nine 20-ton closed motor cars, built by the American Car company of St. Louis. The cars, one of which is shown in the group picture, are equipped with four 50-horsepower, No. 34 Lorain motors, mounted on Peckham double trucks, and have a maximum speed of 45 miles an hour. The car wheels are of the standard steam-railroad type, with 4¼-inch tread and deep flange, and are thus suitable for taking the curves of the road at high speed with safety. Each car is 42 feet in length over all, and has a seating capacity for 44 passengers. Smoking compartments are provided at one end of the cars.

HERBERT W. WOLCOTT, GENERAL MANAGER KANSAS CITY-LEAVENWORTH LINE.

The McGann storage-air system is used on the cars to operate the air brakes and also air whistles. A compressor in the power house at Wolcott supplies the compressed air, the pressure in the storage tanks on the cars being between 300 and 350 pounds. The brake pressure is carried at about 40 pounds. This air-storage system has given excellent satisfaction and is free from the noise caused by the motor-driven air compressors carried on the cars in other systems. The cars are provided with electrically illuminated signs, denoting their destination, mounted below the windows of the vestibules on the ends of the cars. They are also equipped with electric heaters. It is the intention of General Manager H. W. Wolcott to equip the cars with acetylene-gas headlights, as he is firmly convinced of their greater usefulness as compared with electric headlights.

The regular schedule of the Kansas City-Leavenworth line provides a car leaving each terminus every hour. On Sundays and holidays a half-hour schedule is in force. An express-package service is provided, the express car leaving each end of the line every three hours. At present the express business of the company is small, but when suitable terminal facilities are obtained it is expected that this branch of the traffic will be greatly increased and that a remunerative freight business may also be handled.

For picnic parties and also to provide extra facilities for excursion business, the company has remodeled three box cars and uses them as trail cars for passenger service. To please all factions of its patrons the company has named the cars, respectively, "McKinley," "Bryan" and "Dewey," these names being painted in large letters on the sides of the cars. A trolley locomotive, named "General Funston," is used for hauling work trains in the construction and repairing of the road and also to carry working parties. This locomotive is driven by four 50-horsepower motors, the same equipment as is used on the motor cars, except that the motors are geared for a lower speed. The remainder of the rolling stock consists of 12 flat cars used in hauling ballast and material for the construction parties. A large brick and stone car barn, affording accommodation for 50 cars, is located near the power house at Wolcott. Besides a ma-

chine shop, this building contains the offices of the company.

The company owns and operates its own stone quarry at a point on the line about two miles south of Wolcott. Here all the ballast for the road is quarried and crushed in a large stone crusher, from which it is discharged through chutes to the ballast cars on the track. For a time the rock crusher was operated by a 28-horsepower gasoline engine, but that has been supplanted by a 50-horsepower railway motor, which has resulted in a saving to the company of about $10 a day. Between 225 and 250 cubic yards of rock is turned out by the plant daily.

The railway is equipped with a private telephone system for train dispatching. Fifteen stations are provided at different points on the road. The system was installed by the Smith Interchangeable Telephone company of Chicago, some instruments of the Kansas City Telephone Manufacturing company's make also being used. The railway company is installing a block-signal system at the switches, which will materially increase the regularity and safety of operation of the cars.

The Kansas City-Leavenworth railway was constructed and is operated by the Cleveland Contracting company of Cleveland, Ohio. The Kansas City-Leavenworth Railway company has an authorized capitalization of $1,000,000 and is officered by the following-named gentlemen: President, David H. Kimberley of Cleveland; vice-president, H. C. Ellison; secretary and general manager, Herbert W. Wolcott; treasurer, Charles O. Evarts; general superintendent, O. B. Henry; purchasing agent, Harry E. Gabriel; electrician, Charles Steig. The company owns a franchise which will bring its cars into the center of Kansas City, Kan. The extension, which is now being constructed, will branch off from the present line 1½ miles from the existing terminus at Grand View and run through the northern part of the city for a distance of 2½ miles to a point about two or three blocks distant from the juncture of the Missouri and Kaw Rivers. This new extension, instead of connecting with but one line of the Metropolitan Street Railway company's system, as at present, will cross and make connections with five lines of the Metropolitan system.

Experiments in Producing Diamonds with the Aid of Electricity.

Experiments have been carried on by Majorana to show that in all probability the production of small crystals of carbon or diamonds, in the electric furnace, is caused by the enormous pressure exerted upon the interior of the molten mass. F. Mollwo Perkins, in Nature, describes some of these experiments as follows:

"It is well known that synthetical diamonds have been obtained by means of the electric furnace; charcoal obtained from sugar is rammed into a wrought-iron cylinder, which is then closed with a plug. The cylinder is placed in a bath of molten iron kept at a high temperature in an electric furnace, after which the crucible which contains the iron is rapidly cooled by immersion in melted lead. On dissolving the iron in acid minute diamonds are obtained. It was a question whether here we had a case of simple crystallization of the carbon from the molten metal on cooling, or whether the enormous pressure which was exerted from the interior of the mass by the rapid cooling of the outside acting upon the carbon at a high temperature caused the formation of crystals of diamond. An exceedingly ingenious experiment which has been carried out by Majorana shows that at any rate the influence of high pressure and high temperature combined is sufficient to convert amorphous carbon into the crystalline variety. Majorana's experiment is as follows:

"A cylindrical chamber is hermetically closed at the top by a solid block of iron, the bottom by a solid piston. The sides of the chamber are made of tempered steel, and to further strengthen it the chamber is surrounded by 15 iron rings, one centimeter thick, which are bolted together. The whole system is placed within a hexagonal frame, also made from iron plates. The piston has a small solid iron cylinder about one centimeter in diameter attached to it, at the end of which is fastened a small piece of carbon, about two grams in weight. Directly below the piston a thick block of iron is fixed, into which a hole exactly the size of the small end of the cylinder has been drilled. In carrying out the experiment the carbon is heated by means of the two carbon poles, with a current of 25 amperes and 100 volts. When the carbon has become white-hot, 70 grams of gunpowder, contained in the chamber, is exploded, the piston being driven down, carrying the heated carbon before it and compressing it with enormous force. On taking the system to pieces the carbon is found to have been partially converted into microscopic diamonds, which, when freed from unchanged amorphous carbon, are found to possess all the characteristics of natural diamonds."

Snow Fighting and Car Heating in Quebec.[1]

By D. E Blair.

The greatest difficulty encountered by the railway company in its efforts to provide a regular and efficient car service during the winter months is the clearing away of the snow from the tracks. It is not so much that the snowfall is somewhat heavier than in Montreal and Ottawa districts, as that the extremely narrow strips of roadway either one side of the track or the other soon become piled up with snow to such an extent that all snow removed by a passing sweeper immediately slides back on to the rails and blocks the passage of the following car.

Another serious disadvantage is that all cars in the city have to run over some sections of single track. This fact requires, of course, that cars shall make regular crossings at certain points, and if one car should be late for—or worse still, not reach—its crossing point, several of the following pairs of cars which cross at the same point will be stalled there until the tangle is straightened out. A delay of this sort is disastrous in many ways, because the leading car, when it gets away, has sometimes to plow its way through a heavy accumulation of snow until it is, possibly, extricated from its sorry plight by a passing sweeper, which has to be signaled and shunted past the waiting cars before it can be of any service. Matters are soon straightened out, but then that sweeper should have been somewhere else and there is more trouble ahead. Just as long as all cars make their proper crossings, no matter if they be a few minutes behind scheduled time, everything works smoothly, and after that complications seem to increase in geometrical progression.

It is the practice to send out the "wing plows" as soon as a certain amount of snow has fallen, and these follow the sweepers around the whole length of the track, at regular intervals, pushing the snow piles back as far as six feet from the rail where it is possible, although there are miles of track to be kept open where there is less than that distance between the rail and the actual buildings, to say nothing of the sundry poles and sidewalks that necessarily intervene.

As the day wears on and the snow still continues to fall, the swing of the plows is limited to two feet, and possibly to one foot, after which it is a hard struggle to keep everything moving through the rectangular channel four to five feet deep, which has been formed by the wing plows in their endeavors to clear the right of way.

There are several bad spots at which it is absolutely necessary to keep gangs of snow shovelers at work as soon as the storm reaches any more than even moderate proportions.

It has further been necessary on two or three occasions to pull all cars out of service in order to give the tireless sweepers a chance to keep the road open, but only once in 1898 and once in 1899 has the service been entirely blocked, and that for one day only.

Nearly all cars in service now carry side brooms or flangers about three feet in length, which are set obliquely across the rails about one foot ahead of the front wheels. These consist of cast frame, into which are fastened a number of cuttings from the sweeper brooms about 10 inches in length. They cost very little and have proved of invaluable service in keeping the rails clear of snow during the hourly or half-hourly intervals between passing sweepers; in fact, the car service very often depends entirely upon these to get through a light snowstorm, a couple of sweepers being sent out, after it is all over, in order to clean up.

These long brooms have another great advantage over a narrow steel wire brush, in that they keep the snow and ice at each side of the rails at an easy slope toward the bottom, instead of cutting a deep rectangular trough which remains filled with snow after the sweeper brooms have gone over the track.

Since adopting these brooms on the road, a marked decrease in the power consumed by the rolling stock during storms is noticed, and a great saving has been effected in the quantity of rattan used by the sweepers for each mile of sweeping. This results from the fact that when the transverse section of the winter roadbed is properly graded the sweeper brooms need not be let down so far in order to clear all snow from the rail, thus saving a great deal of breakage.

The average snowfall in Quebec for the last three years has been as follows: 1897-98, 104.6 inches; 1898-99, 120.6 inches; 1899-1900, 100.3 inches.

In the year 1899-1900 the total cost of the removal of snow was $16,336.08. Fifteen miles of track was kept open, and the total number of miles swept was 6,272.

With reference to the removal of snow, the city by-laws enact "that proprietors or occupants shall remove the snow and ice from their roofs and from the streets, from the street line to the center of the street, and keep the same within two inches of the pavement."

The by-law granting a franchise to the Quebec Railway, Light and Power company enacts "that the company shall remove the snow from their tracks and two feet on either side thereof." As the company could not see its way to carry out this regulation without having trouble with the proprietors or tenants, it every year makes an arrangement with the tenants on that side of the street on which the company throws its snow, to remove the same, paying them at the rate of 10 cents per lineal foot of their frontage, except in places where the snow is known to accumulate, where they pay at the rate of 15 cents per lineal foot. Consequently, all the company has to do is to throw the snow off its tracks, leaving the proprietors to remove the same along with their own. With this arrangement the proprietors seem very well satisfied.

One can better appreciate the relative magnitude of the snow expenses when told that $1.54 has to be deducted from the daily gross earnings of every car in service during the year in order to make up the amount.

All closed cars in service are heated electrically during six months of the year, the heaters being divided into four sections, two on each side of car, each pair being separately controlled. The current consumed by each pair is 4.9 amperes, and it therefore requires 9.8 amperes at 520 volts, 5.1 kilowatts, to heat a car during four months of the year when both sides are in use, but during the months of November and April one side is quite sufficient to maintain a comfortable temperature within the thin shell which composes the car body.

Taking the average time of service of car at 18 hours per day, and the actual cost of the extra current required at 0.65 cent per kilowatt-hour, the cost of heating one car is as follows:

$$5.1 \times 0.65 = 3.31 \text{ cents per hour.}$$
$$59 \text{ cents per day.}$$
$$150 \times 59 = \$88.50 \text{ per year.}$$

This is equivalent to 0.204 cent per car-mile, and the maxim taught is, "Don't use electric heaters in a cold climate unless you have the advantages of an unlimited waterpower and station capacity." The interest on first cost, depreciation and maintenance of the heating equipment would not add more than two or three per cent. to the figures.

1. Part of a paper read before the Canadian Electrical association, at Kingston, Ont., August 30, 1900. Mr. Blair is chief electrician of the Quebec Railway, Light and Power company.

Electric Railways in Montreal.

Eight years ago the Montreal Electric Street Railway company inaugurated its electric service. The trial trip was made on September 19, 1892, and the cars began running regularly two days later. After the preliminary trip of the electric cars, the success of the new venture was assured. During the eight years that have passed the number of passengers carried have more than quadrupled, the figures being, in 1892, 11,631,000, and for this year it is estimated over 45,000,000 will be carried. During the last year extensive new sheds and shops have been built. Over 100 miles of single track are at present being operated, and about 230 cars run every day. The cost of operating the service amounted to over $1,000,000 last year. The company employs nearly 2,000 men, holding various positions on the railway. The company's rolling stock, at present, consists of some 800 open and closed cars, together with other classes of cars. The company is manufacturing new cars in its workshops all the time, with the latest improvements for the safety and comfort of its passengers, who at present average 160,000 a day. The gross receipts of the company in 1892 were $564,406, and in 1899, $1,660,775. The operating expenses in 1892 were $466,647, and in 1899, $912,949. The net earnings of the road in 1892 amounted to $97,761, and in 1899, $747,826. The longest trip a passenger can take on the company's route without a transfer is seven miles. The time of service is stated by the road's authorities to average one car for every two to 2½ minutes on all the independent lines during the working day, which lasts from 6 a. m. to 8 p. m. Following are the names of the officers of the company at the present date: President, L. J. Forget; vice-president and managing director, James Ross; general manager, F. L. Wanklyn; directors, R. B. Angus, K. W. Blackwell and F. C. Henshaw; comptroller, W. G. Ross; superintendent, D. McDonald; secretary, M. H. Watts.

German Cables in Chinese Waters.

The Administration of Posts of the German empire has taken steps toward establishing new telegraphic communications with China and the East. It was desired to have a submarine cable laid between Kiao-tcheou and the nearest terminus of the Great Northern Telegraph company's lines before the autumn storms set in. The firm of Felten & Guilleaume made 472 kilometers of this cable at Rotterdam in four weeks—a remarkable achievement, considering that all the wires required had to be specially manufactured. The cable was shipped on September 18th, by the steamer Von Podbielski, and it is expected that it will be laid about November 1st. It will connect Tschifu on one side with the Kungkungtau Islands, and on the other side with Tsintau.

In addition to the cable above mentioned, the Nordenham factory of the North German Submarine Cable Works is now manufacturing a cable of a length of 715 kilometers for the purpose of connecting Tsingtau and Shanghai. It is expected that the laying of this cable will be completed in the spring of next year.

The strike at Terre Haute, Ind., continues to tie up the street-railway system, although the company manages to furnish light and power for the street fair now going on. Thus far the efforts at arbitration have not succeeded.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

The Supreme Court of Minnesota has granted a rehearing in the case of the city of Minneapolis against the Northwestern Telephone Exchange company. The case involves the city's right to declare null and void a telephone company's franchise. It was taken to the Supreme Court on a demurrer, and the lower court's decision reversed. The Supreme Court thereby ruled that the company's franchise was an irrevocable contract and could not be impaired by action of the council.

Silas J. McGregor has been granted a franchise for a telephone exchange for Hibbing, Minn.

The Forman Telephone company has lately completed the rebuilding of its exchange at Lisbon, N. D.

A new exchange has just been put in operation at St. Thomas, N. D.

About 80 telephones were recently burned out at Marinette, Wis., during a fierce storm.

It is understood the Northwestern Telephone Exchange company will extend its toll line from Northwood, N. D., to Hatton and Mayville in the spring.

The Fergus Telephone company has completed a line from Fergus Falls, Minn., to Carlisle and Rothsay, Minn.

It is announced at La Crosse, Wis., that the erection of the new central-exchange building for the Wisconsin Telephone company is delayed by the inability of the company having the order to manufacture the interior equipment. As soon as that is in sight work will proceed on the building.

The Electric Telephone company is arranging to establish an exchange for Lamberton, Minn.

Harry Slater has sold his interest in the St. Peter (Minn.) Telephone company to James Bennett, another member of the company. Mr. Slater proposes to establish an exchange in some town of about 5,000 inhabitants.

The Blue Earth Valley Telephone company of Winnebago City, Minn., contemplates extending toll wires to Bricelyn, Minn., and establishing a local exchange.

The Northwestern Telephone Exchange company has installed a new switchboard at the Shakopee (Minn.) station.

The Johnson County Telephone company is being urged to extend a toll line from Iowa City, Iowa, to Sharon Center, Amish and other post-offices in the southwestern part of the county.

A line is being built between West Point and Farmington, Iowa.

The new exchange at Hedrick, Iowa, is approaching completion. It will start with 53 connections.

W. H. Blake of Cheboygan, Mich., is an applicant for a franchise at Sault Ste. Marie, Mich., to install and operate a local system. He proposes to form a local stock company, in which a controlling interest shall be vested in the local owners.

The telephone system at Nashua, Iowa, has been rebuilt.

The Iowa Telephone company is seeking to ascertain the demands which the council of Des Moines, Iowa, will ask in a franchise for that company. For the last three years the company has operated in Des Moines without a franchise. It is understood the company will offer one-twentieth of its gross receipts and will agree to place its wires underground. The company has asked for a new franchise several times, but has been unwilling to accept an instrument regulating its charges.

The Centerville (Iowa) Telephone company has begun operating its new exchange. The system starts with over 200 connections.

The Ida County Telephone company of Ida Grove, Iowa, has 160 instruments in use and has invested in the system about $5,400.

Musson Bros. plan to have the new exchange being installed at Atlantic, Iowa, completed and in operation by November 10th.

Subscribers of the Sunset Telephone company in Aberdeen, Wash., want night service. When the exchange was organized they were promised that when the list reached 50 they would be given night service. Now there are 140 subscribers, but no night service. A petition is being circulated, which states that unless it is given, the signers will discontinue their instruments.

The switchboard for the telephone station at St. Charles, Minn., was burned out lately, during an electrical storm.

The Standard Telephone company has instituted night service for its office at McGregor, Iowa.

The Ogden (Iowa) Telephone company is now giving its patrons night and Sunday service.

The La Crosse and Southwestern Telephone company will build a line from Wonewoc to Viroqua, Wis., 40 miles, with a metallic circuit.

The Dwelle Telephone company has put in a 52-cable on Main street in Lake City, Minn.

Lightning struck the office of the People's Telephone company at Superior, Wis., and set fire to the switchboard.

The Sunset Telephone company has completed a line between New Whatcom and Seattle, Wash., via Mount Vernon. R.

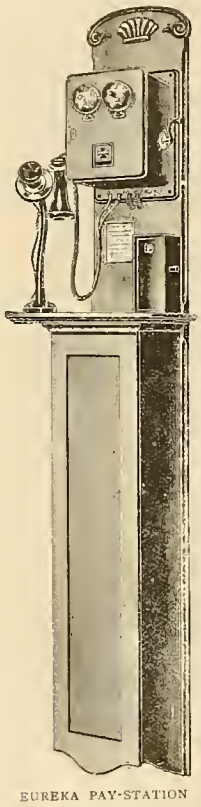
It is stated in Australia that tenders for the construction of a telephone line between Sydney and Melbourne are now being invited by the postmaster-general. The cost is put at £24,000.

London-Brussels Telephone Line.

[From the London correspondent of the Western Electrician.]

It has several times been unofficially announced that telephone communication with Brussels would shortly be at the disposal of Londoners, and at last the scheme appears to be within measurable progress of completion. There have been two proposals under consideration, one involving the laying of a new submarine wire between the English and the Belgian coasts, thus constituting a complete new route, and the other, of utilizing the Anglo-French line, as far as the French coast, and then reaching Brussels by means of land lines along the north of France. The latter scheme will probably be adopted, for the English electrical engineers have so far been unable to devise means of transmitting a sufficiently powerful electric current over a submarine cable of more than 20 miles in length. This distance has been successfully used in telephonic communication with France and with Ireland, and it will doubtless be somewhat increased in the near future, but a great deal of progress will have to be made before the scheme of talking across the Atlantic, for instance, is realized.

To put London and Brussels in telephonic communication is an expensive business, and much negotiation has been necessary to bring the Belgian and British governments into accord, but the difficulties have been surmounted, and it is probable that by the beginning of next year the new line will be working, although the English authorities decline to pledge themselves to a definite date. The charges for the use of the telephone will, in all probability, be similar to those for talking to Paris, viz., $2 for three minutes' conversation.



EUREKA PAY-STATION INSTRUMENT.

Eureka Pay-station Instrument.

The accompanying cut illustrates the No. 39 toll-line, bridge, automatic pay-station telephone of the Eureka Electric company. The operation of the instrument is simple and along the lines of established practice in slot-machine telephones. The set shown is equipped with the new Eureka No. 19 receiver, which has the invisible-cord connections on the side, and is furnished with either the four or five-bar bridging generator attached.

The company furnishes these telephones for either bridge toll-line work or in series construction, as may be desired. Altogether, the telephone makes a handsome appearing instrument, having a case for batteries below, and the transmitter attached to a vertical adjustable arm. The signal employed is said to be especially efficient.

Drainage Canal Telephone Line.

On account of the delays that the trustees of the Drainage Canal have experienced in getting telephone connections between Chicago and Lockport, it was decided some time ago to construct a private line along the canal, and $6,000 was appropriated for that purpose. Work was begun immediately. A number of the poles are already in place, and the wire has been purchased and is ready to be strung. Recently officers of the Chicago Telephone company appeared before the trustees and offered to purchase the material on hand and lease a wire at a low rate if the construction of the private line were abandoned. After a discussion of the subject the telephone people were asked to submit their proposition in writing at the next meeting.

In case of trouble in the river, which necessitated the immediate closing of the controlling works, serious damage might result from any delay in communicating with Lockport.

The Hornellsville Telephone company has been incorporated in New York to operate a telephone line between Hornellsville, Olean, Bath, Wellsville and intermediate villages. The capital stock is $50,000. The directors of the company are: Burt G. Hubbell of Cleveland, Ohio; F. D. Sherwood and James B. Day of Hornellsville.

Independent Extensions in Michigan.

The Citizens' Telephone company of Grand Rapids, Mich., has completed arrangements whereby the Independent exchange at Traverse City and the Independent toll lines covering Leelanau, Grand Traverse and Benzie counties, and a portion of Wexford County, in Michigan, will pass under its control. The purchase includes, in addition to the exchange at Traverse City, which contains 296 telephones, toll stations at Acme, Bingham, Keswick, Sutton's Bay, Omena, Northport, Provemont, Leland, Good Harbor, North Unity, Maple City and Cedar City. The territory covered embraces a population of about 60,000 persons. The Citizens' company also is planning to construct a toll line from Traverse City to Sherman, which will include stations at Grawn, Monroe Center, Wexford, Thompsonville and Copemish. This will connect the new system with Grand Rapids and the lower part of the state by a first-class copper circuit. Frankfort, also, will be included in the circuit by means of a line from Thompsonville.

GENERAL TELEPHONE NEWS.

The Honey Grove and Ragsdale (Texas) Telephone company has been chartered with a capital of $1,200, by J. W. Underwood, P. M. Price and T. U. Cole.

The Central Indiana Telephone company has been incorporated at Sheridan, Ind., with a capital stock of $10,000. The directors are John H. Cox, Dorval Cox and Leland D. Cox.

The stockholders of the Isle of Wight Telephone company at Suffolk, Va., have elected Joseph W. Holloway president. It is the intention of the company to extend its lines to several outlying points.

The Pendleton Telephone company of Pendleton, S. C., has been chartered, with a capital of $600, by J. C. Stribling of Pickens County, H. P. Litton and J. H. Mounce of Pendleton, N. C., and others.

The Southern Bell Telephone and Telegraph company has been granted permission by the city council of Tuscumbia, Ala., to erect and operate telephone and telegraph lines in Tuscumbia, for the purpose of establishing a local telephone exchange. It is understood that work will begin immediately.

The Chicago Telephone company is meeting opposition in its effort to run telephone lines through Bellwood, Ill. The trustees of the village have demanded that the company paint its poles and that a special franchise be secured. Fifteen linemen were arrested while at work recently, and placed under $100 bonds each, awaiting the decision of the courts.

The mayor of Baltimore is said to have expressed regret that the last Legislature did not repeal the Chesapeake and Potomac telephone ordinance. He thinks that the injury to the city by this ordinance is very great, as it not only gives improper use and control of the streets of the city to a private corporation, but provides a private system of subways, when the city is rapidly furnishing a public and municipal system.

A franchise has been granted to C. R. Callaghan and Frank A. Knapp, president and secretary, respectively, of the telephone company at Bellevue, Ohio, to erect a telephone system in New Washington, Ohio. The plant will be thoroughly modern and up-to-date and a toll line will be built to Bucyrus, where long-distance connections will be obtained. A small plant will also be installed at Sulphur Springs, a small village in the vicinity.

In a creditable souvenir number of the Terre Haute Express is an account of the Citizens' Telephone company. This company is owned and controlled entirely by Terre Haute capital, and was one of the first of the Independent concerns in the country. It was reorganized this year with a capital stock of $150,000, with the following-named officers: President, Fred B. Smith; vice-president, C. R. Duffin; secretary and treasurer, G. A. Conzman; general manager, H. A. Coit. The company has some 750 subscribers, all on three-year contracts. Over 45,000 feet of wire has been laid underground lately, and a common-battery exchange is now being installed, manufactured by the American Electric Telephone company. A long-distance service is promised.

MANUFACTURERS AND DEALERS.

The National Measured Service company was incorporated at Springfield, Ill., on October 11th, to control and manufacture an automatic telephone meter, to be used at stations where the rate charged is regulated by the amount of service given. The capital of the company is $50,000, and the directors are George H. Miller, Gilbert Noxon and H. H. C. Miller.

The Western Telephone Construction company of Chicago has recently placed upon the market its new Western Express No. 3 bridging telephones for heavy toll-line work. These instruments are equipped with the company's latest product, a new five-bar laminated-armature generator which has been especially designed for the purpose of furnishing an instrument that will give a satisfactory service over long and heavily equipped toll lines. It is claimed that on well constructed lines this generator will ring as high as 35 or 40 telephones.

American Steel and Wire Company at Paris.

The American Steel and Wire company's exhibit at the Paris Exposition is one of the most complete and interesting of the entire exhibition. The installation is in the department of mines and metallurgy, and was not placed with the other exhibits from the United States for lack of space.

The main-floor exhibit, illustrated by the accompanying picture, occupies a space of 50 by 50 feet. It comprises iron ores and coal from the company's mines in Michigan, Minnesota, Wisconsin and Pennsylvania; limestone from its quarries, coke from its ovens, and pig-iron from its blast furnaces, the quality and nature of the pig-iron being illustrated by fractures. Ingots, blooms and billets from Bessemer and open-hearth steel mills are also shown. These products are compactly grouped near the entrance to the exhibit.

In the center of the space is an ornamental bronze pagoda, with art-glass roof, and panels illustrating various manufactured products, such as sections of beams, channels, angles and bars, sections of shafting, rail splices and frog filling, horseshoes, spikes, nails and tacks, barbed wires, bale ties, fine copper wires, music wires, fine spooled wires, all sorts of chains and rivets, coiled, spiral and flat springs, clock springs, wire ropes, insulated wires and cables, sections of submarine cables, etc.

In the space surrounding the pagoda are samples of sheet-steel, with illustrations of quality, in the shape of cold bending and stamping tests, large steel boiler heads, many bundles of woven-wire fences and galvanized poultry netting. Piled in

AMERICAN STEEL AND WIRE COMPANY'S EXHIBIT AT PARIS.

attractive pyramids are wire rods, steel and copper wire in bundles and on reels, copper trolley wires, weatherproof and lead-encased cables, copper rail bonds, wire ropes, etc. The feature of the exhibition is the great variety of products shown. The entire range of the steel-producing industry appears to be covered by the products of this company, which is popularly, but erroneously, supposed to be confined to the wire industry.

The gallery or auxiliary exhibit consists of 40 large panels, six by five feet in size, on which are artistically grouped products of the various departments, while in glass cases, beneath the panels, additional samples and test pieces are shown, the entire square being surmounted with 50 large photographic reproductions or birdseye views of the various mines, furnaces, steamships and manufacturing establishments owned and operated by the company.

The entire exhibit is certainly a credit to the American Steel and Wire company. It was designed and arranged under the personal supervision of P. W. Moen, third vice-president, and F. H. Daniels, chief engineer, of the company. It was entirely set up before shipment to Paris in the Worcester plant, then taken down, shipped and reconstructed on the other side.

It is not strange that so complete an exhibit should be rewarded with high honors. The American Steel and Wire company received more grand prizes and gold medals than any other American exhibitor, the awards being as follows: Four grand prizes, two gold medals and a collaboratory gold medal each, to President Palmer and Chief Engineer Daniels, expressive of appreciation of their share in making such a showing for their company. The detailed awards were:

One grand prize in Class 26 for iron and steel galvanized telegraph and telephone wires, pure copper wires, insulated conductors, rail bonds, trolley wires, feeder cables for light and power, aerial, underground and submarine cables.

One grand prize in Class 7 for music wire, for greatest tensile strength, ductility and high finish.

One grand prize in Class 63, covering metallic ores, coal and coke, also natural mineral paints, such as Venetian red and copperas, of which this company claims to be the largest manufacturer in the world.

One grand prize in Class 64, covering pig-iron, steel in ingots, bars, sheets, finished plates and wire rods; also copper and copper alloys, ingots, bars, etc.

One gold medal in Class 30, covering bicycle and carriage wire spokes and kindred products.

One gold medal in Class 65, a general metallurgical class, including wire nails and tacks, barbed wire, wire rope, horseshoes, woven-wire fencing, springs, chains, staples, wire netting, and kindred products of the wire industry.

A grand prize was voted in Class 65, but withdrawn, because grand prizes had already been awarded in Classes 63 and 64, which, being so closely related to Class 65, it was considered a crowding of honors to award another prize in this class.

Western Union's Report.

The annual report of the Western Union Telegraph company for the fiscal year ended June 30th shows: Gross earnings, $24,758,570; increase, $804,258; operating expenses, $18,593,206; increase, $507,627; surplus after dividend, $391,278; increase, $287,586; profit and loss surplus, $8,458,206; increase, $391,279. The interest paid on outstanding bonds last year was $896,305. The amount of interest payable on the bonds now outstanding is $956,160, or an increase of $59,854 a year. The lines of the company were increased during the year by 2,849 miles of pole construction and 28,520 miles of wire, and there was also an increase of 615 offices. E. H. Harriman and Charles Lockhart were elected directors in the places of Alonzo B. Cornell and the late C. P. Huntington. Other members of the old board were re-elected.

Salt Storms in Utah.

Along the high-voltage transmission line running from Provo, Utah, to Tintic, the "salt storms" from the plains often produce remarkable electrical displays. On account of the moisture in the air and the thick covering of the poles with salt, powerful discharges occur at frequent intervals; short circuits are momentarily caused, the lights dip, and sometimes the operation of the motors is interfered with. These discharges are usually of dazzling brilliancy, and at times startling. The flames are said to reach a height of from six to eight feet, holding for a second or two, then break from one of the wires and die away. It is only when the arc is continuous between the wires that there is any interruption of the service. One flash which blew the station fuses and caused a shutdown held its place between the wires for five or six seconds, but most of the flashes cease almost on the instant of completing connection.

The Newton and Boston Street Railway company seeks authority to issue new bonds to the amount of $75,000.

Important Street-railway Decision in Wisconsin.

The Supreme Court of Wisconsin, through Judge Winslow, the other justices concurring, handed down an opinion on October 12th which has an important bearing on the street-railway situation in Milwaukee and also in other cities in the state. Last January an ordinance was passed by the Common Council of Milwaukee, granting an extension of 10 years of the street-railway franchises of the Milwaukee Electric Railway and Light company in return for a reduction of fares to a four-cent basis for certain hours of the day and a straight four-cent fare in the course of a few years. This ordinance was passed by the council in spite of an injunction that had been secured restraining that body from taking the action. The aldermen were brought before Judge Ludwig of the local court and held by him for contempt. An appeal to the Supreme Court was taken by the aldermen, and that body now holds that a legislative assembly cannot be restrained, and, accordingly, sets aside the contempt proceedings.

The court, in effect, holds that the proceedings before the Common Council were regular, that body not having exceeded its authority. Citizens, the decision holds, in effect, cannot question the discretion of the Common Council, even though exercised wrongly. The discretion lies with the council. The decision is regarded as one of the most important the court has handed down for a long time. It is lengthy and discusses the rights and privileges of street-railway companies in a manner never gone into before.

Judge Winslow, in the opinion, said, after referring to the offer of $100,000 to the city for the franchise, which was refused:

"It seems plain to us that this action of the Common Council cannot be called in any proper or reasonable sense a squandering of public funds or property. The question before the council was what terms should be attached to the grant, whether it was more beneficial to the public to secure a cash payment, which would benefit taxpayers only, or to secure lower rates of fare for the public generally, or to impose other conditions, and after exercising its discretion in favor of a general reduction of fare it cannot be said that any city fund has been squandered, lost or misused. Street-railway companies do not get their rights from their charter, but get them from the city. The fact that the Common Council extended franchises which had not expired would not make the ordinance void, as the council had that power."

Of the objections concerning alleged irregularity of procedure in passing the ordinance the court says they cannot be raised by private parties, but only by the state.

The decision puts the company on a secure footing and permits it now to proceed with the improvements planned under the franchise.

Electric Cooking at the Paris Exposition.

One of the most extensive applications of electric cooking is that which has been made at the restaurant in the basement of the Spanish pavilion in Paris. As the Spanish pavilion contains a number of collections of great value, the government authorized the establishment of a restaurant in the basement only on condition that no coal, gas, or petroleum should be used, on account of danger from fire. The electric system was thus almost compulsory; it was, however, quite an undertaking, as the Scientific American remarks, to establish a plant of this kind, as over 400 meals a day were served, with the complicated menu necessary for a high-class restaurant. The installation was made by Parvillé & Co. of Paris, and is now in successful operation. The outfit consists of a large range, two large broilers, two ovens, a hot-water reservoir, a vegetable boiler and a small heater. The principle of the apparatus consists in the use of a metallo-ceramic resistance, based on the fact that the conductibility of metallic powders is diminished by mixing them with powder of refractory material.

The consumption of energy in proportion to the heat given off is within reasonable limits. The resistance pieces are easily replaced without taking apart the apparatus. In the large range, which measures three by six feet, there are eight fireplaces, each consisting of a group of these resistance bars, which are raised to a bright red by the current and will support a temperature of 1,200° C. without deteriorating. Four of the fireplaces consume 25 amperes at 100 to 110 volts, and the other four, 20 amperes. The heat not utilized by direct radiation is used to heat a series of intermediate plates by which the cooking is finished. The two broilers give a high temperature, and heat from above, avoiding the falling of fat and the consequent odor. They take a current of 25 to 35 amperes. Of the two ovens, one is arranged to be heated by the lower part and consumes 20 amperes; the second has several heaters placed in the upper part and connected to different circuits, so as to be used independently or together. It roasts every day at least 75 pounds of meat at one operation, taking about 30 amperes. The vegetable boiler and hot-water reservoir have each a capacity of about 60 gallons. For the coffee, tea, etc., a small heater of two fireplaces is used, besides a water bath. The different heaters are constructed of sheet-iron, with solid iron corners and braces. They are made with

double partition, the interior space being filled with asbestos. This installation has worked very regularly since the first of May, and demonstrates the practicability of electric cooking when applied on a large scale.

Electric Furnaces.[1]

The employment of the electric furnace has made rapid advance within the last few years, and we find to-day a large number of forms in practical use. It will be of interest, therefore, to study the different types which they represent and the progress made in their construction.

The forms in use to-day have been derived, for the most part, from the form of crucible of Siemens and Hutington, or from the Moissan furnace.

Moissan Furnace.—This furnace is characterized by the employment of the electric arc as a source of heat only and not as an electro-chemical agent. By its means temperatures are attained in excess of those from any types previously used. The highest temperatures attainable by furnaces other than the electric type are limited to about 1,800 degrees; the blowpipe with illuminating gas and oxygen gives 2,000 degrees; with the Moissan furnace temperatures certainly exceeding 3,000 degrees are possible.

In this apparatus the arc plays between two horizontal carbons extending into a narrow chamber hollowed out of a block of quicklime. A cover of the same material closes the furnace and reflects the heat from the arc upon the material to be treated, which is placed beneath the carbons. The calorific action of the current is thus clearly separated from its electrolytic action. The arrangement also prevents any impurities of the electrodes from intermingling with the substances melted.

As a result of the feeble conducting power of the material used, a thickness of the dome of only 30 millimeters is sufficient to allow a fusing of its lower face, with the production of the Drummond light, while the exterior face of the dome remains cool enough to handle.

Siemens Furnace.—This furnace is designed along other lines. The first Siemens furnaces were intended for fusing metals, and consisted each of a crucible of refractory material, with double walls of an insulating envelope, and receiving the electric current at its base. A vertical electrode, placed above the crucible, served as the second conductor. The material introduced in the crucible took the place of the intermediate conductor, and the electric arc played between the electrode and the material itself. The automatic regulation of the arc is obtained by a shunt solenoid, placed in the circuit and producing a displacement of the electrode.

Industrial Furnaces.

Cowles Furnace.—In 1885 appeared the Cowles furnace, with which were made the first applications of electricity to the reduction of oxides.

In this apparatus one end of a chamber of refractory material is made of a conducting substance and constitutes one pole. The other extremity of the chamber is closed by a graphite crucible, forming the other pole.

In 1887 the Cowles brothers took out a new patent on an electric furnace in which the charge was introduced in a continuous manner.

Héroult Furnace.—The Héroult furnace, applied first to the reduction of alumina by copper, is based upon the same principle as that of Cowles. The copper is introduced into the furnace in form of granules. The current melts the metal between the two electrodes. The alumina is then poured in, and one obtains an alloy of aluminum and copper.

Froges Furnace.—The factories of Froges and of Newhausen have employed the Héroult furnace in the manufacture of aluminum. On the appearance of carbide of calcium the same furnaces served for the manufacture of this substance.

The special furnace designed for this latter purpose, and which is called by the name of Froges, is composed of a vertical electrode capable of an up-and-down movement, in a chamber whose base is carbon, and which is mounted upon rollers. This chamber constitutes the second electrode. The walls are double and of an insulating material. The carbide is taken out to cool through an opening in the lower part of the furnace, and when the operation is finished the movable furnace is removed and exchanged for another.

Modern Applications.

The appearance of carbide of calcium was a signal for the designing of electric furnaces of great efficiency and of continual operation. These forms may be classified as: First, those based upon the Moissan and Siemens furnaces, called arc furnaces; second, those based upon the Héroult type, called resistance furnaces; third, those modeled after the first Cowles furnace, called superficial resistance furnaces or incandescence furnaces.

Arc furnaces may be classified as follows: Single-arc furnaces with two movable electrodes; single-arc furnaces with one movable electrode; furnaces with several arcs.

Single-arc Furnaces with Two Movable Electrodes.—The two electrodes are the more often placed in an inclined position and capable of being thrust into a chamber of refractory material. The material to be treated is placed about the arc, being introduced at the top of the furnace.

To this type belong the Patin furnace, that of the Deutsche Gold und Silberscheide Anstalt, for the production of calcium carbide, and the Street furnace for the production of graphite.

Single-arc Furnaces with One Movable Electrode.—The movable electrode is ordinarily placed vertically; the fixed electrode is placed horizontally or inclined, and is built up of an assemblage of carbons called the "sole."

The material is introduced at the upper part of the furnace, and the arc plays first between the movable electrode and the sole, then between the fixed electrode and the molten material. The tension employed in this type of furnace varies from 50 to 60 volts.

To this category belong the electric furnaces of the Société des Carbures Métallique, shown at the exposition, and the systems of Siemens and Halske, Schuckert, etc.

Furnaces with Multiple Arcs.—These are only variations of the two preceding types. They are employed to distribute the calorific action of the arc over greater surfaces, and not merely at the point of emission of the arc.

To this type belong the Gin and Leleux furnace, those of Bertolus or Memmo, Nicolaï, Bovy, etc. The first of these has been employed for the manufacture of calcium carbide and of phosphorus; it contains four pairs of carbons, four arcs in a single chamber, and its sole has a helicoidal movement below the arcs.

The Bertolus furnace, employed in the factories of Bellegarde, uses a three-phase electric current and three arcs, by means of three movable carbons inclined and placed above a common sole connected or not connected to the dynamo.

The Nicolaï furnaces are composed of a metallic crown, covered with carbons and forming one pole; the other pole consists of several electrodes placed circularly and given a movement of rotation above the fixed metallic crown, upon which the material to be treated is spread.

In all these furnaces the temperature seems to vary with the current intensity. The potential employed being almost constant for a given application, it follows that in powerful furnaces the temperature is too high in the arc itself. The employment of multiple arcs only imperfectly remedies the chief fault of the use of the electric arc, which is that it produces at a certain point a great volatilization of the material and sometimes a dissociation of the substances obtained.

The movable electric arc behaves badly at best; its resistance is made endlessly variable, and its temperature is either too low or too high. The manufacture of calcium carbide, especially, is practically impossible with this type of furnaces.

It should be remarked that, the electric arc being inductive, its employment as a resistance on an alternating circuit provokes a lag of current which represents a considerable drop of potential.

Resistance Furnaces.—These furnaces are built as the preceding, but arranged to work only at low tension. The electric work is represented by Joule's formula, and the temperature obtained, for a given power, is a function of the cross-section of the electrodes.

In furnaces based upon this principle the fusion is quiet; the gas resulting is not blown violently out of the furnace, as is the case with the electric arc.

With these furnaces in the manufacture of calcium carbide, an electromotive force of only 20 to 25 volts is required.

In the furnaces of Gin and Leleux the movable electrode serving to regulate the tension is built up of carbons of different conductivities and is sometimes 800 millimeters on a side.

Furnaces with Superficial Resistance.—In this type the electrodes do not of themselves permit the passage of current. It is necessary at the start that the electrodes be united by some conductor, like powdered carbon. This conductor is then carried to a high incandescence by the current and forms a bed of fusion upon which the material to be reduced is placed. This type of furnace allows us to utilize in one chamber a greater power than any other, for this power, for a given current, varies with the displacement of the electrodes—a displacement which is easy to regulate.

To this class of furnaces belong the Cowles furnace and others more recently designed, using two groups of electrodes.

Direct-current machines were originally the only source of energy used for electric furnaces, but now we utilize single-phase and polyphase alternating generators. The first electric furnaces using direct currents, and in which electrolytic action took place, have been designated as electrolytic furnaces, in distinction from those known as electrothermic furnaces.

Alternating-current Furnaces.

The employment of alternating currents for furnaces has been greatly extended, because it insures a better mechanical working, the alternating-current machines suffering less than others from the sudden variations of resistance which may be produced in the electric furnace. Moreover, the electrolytic action of continuous currents, often very objectionable, is obviated, and the two electrodes are equally consumed, by the use of alternating currents.

With an alternating single-phase current the furnaces can be placed in series or in parallel, like any ordinary resistances. But since, when put in series, the topping of one furnace will throw the whole battery out of action, we rarely place more than two furnaces in series on the same circuit. Arc furnaces perform better in quantity than singly, as sudden variations are then avoided. Incandescence furnaces, with their great regularity of working, may, on the other hand, be used advantageously when connected in series.

Furnaces with Polyphase Current.—The Bertolus furnace was the first of this type, using, as we have seen, three electrodes connected to the three terminals of the generator, with a common sole. The two-phase current has been utilized in a similar manner. But generally the different phases of polyphase currents are used separately in furnaces operating as single-phase furnaces. The employment of polyphase currents allows a considerable economy in copper in the feed circuits.

Electrodes.

The difficulty of obtaining electrodes of sufficient dimensions and convenient form for a long time limited the size and power of furnaces. The consumption of these electrodes constitutes an important element in the economic production of calcium carbide. The carbons of high conductivity making up the electrodes are burned in contact with the air, because of the excessive temperatures, and it is now sought to shield these from the air and cool them by a circulation of water about the parts exposed. In the latest forms of Gin and Leleux cold air is substituted.

Voltage and Current Strength.

Low-tension currents of 8,000 to 10,000 amperes are frequently employed. As it is impracticable with these heavy currents to use circuit-breakers, the movable electrode of the furnace serves for this purpose.

The manufacture of carbide of calcium requires potentials of 50 to 60 volts. The fusion of bauxite for the manufacture of artificial corundum requires 50 volts; that of iron ores requires only 20 volts, on account of the high conductivity of the vapors given off.

In superficial-resistance furnaces, because of the arrangement of the electrodes, which allows the introduction of a great quantity of material to be fused, the potentials may be carried as high as 80 to 100 volts.

Conclusion.

According to recent estimates the power utilized in electric furnaces to-day represents a total of nearly 250,000 horsepower, of which the manufacture of carbide of calcium consumes 165,000; that of aluminum, 27,000; that of copper, 11,000, and that of carborundum, 2,000 horsepower. In France alone over 60,000 horsepower is consumed in the calcium carbide industry.

The joint manufacture of phosphorus and calcium carbide in the electric furnace has been attempted during the last year; and very recently, that of vanadium and of ferrochrome, in the works of Savoie.

Great advance has been made of late in the mode of construction of electric furnaces. Thus the output from apparatus for manufacture of calcium carbide, which was only three kilogrammes per kilowatt per 24 hours in 1897, is to-day, in the Gin and Leleux furnace, 6.2 kilogrammes. This represents a thermal efficiency for this furnace of about 75 per cent.

1. Abstract of a paper read before the Paris Electrical Congress of August 18-25, 1900, by Mr. Keller.

Universal Exhibition for Lighting Industries.

An exhibition to be given during the month of November at Vienna will be devoted to the science and art of illumination in its broadest sense. "It seems a most suitable occasion," says the prospectus, "to draw conclusions as to the actual values of existing methods of illumination and to readjust our views of an industry which has attained such a high state of perfection. It is desired to lay the present state of the art before the public in order to abet improvements and make better known the innovations in this field. Acting from these considerations, and under the auspices of Das Moderne Beleuchtungswesen, a technical journal, the committee has arranged the first "Universal Exhibition of General Lighting Industries, and invites the co-operation of manufacturers, inventors and others interested.

The exhibits are to be classed under 14 groups: Historical development of methods of illumination; light in service of religion and art (church illumination); lighting of cities and open-air establishments; house and dwelling illumination; employment of light in schools and hospitals, hygiene of light, light as a means to health; factory illumination; lighting of railroad trains, ships and sea illumination; light in its application to military operations on sea and land; light in photographic reproduction; light as aid in lighting fire and water; lighting of fortifications; light in decorative work; miscellaneous; literature of the art.

The committee of arrangements includes Messrs. Erich Kielmannsegg, Hanst and H. von Wartenhofen, together with Profs. Nernst, Zickler, Loos and others. The Bureau of Entries is located at 1. Lothringerstrasse 15, Vienna, Austria.

The Santa Fe Street Railway company of New Mexico has been incorporated, with $250,000 capital stock, by G. Nelson of Colorado Springs, M. W. McGrath of Chicago, J. H. Vaughn, J. P. Victory and others. Work has been begun on the construction of the new street railroad in Santa Fe.

Electric Fans and Motors for the Philippines.

By G D. Rice.

There is no doubt that American manufacturers of electric fans, electric motors and similar devices will profit largely by the acquisition of the Philippines, just as soon as more permanent peace is assured. The half-way peace conditions now existing are holding back a great many projects which are under way, and as soon as the right time comes these hindered industries will take a new start. There are a number of capitalists ready in each city and town of importance to establish power stations for the electric-light systems, electric railways, and other uses of electric power which will be required as soon as things are put on a permanent peace basis. Your correspondent has recently interviewed several of these parties. In Manila I spoke with the projectors of the electric-light plant and found that the people were hard pushed for power supply. There were hundreds of business men and proprietors of small enterprises, in which light power is required to operate small machinery, who were offering all sorts of high prices for the rental of electric power.

In Iloilo the people have plans ready and a great advancement is being made in the right direction toward the establishment of a power station to provide electric lights and small power for the numerous small manufacturing industries which have sprung up during the last year under American patronage. On the isle of Negros there are promoters at work planning for the location of the proper installation of electric power, while on Cebu they have already made good progress, and before many months there will be electric lights in operation there and enough surplus power to provide the small manufacturers of fabrics, shoes, metal goods, and the like, with an abundance of power for the operation of machinery, electric fans, motors, etc. The same ideas are in progress on the island of Mindanao, where there have been discovered rich deposits of silver, lead, copper, and even gold. There is a large influx of mining prospectors to this island, and money is going to be plentiful there within a short period.

In electrical devices, as in most other mechanical apparatus, it is well known among the natives that the products of the American shops are superior to those of other countries. There is probably no country in the world in which the workmanship is equal to American. One of the principal reasons for this is that such machinery as electric fans and motors is finished nearly always by high-priced workmen in American shops, while the same styles of devices that come here from England, Spain and Germany bear the marks of the apprentice in finishing. In order to compare the excelling points of American fans and motors with those from other countries, one has only to come to a country like this and watch the goods as they come in. It is very easy to distinguish an American fan or motor as soon as it is landed on the wharf and without reading the label. This difference in the electrical fans, motors and other electrical devices is resulting, and will continue to result, in a great many unsolicited orders for American machines being sent from the Philippines.

The indications are that the demand for the electrical devices will be very large within a short time for the reason that there are plans in progress for the establishment of central electric power stations in nearly all of the important cities and towns and on some of the more important islands. Rich foreigners are preparing to control the system of power stations so as to provide electric lights for the cities and towns, and power for running small machines and cooling apparatus, such as fans, etc., for houses and business establishments. The large scale on which these enterprises are planned will mean the investment of many hundreds of thousands of dollars in fans, motors and general electrical machinery.

About a year ago, when the ships of the United States Navy began to stop here at the wharfs where the natives could inspect them, one thing that attracted much attention was the little electric fans in operation in the staterooms. These fans produced a current of air that had a decided cooling effect, so that that portion of the day which is usually lost to the business man in this section due to the intense heat could be utilized. It has been customary for the people of the Philippines to cease all labor from 11 in the forenoon to about two o'clock in the afternoon, and with American competition, which is now coming in, many of the native mercantile houses and manufacturing concerns prefer not to lose this important part of the day. In fact, many of them have abandoned the custom by ceasing work for no more than the regulation noon hour. As the work was ceased because of heat, and as the introduction of fans operated by belts running from handwheels so cools the air that it is possible to continue operations, the demand for fans made specially for the purpose of cooling interiors of workshops is exceedingly large. If an agent of an electric-fan concern were to canvass any of the manufacturing sections with a type of fan that could be operated under the prevailing conditions, he would take orders about as fast as he could write. Of course, the chief trouble at present is the lack of power, and a number of the fans in operation are run by small steam engines, and in some cases by power developed from water wheels, caribou power and even power derived from a handwheel operated by one or two native boys for 10 cents each for a day of 10 hours.

The metals and other ores of the Philippines have attracted capitalists here with a view of operating the mining districts, and in many places they have put in shafts which cannot be worked to advantage owing to the lack of sufficient air. Air currents are being developed in some of these shafts in very crude and uncertain ways, and in several instances which came to the notice of the writer they experienced disasters owing to the stoppage of the air currents as a result of the defective ventilating apparatus breaking down. In one place propellers were fitted to bearings at each turn of the shaft, and as long as these propellers were operated the air current developed was enough to keep up the proper circulation. The mode of operating the propellers consisted in running lines of hemp rope from the grooved wheels of one propeller to those of the next, and so on through the shaft. The main rope ran to the surface, where it was driven by means of a wooden cylinder. Whenever this cylinder broke down, or anything occurred to put the propeller system out of service, the occupants of the shaft would run to the surface for air. Some day there will be disaster in that mine. But there is no remedy under the prevailing conditions, and the same state of affairs exists in many of the newly started quicksilver mines on Panay island, where some of the discharged soldiers who formerly were engaged in mining and prospecting have located good claims and are working them. If the proper equipments for moving the air currents in the mines could be obtained, almost any prices would be paid.

The natives of the Philippines are not exactly a lazy lot, but the natural conditions of things, the climate and everything pertaining to the country for the last two or three generations have encouraged laziness. There have been many wars with Spanish soldiers, local tribes, and finally the Americans. When war prevails no man's property is safe, and the constant war in these islands has prevented the natives from working and accumulating property. They have not had the courage to till the soil for the purpose of letting enemies gather the crops. The lazy hours of the day have been many and will continue so for some time yet. During this interval of laziness on the part of the native he seeks to be cool and comfortable, and if money can purchase for him a fan that will cool his surroundings he will have it at any cost. The natives of the islands are not all a poor lot, for many have their horses, carriages and servants, and these represent a goodly proportion of the population in every city and town of the Archipelago. These are the people that will buy the electric fans and use them in their homes just as soon as there is power to operate them.

The demand for the fans will also be large from the mercantile establishments in which bookkeepers and others are obliged to swelter under the heat and the close conditions prevailing in most of the rooms at present. The American army has located offices in many of the cities and towns, and the suffering of the soldier clerk in these places might be and will be promptly rectified, as soon as means are provided. But it is all working the right way and within a few months there is going to be considerable of a demand for these little air-cooling devices which are so numerous in the United States and other countries.

The stores of the Philippines are, as a rule, constructed after the American plan so far as the store itself is concerned. The furnishings, however, are different, and instead of the show window which is so attractive in American stores, the front is usually barricaded with stone or wood, for purposes of protection against invasion, a necessity which is now past. There is, therefore, in most of the stores of this country, nothing more than the door and one or two little rear windows for the purpose of letting in the light and the air. The stores were all erected with a view of protection for the goods in case of a riot or an attack from the tribes of the hills, and in many stores I noticed that, by lifting a trap-door in the middle of the floor, it was possible to descend into a vault, large enough to hold the proprietor and his family, besides a goodly proportion of the stock of goods.

The compactness with which the stores are made in the Philippines makes them very hot and close, and a representative of an electrical-fan concern could take orders for ventilating and cooling fans in these stores in large numbers. He could commence operations in Manila at the present time. The stores in Manila are made more on the American plan than those of the other places on the islands, and many of them have open fronts. Even in these open-front stores there is need of fans, and already some of the stores have put them in. The ice-cream saloons, of which there are several in Manila, two in Iloilo, and about one each in three or four of the larger cities of the islands, where they can get ice from the government ice-making machines connected with the hospitals, are nearly all fitted with some sort of a cooling device, usually rigged up on the propeller system, in all of the places, except in the Manila saloons, where they have good fans.

The Philippines have been noted for their sugar products for generations, and there are many sugar mills dotted all through the islands. In one trip I made across Panay it seemed to me that there was a sugar mill in every square mile. In some of the sugar-making departments where they do the boiling in stone basements, the heat is so severe that even the natives, who are naked, can remain inside but a few minutes at a time. All that is wanted in these rooms is one or two fans to keep the air moving. The sugar-mill managers of the Philippines are all immensely wealthy, and any improvement that will put money into their pockets will be appreciated and bought by them.

When the proper time arrives for the use of electric motors in the islands the demand for these machines will exceed the expectations, for the reason that there is a vast amount of wood-working machinery, printing machinery, mining machinery and machinery in the metal-working shops, that cannot very well be operated by steam power, owing to prevailing conditions, but which can be run by small motors. There will be a call for these small motors to operate presses and isolated machinery in mines, mills, etc. The pumps used in the mines and other places can also be worked to good advantage by motors.

Some of the first motors manufactured in the American shops have, in some peculiar manner, worked their way around the world into the Philippines, and it would be better if they were not here, because these motors are set forth by the dealers in machinery as being of modern make. It would never do to state that these motors are of ancient pattern, for they could not be sold. Therefore, some of the buyers of motors for doing light work have been deceived in this way. At one shop I noticed that a pump appeared to be doing a great deal of groaning and jumping, and, upon examination, found that it was operated by a defectively constructed motor of old pattern and which did not work well. The speed was very irregular. In another case I saw one of the oldest patterns of American motors fixed over with new parts, and this one operated steadily with fair speed, but it was easy to distinguish that it was not a modern pattern.

The newly built American motors are superior to any types of motors sent here by German, English or Spanish firms. It is readily seen that each detail of construction of the American motor has been carefully inspected and that it has not been sent out of the shop in which it was made with defects in it, as is the case with many of the other types of motors shipped to the Philippines from other countries. The popularity of American-made electrical motors is due to the good condition in which the motors usually arrive, as many of the shipping firms in other countries fail to pack their machines properly. I have seen boxes containing delicate parts of electrical motors opened in the shops of this country and noticed that a goodly percentage of the parts were broken. The shippers forget that the box of parts is going to be subjected to a severe rolling and tumbling process on the ocean for quite a number of days, and they fail to pack the parts securely; they are liable to permit a bolt, a casting or a small piece weighing a pound or so to remain loose in the box among the other parts. This loose piece will be tumbled about among the other parts during the entire journey, and by the time the package arrives at its destination here in this country the loose piece will have chipped off numerous pieces of metal from the secured portions and perhaps have broken some of them. I have seen cases in which a loose piece has worked its way completely through the side of a wooden box and been lost. The constant hammering at the wood cuts the fiber and finally wears a hole. Good packing, therefore, is essential, and the American shippers are doing better in this direction than many of the shippers of other countries.

The general popularity of American-made fans, motors and general electrical devices in the Philippines is counting for a great deal in the favor of dealers in machinery, and the latter are receiving five orders for American fans and motors to one for all the other countries combined. "That the Americans do better work and that their motors give better satisfaction" are the reasons for this, as explained by one dealer. Another said: "The machines are right, prices right and the work is done right." All have a word of praise for the American machines.

A Boston Idea.

The new exhibition department of the Edison Electric Illuminating company of Boston was formally opened on October 3d, at the new building of the company, at 1 and 2 Head place. The exhibits will be open at all times to the public. Nothing is to be offered for sale, but opportunity is afforded manufacturers of electrical appliances to display their goods under the most favorable conditions. The rooms are artistically arranged and the ornamental arrangement and variety of the lighting, produced by nearly 800 16-candlepower incandescent lamps, is in itself an attraction. Among the interesting things displayed are an electric refrigerator and ice machine, a forge for heating iron to welding heat by means of electricity, and a horse-clipping and grooming machine.

The St. Thomas (Ont.) Street Railway company has increased its capital stock from $100,000 to $250,000, and will commence the extension of a radial line to Port Stanley this fall.

CORRESPONDENCE.

London Letter.

London, October 2.—Bond street station on the "Twopenny Tube" was opened last week for traffic for the first time. Thousands of passengers on the new line have been much exercised in mind as to the cause of the delay. The circumstances are somewhat singular. The ship which conveyed the original elevator machinery from the United States was wrecked, and the machinery lost, necessitating a second construction, which took several weeks to complete.

An eminent engineer, who does not wish his name mentioned, said to me during the last week: "I can never mount an omnibus or a horse-driven tramcar without a feeling of compunction. Horses in a private conveyance seem to me as much out of place as dogs in harness. In a few years everybody will think so." In the minds of most people electrically driven conveyances which do not provide their own energy are confined to rails. This, however, is not the case either in fact or theory. The trolley wire has been found quite adaptable to ordinary vehicles, traveling over common roads, and the system now brought into practice abroad will probably be largely employed for both tramway extensions and ordinary road traffic.

Professor Baum's experiments with the Baum space-telegraphy system made between Cruxhaven and Heligoland, a distance of 62 kilometers, have been perfectly successful.

The employes of the Ashton under Lyne electric tramways are out on strike and the position is so serious that on Tuesday the cars were under police protection. This course was adopted in consequence of disorderly scenes the preceding day, when stones were thrown and the glass of several cars smashed. Efforts have been made to recruit from the Isle of Man, but though a number of workmen were brought over, they declined to accept employment when they discovered the position of affairs.

The nave of St. George's Chapel, Windsor Castle, has been fitted up with electric light. The choir will still be lighted with candles.

The Central London Railway company is going to try to find a remedy for overcrowding. So far the number of passengers on the "Twopenny Tube" has been so great that trains have often started full from Shepherd's Bush and the Bank, and have been unable to pick up many passengers at intervening stations. The three-minute-and-a-half service is now to be accelerated to 2½ minutes, and, possibly, cars will soon be running every two minutes. Each train may also have another carriage added to it.

Hull tradesmen have taken up arms against the erection on the city pavements of electrical fuse boxes, and a deputation has waited upon the electric-lighting committee and asked that the boxes be placed underground. The complaint is that the boxes are a nuisance because of the people who lounge about them. The committee promised to see what could be done.

Mr. Charles T. Yerkes was on Friday elected chairman of the Charing Cross, Euston and Hampstead Railway company. This marks the closing of months of negotiation between the projectors of the original company and the American street-railway millionaire. It also establishes beyond question the fact that the railway which has hitherto existed only on paper will shortly become an actual reality. A dozen gentlemen, mostly lawyers, met at the Charing Cross Hotel on Friday to close up the deal, by which the company passes into American hands. Mr. Yerkes, who arrived from Paris on the previous day, was present, accompanied by Housman & Davies of New York, who have had charge of the negotiations from the beginning. Mr. R. W. Perks represented the company, and other legal gentlemen were present on behalf of individual directors and shareholders. The capital sunk by the promoters of the company, some $300,000, represented mostly legal expenses and cost of surveying the route. To this is added calls of $10 a share paid on 451 shares taken up and some $100,000 for other expenditures since the line was projected, seven years ago. With an addition for the good will of the concern, the total was brought up to nearly $500,000, and a check for the full amount was paid by Mr. Yerkes at Friday's meeting. The authorized capital of the new company is $8,880,000, in shares of $50 each, and $2,960,000 in debentures. The syndicate of American capitalists who are associated with Mr. Yerkes will raise the whole of this sum. The line itself will be an underground electric, running from Charing Cross to Hampstead, with branches connecting with Euston and Kentish Town. The terms of the act provide that it shall be completed by 1902. It will be run on the "Twopenny Tube" plan, and is expected to be the first of an underground system crossing London in a manner not at present available by the Metropolitan Railway company's inner circle. The equipment of the line is to be of the latest American pattern, the third rail being adopted as a feeder for the electric motors.

W. H. B.

New York Notes.

New York, October 13.—The contract between the Metropolitan Street Railway company and the United States government for carrying mails on the Third Avenue and Fort George line came to an end on October 1st, and the company has refused to renew it. The public suffers many disadvantages from this state of affairs. Under the contract mail cars were sent out from the postoffice every half hour, attached to a Third Avenue car as a trailer and filled with mail. Pouches were delivered at 10 stations from Ninth street to One-hundred-and-Fifty-seventh street. It took about an hour and 40 minutes to get mail from the postoffice to Fort George. On the return trip the mail was gathered up along the route, and what was for New York Central and New York, New Haven and Hartford trains was dropped off at Forty-second street. Thus close train connection was secured. The nine cars were rented to the government for $10,000 a year. The contract has been canceled by the Metropolitan company, according to its officials, simply for the reason that the company does not want to be bothered with mail cars. The company fears no strike, and accordingly feels that the mail service offers no inducements.

Six handsome cars for the first electric train of the Manhattan Elevated Railway company are now at the shops at Ninety-eighth street and Third avenue. A motor car is placed at each end of the train. The company has not yet announced when the trial will occur, but it will probably be over the Second Avenue line.

The Metropolitan Street Railway association, composed of employes of the Metropolitan Street Railway company, celebrated its fourth anniversary on the night of October 6th, by a vaudeville entertainment in Carnegie Hall. The hall was filled with the wives and friends of the employes of the Metropolitan company. H. H. Vreeland, who is the president of the association, made a brief address, in which he welcomed the families of the employes. The end of the present financial year showed the membership to be 3,312. During the four years the organization had paid in sick and death benefits the sum of $43,916. It also owns a circulating library of 1,300 books, to which the members and their families have access, and a bed in St. Vincent's Hospital, the gift of President Vreeland. The membership of the organization has increased in four years from 100 to 3,312, which number includes a large majority of the company's regular force.

The suit which Alexander R. Hart, formerly president of the Long Island Electric railway, brought against Martin Maloney, a wealthy Philadelphian, for a commission of $20,000, alleged due him, has been dismissed by Justice Gaynor of the Supreme Court of Queens County. The suit originated from the sale of the plant of the Jamaica Electric Light company to the Pennsylvania Power, Light and Heat company.

Mr. and Mrs. Charles T. Yerkes arrived from London to-day on the Deutschland. Mr. Yerkes has been abroad four months, and during that time succeeded in obtaining control of a valuable underground-railway franchise in London. Upon being interviewed, he refused to say anything in regard to his street-railway affairs. He said he would remain in New York a few days and then go to Chicago.

M. L. G.

Northwestern Notations.

Minneapolis, October 13.—Superintendent E. C. Walley of the Walla Walla (Wash.) Electric company sustained a shock of 1,040 volts while repairing a transformer. It did not have any serious effect, and he was soon at work again.

The Electric Light company of Little Falls, Minn., has placed orders for a new incandescent-light machine. The old machine was recently damaged so badly that it will take a long time to repair it, and the company has concluded to buy a new one.

C. M. Hertig of St. Cloud, Minn., seeks to promote a company to secure the electric-power and heating plant there, which is now in the hands of a receiver.

The Albert Lea (Minn.) Electric company has ordered two new boilers of 400 horsepower each, to furnish power for the extension of the plant.

Recent breaks in water pipes in St. Paul have revealed the fact that the street-railway company's employes have been grounding heavy currents on water pipes. The result has been that this use of them for return currents has produced electrolysis, in many cases causing great holes to be made in the piping. The officials of the street-railway company claim that it has been done without their knowledge or instruction. It is urged that if the rails were not assisted by the easily conducting water mains, some portion of the current would lie in the ground and make it unsafe in wet weather to persons or animals. The currents in some parts of the system of mains have been so strong that workmen have refused to touch the pipes. The St. Paul Water Board will complete its investigation and will charge the street-railway company for the pipe and labor involved in repairing the break recently made, which is charged to electrolysis. The street-railway company has promised that no more connections shall be made to water pipes.

The Richardson Electric Light company has begun work on a power station for its new system for Cloquet, Minn.

The special lighting committee of the council of La Crosse, Wis., will have the city engineer prepare plans for the proposed municipal electric plant.

P. J. Wrangelborg is an applicant at Evansville, Minn., for a franchise for a lighting plant.

The Electric company at Ida Grove, Iowa, is about to add a fourth boiler to the battery in its power station.

The council of Pelican Rapids, Minn., looks forward to installing an electric-light system for that village next summer.

The Hughes Electric Light company of Fargo and Bismarck, N. D., is an applicant for a franchise at Minot, N. D.

The mill company at Adel, Iowa, has completed its lighting system and put it in operation.

The Winnebago Traction company of Oshkosh, Wis., is putting into use cars with vestibules on them.

The house containing the dynamo and electric apparatus for running the underground ore cars of the Oliver Mining company at Ironwood, Mich., was recently burned. The contents of the building were a total loss and the damage amounted to $35,000.

The council of West Superior, Wis., has voted to annul the franchise of the Duluth-Superior Traction company in that city, and instructed the city attorney to proceed against the corporation to that end.

Football is being played this fall at Des Moines, Iowa, by electric light.

The mayor of Burlington, Iowa, in a communication to the council, advises that body that the rates paid for street lighting are too high, and suggests an investigation as to the average price paid by other cities before entering into a new contract. The present contract expires September 1, 1902.

The Oelwein Electric Light company of Oelwein, Iowa, has disposed of its plant to Illinois capitalists who have reorganized as the Oelwein Light, Heat and Power company. A heating system will be installed in connection with the plant.

The Phœnix Mill company of Herman, Minn., contemplates installing a plant for lighting the mill by electricity.

The council of Albert Lea, Minn., has granted a franchise to the Albert Lea Electric Light company to put in a public heating system.

The average cost of street lights for the year ended March 31st for Lyons, Iowa, was $54.53. Clinton, proper, of which Lyons is a part, averaged $90, but the lights there burn longer hours.

A heater and water filter in the power house of the Ottumwa (Iowa) Electric and Steam company blew up recently and stopped the cars and power service for four hours.

A new dynamo of 200 lights' capacity is to be put in for the courthouse at Superior, Wis. It replaces a 75-light machine, which has been unequal to the load put upon it.

The electric-light system at Horr, Mont., has been completed and tested.

The mayor of Des Moines, Iowa, has vetoed the ordinance lately passed by the council allowing the Edison Light company $1,250 extra compensation in consideration of the company putting its wires underground.

The council of Appleton, Wis., has directed the city attorney to take steps to compel the local street-railway company to repair its tracks and operate cars or forfeit its franchise. The line has not been operated since the power house burned, in July, and no progress has been made toward replacing it.

The suit against the Twin City Rapid Transit company, by the city of Stillwater, Minn., to forfeit the franchise, has been transferred to Minneapolis for hearing.

The differences between the Duluth-Superior Traction company and the Woodland company in Duluth, Minn., have been settled temporarily. The Woodland company pays $500 for repairs to the tracks, and the Duluth-Superior company agrees to operate the line until spring.

A large mill is to be established at Somerset, Wis., in connection with the electric power plant just completed. Each machine in the mill will be direct-connected to an independent motor, thus avoiding the use of belting and shafting.

The courts in Seattle, Wash., hold that a street-railway company has a right to expel a passenger from a car who will not or cannot tender in payment of his fare a bill of reasonable size. The company there agrees to change a bill up to $5. Since the raising of the question the conductors of the Consolidated Street Railway company have been instructed to accept bills of large denominations when offered for fare—as high as $100—and tell the passenger to call at the general office for his change.

Auburn, Renton and Issaquah, Wash., are to be lighted by the Snoqualmie Power company. The transmission wires of the company pass through those towns on the way to Seattle, and are to be tapped.

The Seattle Electric company of Seattle, Wash., has just put into service 10 new cars, 38 feet in length, equipped with air brakes.

The plant of the Hughes Electric company at Bismarck, N. D., is about ready for operation.

Negotiations are pending between the Appleton (Wis.) Electric Light and Power company and the Green Bay and Mississippi Canal company for the erection of a power house at the upper dam, to develop electric power for the street-railway system.

The council of Sioux Falls, S. D., has rejected an application for a franchise to establish a street-car system.

The electric-light company of Chamberlain, S. D., will sink another artesian well to furnish power for the plant.

The council of Moorhead, Minn., will proceed to stop the Fargo-Edison Electric company of

Fargo, N. D., from entering Moorhead and furnishing light.

August Lenzi has brought suit against the street-railway company of Tacoma, Wash., to recover damages for $1,500, for injuries sustained in the 4th of July accident. He also asks that a receiver be appointed to protect his claim and those of others injured at the same time. He alleges that the company's finances are in such shape that the management will probably transfer large sums from its treasury to its stockholders, as self-protection, and for this reason he asks a receiver.

A street car in Butte, Mont., slipped on an incline and ran into a loaded ore car, which was being switched. The vestibule of the car was badly wrecked and the driver was bruised and cut by flying glass. Two passengers received slight injuries. R.

Baltimore, Md.

Baltimore, October 13.—The Belt Tunnel of the Baltimore and Ohio railroad is being equipped with the third-rail system. The third rail is to be laid outside the track rails and will displace the overhead-trolley wire, now used. Ample protection from shocks will be furnished by plank guards about the rail.

Some time ago the United Railways and Electric company offered the city of Baltimore $10,000 in cash and the viaduct bridge over Stony Run, in order that Mayor Hayes might get a shorter and more direct route to Druid Hill Park. The company also agreed to take up its tracks on Oak street. In return, the company sought certain privileges as to laying a number of curves and switches throughout the city. At the recent meeting of the council of the city the ordinance granting these privileges was brought up, but it was then stated that the company requested that the ordinances be laid on the table, and, on motion, the ordinances were so disposed of. The company had come to the conclusion not to accept the ordinances under the amendments and restrictions placed thereon by the Board of Estimates.

The Subway Commission hopes shortly to have the municipal subways completed in certain districts of the city, and will, as soon as this is accomplished, require all overhead wires to be placed in these subways.

The mayor is awaiting the final report of the Municipal Lighting Commission before taking steps toward establishing a city lighting plant.

The car barns opposite Carroll Park, now in course of erection, for the United Railways and Electric company will be completed about the beginning of winter. The new barns are among the largest ever erected in this country. They will occupy when completed an area equal to eight city blocks, from Columbia avenue south to Carroll street, and from Bush street west to Elk street. The "bays" are immense steel-framed sheds, with brick walls, 475 feet long and 90 feet wide. Blacksmith shops, foundry and lumber yards are connected with the barns. N. C.

Southern Developments.

Charlotte, N. C., October 12.—A special meeting of the board of aldermen of Wilmington, N. C., will be held during the present month to investigate the present hitch between the city and the electric-lighting company, and to discuss the advisability of the city's establishing its own plant.

D. I. Hassell and others have secured a commission to establish the Sullivan's Island railroad, which it is proposed to operate as an electric line in Moultrieville, Sullivan's Island, S. C. The capital stock is $10,000.

The new electric line at Spartanburg, S. C., has been completed to Clifton, giving the company about 10 miles of track now in operation.

George W. Miles is president of the Electric Light and Power company, which will erect a big power house 2½ miles from Radford, Va., to supply light and power for Radford. Contracts representing $20,000 have been let. The machinery will likely be installed before January next.

The Richmond (Va.) Passenger and Power company has presented a petition to the City Council to be allowed to "electrify" the Broad street line now operated by mules. The petition is regarded as futile, and it is said that the only thing for the company to do is to use the tracks of the Traction company's line on this street.

The Richmond Passenger and Power company of Richmond, Va., has given a million-dollar mortgage to the Atlantic Trust company of New York to enable it to take up $400,000 outstanding bonds on the plant of the Richmond and Manchester company, and to enable it to rehabilitate its entire system. J. D. Patton is president of this company. D. H. L.

Gleanings from Colorado.

Denver, October 12.—The two new power stations in Colorado Springs are making excellent progress. That of the Colorado Springs Electric company, formerly the El Paso Electric company, is located at Austin Bluffs, where the coal field is situated. The plant is located four miles from the old station, which is to be used for a sub-station. If the plans are executed, 1,500 kilowatts will be delivered by the first of January. The Citizens' Light, Heat and Power company has already begun work on the power station at the Carlton mine on the Denver and Rio Grande railroad. The company will use Allis engines, directly connected to Westinghouse generators, Babcock & Wilcox boilers and American stokers. The station is to be built of brick, near Monument Creek, where water is obtainable. The company expects to supply current by the first of January. The company expects to do a good deal in the way of experimenting with current for heat.

The Florence Street Railway company has been incorporated, with a capital of $500,000, by James Reed, Harry Robinson, H. N. McCook and A. B. McFall. The company is licensed to operate in Fremont, El Paso, Teller, Pueblo and Custer counties. Florence is in the heart of the oil district and it is said the oil interest is back of the enterprise. Florence is a town of between 3,000 and 3,500, but if built the road will doubtless extend to neighboring places, such as Canon City.

Work on the electric road at Santa Fe, N. M., has been begun. The company has a capital of $250,000 and the incorporators are M. W. McGrath of Chicago, J. H. Vaughn of Santa Fe, J. P. Victory of Santa Fe and H. O. Bursum of Santa Fe.

The Denver Tramway company has been asked by a committee of its employes to restore the wages to the scale which existed previous to 1893. Under existing conditions, it is doubtful if the company can accede to the request. Were it not for the bicycle the company doubtless would grant the advance.

Incorporation papers of the Mountain Telegraph company have been filed with the secretary of state. The capital stock is $1,000,000 and the incorporators are John L. Jerome, J. A. Kebler and Delos A. Chappell, and these gentlemen constitute the board of directors, together with John C. Osgood and Morgan Jones. It is announced that the company is owned by the Colorado Fuel and Iron company and the Victor Fuel company. It is stated that these companies' first object is to connect their own properties and then to seek for a general business. J. W. D.

PERSONAL.

Mr. J. Sigfried Edström, who was a resident in this country for about four years, has recently gone from Zurich, Switzerland, to Gutenburg in Sweden, his native place, to install the new electric railway in that city.

Mr. Henry L. Doherty, well known from his connection with lighting and power plants in Madison, Wis., St. Paul, Minn., and other places, was in Chicago last week on his way to attend the annual convention of the American Gas Light association, held in Denver this week.

Albert Lynn Lawrence, who has been engaged in patent-law practice in Chicago for the last five years, first with Barton & Brown and later as associate counsel for the Western Electric company, has removed to Cleveland, Ohio, where he will continue his legal practice at 1410 Williamson building.

Frederic A. Miller has been made general passenger agent of the Chicago, Milwaukee and St. Paul Railway company, succeeding George H. Heafford, resigned. Mr. Miller, who was formerly assistant general passenger agent, has always shown an interest in the electrical affairs of his company, and he has many friends among electrical men who will be pleased to learn of his promotion.

Mr. William Warren Dean of the Western Electric company has accepted a position with the Kellogg Switchboard and Supply company of Chicago. Mr. Dean was at one time connected with the Kellogg company and is the patentee of a number of valuable inventions owned by that concern as well as many others assigned to the Bell and Western Electric companies. Mr. Dean is to take charge of the experimental department and laboratory of the Kellogg company, and will be a valuable addition to that company's force.

ELECTRIC LIGHTING.

The Franklin Water, Light and Power company of Franklin, Ind., is about to let contracts for an electric-light plant to cost $30,000.

The citizens of Ithaca, N. Y., are agitating the question of erecting a second electric-light plant and the establishment of a heating and power-supplying plant in Ithaca.

The annual report of the Edison Electric Illuminating company of Boston for the fiscal year ended June 30th shows the gross earnings to be $1,131,758. The expenses were $725,537, leaving as net profits $406,221.

The Economy Electric company of Warren, Ohio, has been organized, and will at once build an electric-light plant in Warren. The stockholders are P. L. Webb, G. H. Jones, W. H. Smith and G. B. Sawyer.

The Edison Electric Illuminating company of Cumberland, Md., has voted to issue $35,000 of bonds to pay for the steam-pipe system now being laid in the streets, and to make improvements at the electric-light plant of that city.

Articles of consolidation and incorporation of the Hercules Electric company and the Logan Light, Power and Heating company, under the name of the Hercules Power company, have been filed in Provo City, Utah. The company is capitalized at $250,000, divided into 25,000 shares of the value of $10 each. The directors are: Lafayette Holbrook, George W. Thatcher, Moses Thatcher, Eldon P. Bacon and William C. Cates.

ELECTRIC RAILWAYS.

A syndicate, headed by J. F. Shaw & Co. of Boston, has secured the entire right-of-way from Trenton to Philadelphia for a new trolley system.

The council of Croswell, Mich., has granted a franchise to the Detroit, Lake Huron and Lexington Electric railway for a right-of-way through that village.

Charles C. Campbell and associates of Fairfax Courthouse, Vt., will erect a $60,000 electric power plant to supply motive power for their railway at that place.

The commissioners of Belair, Md., have voted to permit the Belair and Havre de Grace Electric Railway company to lay its tracks upon the main streets of the town.

At a special election held at Waycross, Ga., recently, a 50-year franchise was granted to the Waycross and Suburban Railway company for constructing and operating an electric street railway.

Bids are wanted until November 1st for constructing the Arcadia and Clifton Heights Railroad company's line of five miles, to extend from Clifton Heights, Pa., through Lansdowne and Heyville. The necessary surveys have been made. H. M. Brennan of 133 South Eleventh street, Philadelphia, is president of the company.

Junction City (Kan.) capitalists have taken steps toward organizing a company with a capital of $80,000. The company intends to build a street railway to Fort Riley and put in an electric-light plant large enough for Junction City and Fort Riley. Captain B. Rockwell, Captain J. K. Wright, Major J. Davidson and others are interested.

In pursuance of the plan that the Massachusetts Electric companies are working out for the consolidation of the numerous companies controlled by them, the railroad commissioners of Massachusetts have been asked to grant the necessary authority for the Lowell, Lawrence and Haverhill road to absorb the Lowell and Suburban, also for the Brockton road to absorb the West Roxbury and Roslindale line and the South Shore and Boston company, with the right to issue transfer stock.

AUTOMOBILES.

One of the chief features of the Indianapolis carnival was a race on Capitol avenue between two horses and two racing automobiles. The race was one mile, or from Sixteenth street to New York street. The horses were given a handicap of one square and won in both races, but by little more than a neck.

A dense fog marred the run of the Chicago Automobile Club to Milwaukee on October 13th. Of the six machines that started only two reached Milwaukee, those of A. J. Eddy and H. M. Brinckerhoff. Mr. Eddy's machine is a gasoline motor and made the run of about 99 miles in seven hours, arriving at the Hotel Pfister, the rendezvous, at five o'clock. The other five machines in the run were steam locomobiles. Two machines broke down at Kenosha and two were forced to stop at Waukegan. The return trip was made on Sunday afternoon.

PUBLICATIONS.

"Graphite for Automobiles" is the title of a small pamphlet recently issued by the Joseph Dixon Crucible company of Jersey City, N. J. It contains instructive paragraphs on graphite in general and treats particularly of the use of Dixon's pure flake graphite and other graphitic lubricants for automobiles, electric motors, etc.

The Italian journal l'Elettricita has in preparation an "Album of Electricians," to contain over 200 portraits of eminent electricians of several nationalities. The subject-matter will be printed in French. It will be a quarto volume, printed on superfine paper, and costing five francs. Communications should be addressed to the editors of l'Elettricita, No. 11 Via Cusani, Milan, Italy.

Instruction Book No. 3004, issued by the Fort Wayne Electric Works, relates to the type K integrating meters manufactured by that company. It explains the details and working principles of these meters, and gives careful instructions for their installation and connection, speed adjustment on varying loads, repairs, etc. Some helpful wiring formulas are included in the book.

The American Steel and Wire company of Chicago publishes a 60-page catalogue of springs, embracing every variety and size of extension, compression, torsion and flat springs, for every possible application. The book further illustrates various forms of special bent wires which the company offers to furnish, simple or complicated, for all man-

ufacturing purposes. The large facilities of the company enable it to make these specialties at low figures, and to furnish the proper quality of steel to serve each purpose.

The International Storage Battery company of 45 Milk street, Boston, has issued a pamphlet descriptive of its new accumulator, the patent for which was issued last spring. The invention involved in this battery is of a purely mechanical nature and relates to the construction of the grid, which is practically solid and integral in all its parts, reducing the weight to a minimum. The company guarantees the maintenance of its batteries for 10 per cent. per annum of their first cost when used for stationary installations of large capacity.

"Electric Mine Locomotives" is the theme of an exceptionally handsome and well illustrated catalogue of 46 pages sent out by the power and mining department of the General Electric company. The pamphlet sets forth the advantages of electricity over steam, air and other agents in mine haulage, and then enters into a careful description of the types made at Schenectady. In many respects the mine locomotive differs from all other electric-motor cars. It is exceedingly compact, motors, controller, etc., being designed to keep down the dimensions of the frame as much as possible. Larger forms are shown for surface work, resembling more the ordinary electric-locomotive type, as well as electrically equipped larries. The list of the 177 mine locomotives in actual operation shows the draw-bar pull which these insignificant-appearing trundlers can exert; the motors range all the way from 500 to 4,500 pounds in pulling capacity. A large part of the work is devoted to descriptions of actual mine equipments where these locomotives are used, giving details of the work they are doing daily, and, in figures and tables, the economies attained. The book abounds in useful and interesting information for all miners and electrical engineers.

POWER TRANSMISSION.

It is said that a syndicate headed by ex-Governor Mackintosh of British Columbia has secured control of the Slave Lake power in that region. The project contemplates the use of the power on Slave River for the development of electricity to be distributed to coast cities.

On the San Juan branch of the Concho River in the state of Chihuahua, in Mexico, an important electrical power development is to be made. Below the city of Peral, and between that point and Chihuahua, a dam 250 feet wide and 150 feet high is to be constructed, impounding a lake 15 miles long with an extreme width of 3½ miles. Lines of wire will be run from the power house to Peral, 40 miles away, and Chihuahua, 80 miles away, as well as to other towns in the immediate neighborhood.

The electrical installation in the Lancaster (Mass.) mills has been completed, and they are now said to be using more electrical power than any other mill in the country and more than any cotton mill in the world. The power derived from two engines of about 5,000 horsepower is directly applied to two large electrical generators, and thence by underground wires to 30 motors distributed through the mills. These motors run from 50 to 150 horsepower. By the new arrangement an increase in efficiency is secured and the coal consumption reduced. The cost of the plant was approximately $300,000. Chief Engineer W. H. Goodwin is in charge.

SOCIETIES AND SCHOOLS.

The trustees of the American School of Correspondence of Boston announce their willingness to grant a limited number of free scholarships to men in various large establishments in different parts of the country. Correspondence on the subject is invited. The school calls attention to its courses in mechanical and electrical engineering (including a compete course in mechanical drawing), the former including steam, locomotive and marine engineering. As the work is confined to these branches the managers of the school assert the probability of better work being done than would be likely where many other branches are taught.

SPACE TELEGRAPHY.

London advices state that Marconi has successfully transmitted a message by the wireless system from Boulogne, France, to Dover Court, a distance of 60 miles, and that in so doing the customary mode of receiving and transmitting the message on poles was abandoned, the dispatch instead being received on a cylinder only four feet in height.

The Popoff system underwent a long test in connection with the stranding of the Russian coast-defense ship General Admiral Apraxine. This vessel struck last winter on the rocks off Hohland, in the Gulf of Finland. To make her salvage possible communication was established with the mainland and with the ice-breaking steamer Ermack, for which purpose transmitters and coherers were erected on the island of Hohland, and on a small island near Kotka, the distance being 33 miles. The apparatus worked well for a period of 84 days, and 440 official messages were despatched and received. A curious feature is that the system worked better in a heavy snowstorm than in fine weather.

The report comes from the Hawaiian Islands that the Marconi system of wireless telegraphy introduced there for interisland communication has not been entirely successful. The signaling between Honolulu and Molokai is not satisfactory. It is assumed that the heights of the upright conductors at the two points have not been sufficient, and that when this fault is remedied all will work satisfactorily.

TELEGRAPH.

The submarine cable of the Eastern Extension and Great Northern Telegraph companies, between Shanghai and Chefoo, China, has been successfully completed, and the line is open for traffic. This, with the Chefoo-Taku cable, recently laid, connects Shanghai with Taku, independent of Chinese land lines. The companies also announce the opening of branch cables between Chefoo and Wei-Hai-Wei and Chefoo and Port Arthur.

MISCELLANEOUS.

At Port Chester, N. Y., is a band, each member of which, on night parade, carries a small electric light on his instrument. The current is furnished by a storage battery carried in the pocket of each musician. The lights are of various colors and add brilliancy to the parades.

Although not generally known, electricity is playing an important part in the progress of the trans-Siberian railroads. It is stated that even the most isolated towns in the Asiatic desert are as well equipped electrically as some of the modern cities of Europe and America. The municipality of Vladivostok has voted to install 30 kilometers of trolley system in addition to lighting electrically all its streets and the principal houses.

About 70 linemen, members of the Electrical Workers' Union of Los Angeles, Cal., went on strike, on October 3d. The demands of the strikers are for an eight-hour day; for $3 a day for linemen and first-class apprentices, $3.50 a day for foremen, and $2.50 a day for second-class apprentices, all line work to be done by members of the union; and for pay at the rate of time and a half for work done on Sundays and holidays and for extra time.

TRADE NEWS.

A charter was granted on October 8th, at Dover, Del., to the Bishop Electrician company of New York, with a capital stock of $50,000.

The Economy Electric company was organized at Warren, Ohio, on October 8th. The stockholders are P. L. Webb, George H. Jones, H. W. Smith, G. B. Sawyer and J. W. Powers.

The Neely Electric company, having a capital of $50,000, has been incorporated at Washington, D. C., by F. C. Behrens, L. C. Brooks, C. C. Wheeler and others, to manufacture and deal in electrical goods.

The lowest bid received by the Treasury Department for the installation of a wiring system in the United States postoffice building at Newport, Ky., was that of Edward Heaton of New York, in amount, $1,065.

The Alglon Electric company has been incorporated in New York with a capital stock of $5,000. The directors of the company are: Jules E. Serre and Gustav Nordin of New York city, and H. R. Anderson of Rahway, N. J.

The contract for furnishing the United States engineer's office at New London, Conn., with two accumulators has been awarded to the New Jersey Foundry and Machine company, at its bid of $4,957, the time for delivery being five weeks.

At a meeting of the board of directors of the Sprague Electric company of New York, held recently, the following-named officers were elected for the ensuing year: President, John Markle; first vice-president, Edward C. Platt; second vice-president, Allan C. Bakewell; secretary, Charles P. Geddes; treasurer and assistant secretary, H. R. Swartz.

Mr. G. E. C. Johnson, well-known in the electrical and street-railway field, and, until the sale of the Martin J. Insull company to the General Incandescent Arc Light company, the secretary of the former company, has opened an office at 934 Monadnock block, as manufacturers' agent. Mr. Johnson will handle a line of G. I. arc lamps and D. & W. fuses and other electrical specialties.

The Faries Manufacturing company, Decatur, Ill., manufacturer of electric fixtures, suffered considerable loss by a recent fire. The company is pushing the work of reconstruction of its plant, however, and expects to be able to ship goods again in about 10 days. The plant will run night and day as soon as the plant is in shape in order to take care of the large number of orders that have been coming in recently. The Faries company says it did an immense business in September and up to the time of the fire in October, and it believes that the fall and winter trade in the electrical line is to be "something immense."

The first lot of heavy machinery from the works of the Siemens & Halske Electric company at Chicago has arrived at Fort Wayne, Ind. The Siemens & Halske branch of the General Electric company's system is to be consolidated with the Fort Wayne Electrical Works. It is said that about 500 men will be taken from Chicago to Fort Wayne, next spring. New buildings are now going up in the latter city.

BUSINESS.

The Electric Appliance company, Chicago, is agent for the line of annunciators manufactured by Partrick, Carter & Wilkins.

R. H. Leavitt of Capron, Ill., dealer in telephone cross-arms, pins and brackets, announces that he has added the standard electric-light cross-arm to his products. He carries a large stock of both kinds of arms and can make prompt shipments.

W. C. Sterling & Son of Monroe, Mich., report that their pole and tie business is experiencing a remarkable improvement and that their orders are coming in fast. Within the last few days they have closed some large contracts with electric railroad and telephone companies. The general demand for steam-railroad ties is on the increase and this, the Sterling firm believes, will greatly stimulate its business.

The Western Electric company states that its series-enclosed alternating arc lamps are meeting with remarkable success by virtue of the facility with which these can be installed and the low cost of maintenance. Among the cities using these lamps are El Paso, Tex., Fowler, Ind., Chico, Cal., Durand, Wis., Birmingham, Ala., and Chicago. The same company is also carrying in stock a complete line of two and four-pin cross-arms for the electric-light trade. These arms are made of selected lumber, hand-painted, and are full 3¼ inches by 4¼ inches, the regulation size.

Phono-electric wire, made by the Bridgeport Brass company, 19 Murray street, New York, is said to have a decided advantage over other wires for trolley use, in that it is homogeneous throughout and does not depend upon a hardened skin for its strength. On account of its homogeneity, this wire will not, it is said, break at joints or scratches, and will not stretch. Phono-electric is asserted to be the only wire that combines high tensile strength, elastic limit, great ductility and remarkable wearing qualities. For this reason it is especially adapted for use on lines that are subjected to hard service.

Anyone in the western and middle states not familiar with the eastern electrical-machinery market in so far as apparatus "as good as new" is concerned may well give attention to the new catalogue of Rossiter, McGovern & Co. of New York and Brooklyn. In presenting this revised and enlarged catalogue, Rossiter, McGovern & Co. call especial attention to the fact that they handle only machinery of recognized and standard manufacture, such as Westinghouse, General Electric, Brush, Stanley, Crocker-Wheeler, etc., and of these different makes they can furnish the latest and most modern types of apparatus. All the machinery, before leaving this firm's hands, is put in perfect running order. This firm both buys and sells electrical apparatus and purchases for cash machines that have been used, or, where it is desired to increase the capacity of a plant, installs the required machinery and takes the used apparatus in exchange.

The Garl Electric company of Akron, Ohio, has prepared an exhibit of its electric signal and telephone system for the instruction of street-railway men at the Kansas City convention. The display consists of a complete plant, of both steam and electric-railway safety and service system, invented by M. Garl. Mr. Garl has believed many years that a system could be perfected whereby a train might be signaled at almost any point on the road and telephone communication established with any office that might be desired. The system which Mr. Garl now proposes to introduce consists of a series of signal boxes placed along the line of a railroad, all of them connected with the stations by copper wires. The wires are attached to two explosive cartridges in the boxes at the various points, and when the telegraph operator wishes to signal a train at X, for example, he makes the necessary electrical connection in his office. When the locomotive passes the box at X, the pressure on the rail closes the circuit, an apparatus connected with the box having been arranged for that purpose, and the electric current causes the cartridges to explode. This, of course, warns the engineer or motorman, as it may be. He is provided with a small telephone instrument, which may be attached to the wires, giving him communication with the operator at the other end of the line. When the explosion occurs a bell on the operator's table rings, and he knows he will soon be called up, and is giving his attention to his telephone instrument.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 9, 1900.

659,236. Process of Making Sulphuric Acid. Albert C. Johnson, Baltimore, Md. Application filed December 14, 1899.

The process consists in producing a series of electric sparks within a chamber containing vaporous sulphuric-acid gas, and at the same time introducing an oxyhydrogen gas, which is exploded by the electric sparks. By this means the acid-laden particles of moisture may be precipitated.

659,244. Circuit Controller. Adam Lungen, New York, N. Y. Application filed February 23, 1900.

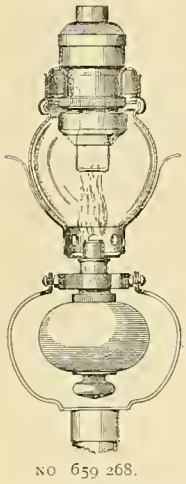
In a circuit controller are combined a pivoted circuit-controlling lever, a second lever bearing against one end of this circuit-controlling lever and having a V-shaped cam surface engaging with the circuit-controlling lever, and means for forcing the cam lever against the end of the circuit-controlling lever and simultaneously moving its cam surface along the end of the lever.

659,268. Glower-heating Apparatus for Electric Lamps. John Van Vleck and William N. Stevens, New York, N. Y. Application filed April 27, 1900.

An electric lamp of the Nernst type is specified, having a fixed glower and a surrounding guard for the glower, provided with an opening below the glower. A removable flame-producing burner for heating the glower is furnished, and means for centering the burner with respect to the opening. (See cut.)

659,269. Annunciator for Telephone Exchanges. Benjamin Waller, Detroit, Mich. Application filed December 20, 1897.

In a device of this character is described the combination with a plurality of synchronous switches, of contacts for the same, circuit closers and annunciators. Means are also provided for holding the annunciators temporarily exposed when actuated by an intermittent electrical current.



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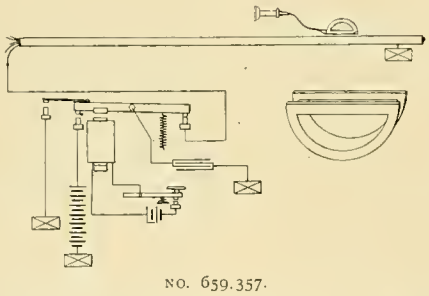


NO. 659.357.

659,338. Process of Extracting Zinc and Copper from Their Ores. Caleb G. Collins, New York, N. Y., assignor to Calvin Amory Stevens, New York, N. Y. Application filed October 30, 1899.

The process of treating ores of copper and zinc described consists in immersing the comminuted ore in a solution containing sodium sulphate and bisulphate (niter cake), removing the depleted ore, and extracting the metal therefrom by electrolytic action, then adding more comminuted ore to the remaining solution, and repeating the operation.

659,355. Trolley Finder and Guard. Harry C. Williams, Pasadena, Cal. Application filed April 26, 1900.

The trolley finder consists of a swinging frame carried by the trolley pole and carrying the trolley wheel, and adapted to be forced downwardly and rearwardly by the resistance of the wire when the wheel is placed thereon. A spring is arranged for returning the frame to an upright position when the resistance is removed, and a pivoted finder is made movable with the swinging frame and adapted to lie below the wire when the frame is depressed, and to assume an upright position when the swinging frame is actuated by the spring.

659,357. Apparatus for Locating Faults in Electric Circuits. William E. Athearn, New York, N. Y. Application filed January 23, 1899.

In a device for locating faults in electric circuits are combined a double-contact relay having one of its contacts connected with the faulty line and its other contact connected with a grounded battery. The lever of the relay is connected with a grounded condenser and actuated by an interrupted local circuit, and an inductor is in circuit with an indicator held contiguous to the faulty circuit. (See cut.)

659,389. Electric Meter. Thomas A. Edison, Llewellyn Park, N. J. Application filed September 24, 1898.

In an electric meter are combined a balanced scale beam and two electrolytic cells, the movable electrodes of which are connected to the extremities of the scale beam, a register train and an escapement operated thereby, and controlled by the oscillation of the scale beam. A movable contact is operated by the register train at each movement of the escapement, and two fixed contacts are provided, with each of which the movable contact successively engages. A divided resistance shunts both cells and a connection is made between the center of such resistance and the movable contact, whereby the current will be successively reversed through both cells. (See cut.)

659,409. Electric Bipolar Dilator. Charles L. Mosher, Chatham, N. Y. Application filed August 25, 1900.

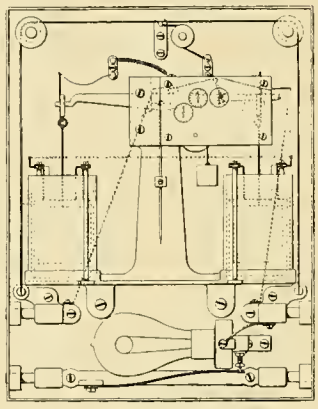
A rectal or other dilator is described, the expanding blades of which are provided with contact plates or poles constituting the terminals of a source of electrical supply, and adapted to be included in an electric circuit.

659,417. Self-adjusting Circuit-breaker for Electrical Welding Machines. John C. Perry, Clinton, Mass. Application filed March 26, 1900.

The inventor describes an electric welding apparatus, a circuit-breaker, means for operating the circuit-breaker, a movable welding jaw and connections between the jaw and the circuit-breaking means. Means are provided for moving the jaw to securely seat the parts to be welded, irrespective of the irregularities in the size and shape of the parts, or of their contact ends or points, and without affecting the circuit-breaking means. After this operation the circuit-breaking means are arranged to be put under the control of the jaw, and then the jaw is moved so as to produce the required amount of upset, the means for breaking the circuit being so timed that they operate the circuit-breaker only when the predetermined amount of upset has been produced.

659,433. Perforator for Preparing Telegraphic Messages. Charles L. Buckingham and Emil Germann, New York, N. Y.; Germann assignor to Buckingham. Application filed January 13, 1898.

A perforating machine is described involving the combination of a punch head, one or more series of punches, one or more series of actuating levers, preferably of bell-crank form, all of which are rounded at one end, and one or more series of hooked links, each of which fits over the rounded end of the lever which it actuates. A comb is shown whose teeth hold each link in place, upon the punch lever which it actuates, and a second comb whose teeth project between the opposite ends of the punch-actuating levers.



NO 659,389

659,454. Switch-operating Mechanism. Frederick A. Ruff, Detroit, Mich. Application filed November 22, 1898.

An insulated trolley conductor section comprises an insulator strip grooved in its under side to receive the trolley wire, conductor sections secured to the strip on opposite sides of the groove and adapted to make contact with the flanges of the trolley. Inclined approaches are detachably secured to the opposite ends of the strip, in line but out of contact with the conductor sections, and form the means for securing the insulated section to the trolley wire.

659,467. Electrical Illuminated Button. Walter A. Church, Pittsburg, Pa. Application filed December 9, 1899.

An electrical cuff button comprises the combination of a pair of buttons proper, a positioning plate, an incandescent lamp mounted within each of the buttons and suitably connected to the retaining plate, an electrical supply and means connected to the plate and the supply for forming an electrical circuit whereby the lamps are illuminated.

659,479. Electric Programme Clock. Harry F. Jordan, Chicago, Ill., assignor of one-half to Albert L. Bentley, Chicago, Ill. Application filed December 15, 1899.

The invention is an electric program clock having a casing, a clock movement, an electric alarm, a pair of concentric plug-retaining circles on the casing and a circuit-closing arm carried by the clock movement. Plugs are arranged for establishing an electric connection between the circles and arm and an electric switch is operated by the clock movement for establishing an electric connection first between one of the circles and the alarm and then between the other of the circles and the alarm.

659,506. Magnetic Regulator for Galvanometers. James J. Bradley, Newark, and Louis M. Pignolet, Orange, N. J.; Bradley assignor to Pignolet. Application filed April 13, 1899.

In an electrical measuring instrument are combined a permanent horseshoe magnet, a plate of iron large enough to extend beyond the limits of the poles of the magnet, and a solenoid containing the magnetic needle, the outer side of the solenoid being contiguous to the plate.

659,533. Electrically Controlled Coin-feeding Appliance for Vending Machines. Richard Kann, Jena, Germany. Application filed March 8, 1900.

Coin-feeding devices are described for coin-controlled vending machines, each comprising a coin guide, a cut-off normally blocking the coin exit in the guide, means for moving the cut-off back to a normal position when moved clear of the exit and an electrically controlled appliance for moving such cut-off clear of such exit. An electric circuit includes this appliance, and circuit terminals are placed in the path of the coin in the guide arranged to be electrically connected by the coin to close the circuit and thereby cause the cut-off operating appliance to move the cut-off clear of the coin exit. A circuit-breaker is also in the path of, and operated by, the released coin in combination with an auxiliary circuit-closer operating to close the circuit the moment the cut-off has cleared the coin exit.

659,539. Supporting Device for Electric Motors. Charles A. Lindstrom, Chicago, Ill., assignor to the Hewitt-Lindstrom Motor company, Chicago, Ill. Application filed October 16, 1899.

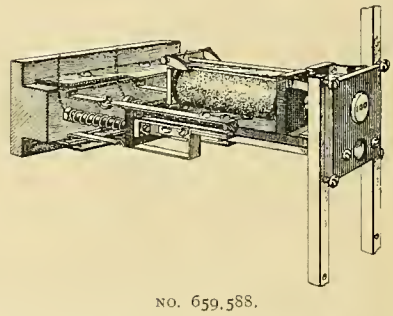
In an automobile are combined with a motor frame a supporting bracket consisting of an attaching plate rigidly secured to the motor frame, and an upwardly inclined arm projecting from the attaching plate, the upper edge of which is flanged laterally and the upper end of which is bifurcated. Each of these bifurcations are provided with inverted U-shaped clips and filler blocks and bolts for the clips.

659,544. Telegraph System. Frank D. Pearne, Davenport, Iowa. Application filed April 16, 1900.

A telegraph system is described, comprising a series of sounders connected in multiple, a series of relays for closing the circuits of their respective sounders and operable by currents of successively greater intensities, and a transmitting circuit including the relays in series, together with means for supplying currents of different intensities thereto. Connections are shown whereby when each relay is operated, the corresponding sounder of the preceding relay will be cut out of its operating circuit.

659,550. Electric Railway. James D. Robertson, La Salle, Ill. Application filed January 31, 1900.

An electric railway comprises bed plates supported between the rails, supports for the inner sides of the plates, the vertical walls of the supports forming walls for a conduit, and a conductor arranged in this conduit. String pieces are arranged adjacent to the inner sides of the rails, and intermediate string pieces are spaced apart to provide a slot between them. These intermediate string pieces have openings through their vertical walls, bed plates are removably attached to the string pieces, and a heat-supply pipe is arranged between the intermediate string pieces.



NO. 659,588.

659,559. Lightning Arrester. Charles M. Taylor, Georgetown, Ky. Application filed June 12, 1900.

The lightning arrester comprises a pair of grounding plates, means for connecting one of the plates electrically with the line wire, a frame of insulating material in which the other of the plates is arranged and spaced from the first-named plate, a protecting cover for the plates, and means for electrically connecting the second-named plate with a grounding wire.

659,588. Telephone-switchboard Annunciator and Jack. Charles T. Mason, Sumter, S. C. Application filed November 28, 1899.

A combined telephone annunciator and jack is described, comprising a horizontal magnet and subjacent jack throat and a drop shutter arranged behind the face plate and hinged below its center but above the jack throat. This shutter is adapted to fall inwardly, and has a projection below its hinged point adapted to extend into the throat of the jack when the shutter is down, and to be restored by the point of the plug coming in contact with the extension, as the plug enters the jack. (See cut.)

659,605. Electric Thermostat. Leonard H. Des Isles, Cambridge, Mass. Application filed January 10, 1900.

A journal alarm comprises in combination a metallic cup adapted to be secured to a journal bearing in electrical contact therewith. A body portion of insulating material closes the cup and completely incloses a metallic terminal, while insulated connections permanently secured to the terminal lead out through the body portion. Means are contained within the cup so adapted as to establish electrical connection between the cup and terminal, when sufficiently heated.

659,631. Device for Removing and Replacing Incandescent Lamps. Roch Croteau and Richard J. Messier, Denver, Colo. Application filed June 11, 1900.

A lamp remover and replacer is described wherein are combined a handle, a cone-shaped cam mounted on its upper extremity, a rod moving longitudinally on the handle, a collar connected with the upper extremity of the rod, and levers fulcrumed thereon above the cam which the lower arms of the levers engage. Springs are provided whose tendency is to hold the lever arms against the cam, and gripping arms are connected with the upper arms of the levers, the arrangement being such that as the rod is moved longitudinally in the handle, the gripping arms are opened and closed through the action of the cam and the levers.

Western Electrician.

EVERY SATURDAY.

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Swiss Power Transmissions with Direct Current.

By Frank C. Perkins.

The Fabrique de Papiers of Biberist, near Soleure, Switzerland, has installed a power plant which is particularly interesting. The power house, shown in Fig. 2, on the next page, is located in the gorge of the River Suse, an Rondchâtel, on the railway line from Bienne to Delemont. The principal works where the power is used are at Biberist, near Soleure. The upper works were previously operated by waterpower, and the development of the additional power was demanded by the increased manufacture of paper at the lower works.

At the power house the generators consist of two series direct-current machines, each generating a constant current of 40 amperes at a potential of 3,000 to 3,500 volts. The generators have a speed of 275 revolutions a minute and are geared to turbines which have a vertical shaft.

The line consists of a pair of wires seven millimeters in diameter and 28.5 kilometers long. The loss on the line at full load is 11.7 per cent. At Biberist the current is utilized to operate two series motors which supply power for the various machines at the works. The voltage on the line is from 6,000 to 7,000 volts, and the output or efficiency of the transmission has been verified by experts to be from 74 to 75 per cent.

The Commercial Electric company of the city of Zong, Switzerland, transmits power from the Lorze River, above the Lake D'Aegeri, by direct-current, high-tension machinery, designed by Mr. Thury and installed by the Cie de L'Industrie Electrique of Geneva, Switzerland. The lake is dammed, and at low water sufficient accumulates at night for a service of 12 hours. The power plant, shown in Fig. 1, is located at Lorzentobel, on the Lorze River. The generators seen in this illustration consist of three groups of machines, direct-connected to the turbines seen at the right. Each unit has a capacity of 120 horsepower. These generators are of the constant-current, six-pole type, and are connected in series.

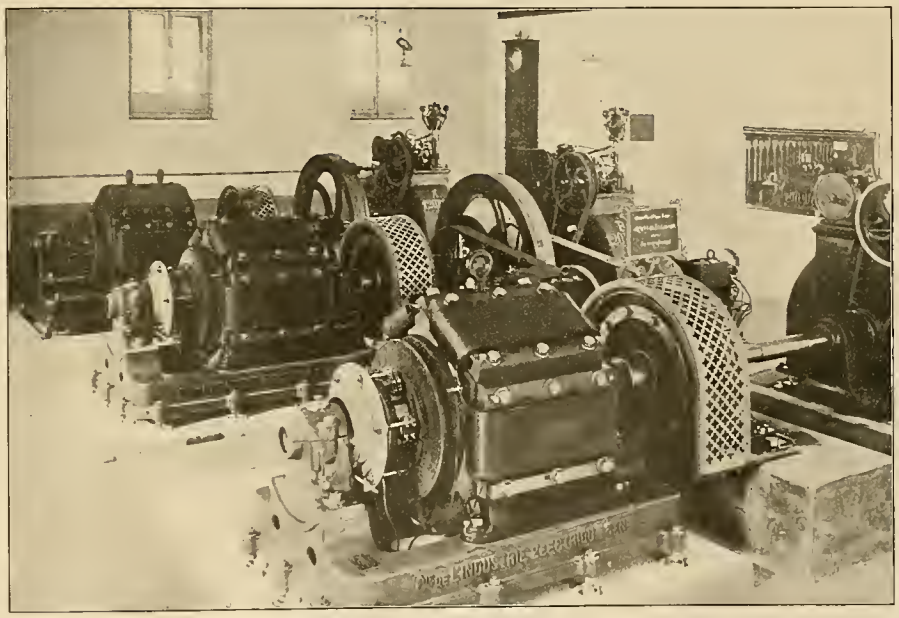

FIG. 1. SWISS POWER TRANSMISSIONS WITH DIRECT CURRENT.—INTERIOR OF POWER HOUSE AT LORZENTOBEL.

In Fig. 3 may be seen a motor-generator of the type used in the Swiss high-tension, direct-current power transmissions. The motor on the right is operated in series on the high-voltage, constant-current line, while the dynamo at the left generates a low-voltage current for general distribution. The care with which the series motor base and the series generator base are insulated by porcelain may be seen in Figs. 1 and 3. The regulating mechanism is also shown in Fig. 1. at the extreme right on the top of the turbines.

Long-distance Transmission by Snoqualmie Company.

The Snoqualmie Falls (Ore.) Power company claims to have transmitted electric power over the longest distance yet attempted. By coupling up its lines in series one circuit of 154 miles was obtained, running from the head works at Snoqualmie Falls to Seattle, back to the falls, thence to Tacoma, and back to the falls again, all in one continuous circuit. Six hundred and ninety-five kilowatts was generated at the power station and 530 kilowatts was delivered to the water rheostat at the end of the circuit, a loss in transmission of 23 per cent. The entire circuit was of aluminum wire. The test was made for experimental purposes only. The initial voltage was 24,000, while the voltage at the end of the circuit was 18,000 volts.

A High-tension Electric Railway in Italy.

The Adriatic Railway company is building a line at Colico, Italy, which is to be 65 miles in length and operated with a pressure of 3,000 volts at the trolley. An exhibit of the company at the Paris Exposition shows details of the line equipment, models of a transformer sub-station and a parlor motor carriage of 300 horsepower. The line itself is expected to be put in operation next year, although on an experimental line, one mile long, in Budapest, the details are being carefully worked out. The lines in Italy which are being converted are at present run by steam. Power will be obtained from a 98-foot waterfall on the River Adda, and at the power station at Morbegno 10,000 horsepower will be available. This will be generated by three turbines and three Ganz three-phase alternators, giving a current of 20,000 volts and 15 cycles a second.

At intervals of 6½ miles will be placed 10 transformer stations, reducing the pressure to 3,000 volts on the two trolley wires. The two overhead wires are three feet apart, and the rails form the third conductor. The cars are to have four motors, each of 150 horsepower. Two motors will be thrown into circuit only when the train, of 65 tons weight, ascends grades exceeding one per cent. at a speed of 19 miles an hour. When all four motors are running, two of them take current, not from the trolleys, but from the other two motors—connected in tandem—so that the speed is thus reduced to one-half without serious energy loss.

There are to be five passenger and two freight trains, the latter to be run at half the maximum speed of 38 miles an hour, and having a carrying capacity of 200 tons. The freight trains will be drawn by 600-horsepower locomotives. The trains are to be equipped with Westinghouse air brakes. The line is to be equipped with a block-signal system. The company is so pleased with the way things are developing that it already contemplates equipping electrically the Bologna-Firenze line, which is several hundred miles long, and crosses the highest point of the Appenine Mountains. The Mediterranean company, which controls the railway system in the west of Italy, is following suit, and has already obtained a royal decree to a project which will require 10,500 horsepower.

The Waycross and Suburban Railway company of Waycross, Ga., has been organized to build an electric line in that vicinity.

Street Railway Accountants' Association.

In connection with the convention of the American Street Railway association last week at Kansas City was held the fourth annual meeting of the Street Railway Accountants' association of America. There were over 50 delegates in attendance at the meetings, which were held in an enclosed space in the upper gallery or roof garden of Convention Hall. The opening session was called to order by President C. N. Duffy on Tuesday morning, October 16th. Daniel V. Kent, auditor of Kansas City, was introduced and warmly welcomed the association in appropriate terms. After a brief response, President Duffy delivered his annual address, in which he reviewed the work accomplished in the past and the present good standing of the association, and drew attention to the work before the members at the convention. W. B. Brockway, secretary and treasurer, then submitted his report, which showed applications from 23 new companies, bringing the total membership, allowing for withdrawals, up to 96.

The first paper of the session was read by John I. Beggs, general manager of the Milwaukee Electric Railway and Light company, on "What Does the General Manager Want to Know from the Accounting Department?" After Mr. Beggs' interesting and instructive address a few remarks were made by Henry J. Davies of Cleveland, an honorary member of the association. Mr. Duffy, as chairman of the committee on a standard system of street-railway accounting, submitted the report of the committee. No changes in the present classification of accounts or in the forms of monthly and annual reports were suggested, and therefore the committee recommended that the classification stand as adopted at the Chicago convention in 1899.

At the opening of Wednesday morning's session C. O. Simpson, auditor of the Augusta Railway and Electric company, Augusta, Ga., read a paper on "The Routine of a Street Railway, Electric and Gas-lighting Company." The paper provoked a long discussion, in which H. C. Mackay, J. M. Smith, F. E. Smith, President Duffy, B. L. S. Tinglay, W. F. Ham and others took part. The report of the committee on a standard unit of comparison was then read by H. C. Mackay, chairman of the committee. This report and its discussion occupied the greater part of the session. Mr. Ham, H. H. Vreeland, C. L. Rossiter, Henry L. Wilson and several others took part in the discussion, which closed by the adoption of a resolution recommending the use of the car-hour as a standard unit of comparison.

On Thursday morning a comprehensive paper on "Departmental Accounts" was read by H. L. Wilson, auditor of the Boston Elevated Railway company. This was followed by a paper on "Material and Supplies Account," by W. M. Barnaby, accountant of the Brooklyn Rapid Transit company. Both papers evoked considerable discussion. A committee was appointed to prepare a uniform set of blanks for the approval of the association on stores, from the purchase to the inventory.

Officers were elected as follows: President, William F. Ham, comptroller Washington Traction and Electric company, Washington, D. C.; first vice-president, J. A. Harder, auditor Metropolitan Street Railway company, Kansas City, Mo.; second vice-president, J. M. Smith, comptroller Toronto Railway company, Toronto, Canada; third vice-president, W. G. McDole, auditor Cleveland City Railway company, Cleveland, Ohio; secretary and treasurer, W. B. Brockway, assistant secretary New Orleans and Carrollton railway, New Orleans, La.; executive committee, C. N. Duffy, auditor Chicago City Railway company; C. S. Mitchell, auditor United Trac-

tion company, Pittsburg; C. M. Hemingway, cashier Connecticut Lighting and Power company, New York; D. E. Tripp, auditor Seattle Electric company, Seattle, Wash. After adopting resolutions of thanks to the association's hosts in Kansas City, adjournment was taken.

Marconi's New System.

Since last January Marconi has been conducting experiments in his laboratory at Poole Harbor, seeking to do away with the tall upright wires and to secure a syntonizing system whereby interference of two or more simultaneous messages may be obviated. It is now stated, on no less an authority than that of Professor Fleming, that he has achieved success to a striking degree. Metallic cylinders, four feet in height, are now used in place of the upright wires, and capacity, self-induction and resistance are inserted at the sending and receiving stations, to allow of resonance between them. Otherwise, the arrangements are the same as before. These metal cylinders, mounted on poles 20 or 30 feet high, sufficed for the sending of messages over 30 miles, and signals were even received from this distance when the receiving cylinder was merely placed upon a chair in a closed room. Two transmitting instruments were used simultaneously, one sending in English, the other in French. At the receiving end two instruments, each syntonized to its own transmitter, were connected to the same upright, and each ticked off its own message, while remaining perfectly unresponsive to the impulses from the other's transmitter.

It is stated in Washington that negotiations are about to be reopened by the Navy Department with the view to installing the Marconi system on ships of the United States Navy. At the time of the previous negotiations Mr. Marconi demanded an exorbitantly high price for the use of his invention. Recently the department has learned that the British Admiralty has secured the use of the Marconi invention at the rate of £200 for each installation, and has placed instruments on board 32 warships. The Navy Department regards that rate as reasonable, and will make overtures to Mr. Marconi in the hope of securing as good terms. Should an arrangement be effected, the vessels for the North Atlantic squadron may be the first to receive the instruments.

High-potential Underground Cables at St. Paul.

In a series of experiments at St. Paul, Minn., carried out last week by Henry Floy of New York, a current of 30,200 volts is reported to have been successfully sent through an underground cable three miles in length. The highest voltage heretofore attained with this class of conductors has been the 20,000 volts used at Niagara Falls. The cable used at St. Paul consists of three copper conductors, each enclosed in a paper tube, and the whole encased in a lead sheet and laid in vitrified-clay conduits. The cable is a part of the system by which the St. Paul Gas Light and Power company is to utilize the waterpower at Apple River, Wis., the other 24 miles of wire being overhead. As a result of this experiment, it is said that the company will employ an average potential of 25,000 volts, furnishing 5,000 horsepower for lighting and power purposes.

An electric-light plant is being established at Saratoga, Miss.

Walton H. Holmes, President of the American Street Railway Association.

As has become the custom of the American Street Railway association, the convention city furnishes the president for the ensuing year. Walton H. Holmes, the gentleman who has been honored with the chief position in the gift of the association, is a practical street-railway man of lifelong experience. He is a native of Kansas City and 39 years of age. It is interesting to remark that he is the son of Nehemiah Holmes, who was the pioneer street-railway man west of the Mississippi River. It was the misfortune of Walton Holmes, however, to lose his father when he was but nine years old, and three years later the self-reliant lad entered the service of the old Westport and Kansas City Horse Railway company as an office boy. From this beginning, Mr. Holmes has passed through nearly every stage of the street-railway business, step by step, until now he is the president of the Metropolitan Street Railway company of his native city, which is one of the leading corporations of its kind in the country.

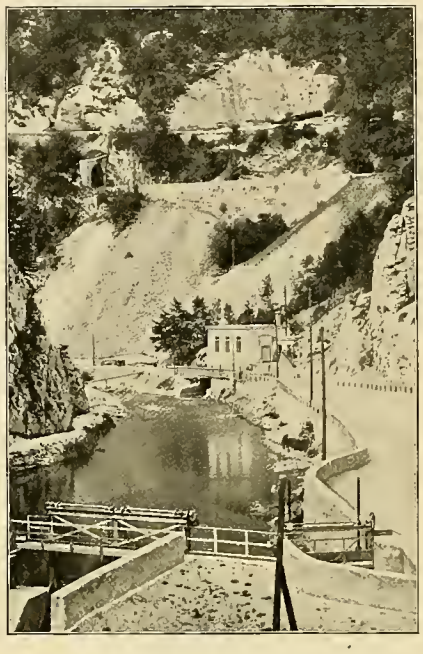

FIG. 2. SWISS POWER TRANSMISSIONS WITH DIRECT CURRENT.—POWER HOUSE ON THE RIVER SUSE.

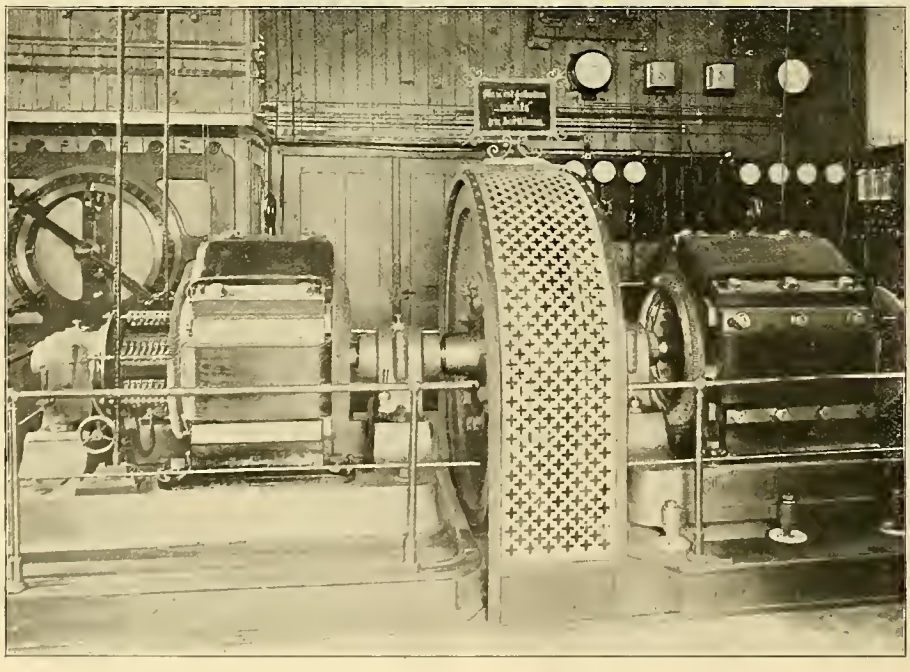

FIG. 3. SWISS POWER TRANSMISSIONS WITH DIRECT CURRENT.—MOTOR-GENERATOR.

As may be imagined, Mr. Holmes' experience has been a varied and useful one. He has served as a clerk, as a superintendent and in various other office capacities; he himself drove street cars in the days when animals were relied upon entirely for power; he has bought mules and corn for the mules, paying for the grain as much as $1.50 a bushel during periods of scarcity; he went through the panic of a grasshopper plague, and knows what it is to scrape the bottoms of the fare-boxes in order to secure enough nickels to buy corn for the patient animals.

In 1884 and 1885 Mr. Holmes, who had by that time become president of the Kansas City and Westport Horse Railway company, became interested with Mr. J. C. Henry in making an electrical test in street-car propulsion on a section of track between the Kansas City Fair Grounds and the town of Westport. These experiments were among the first, if not the very first, in the effort to operate street cars by electricity taken from an overhead wire. The test was a very interesting one, and the cars were operated, but the apparatus was naturally crude, and after some months the experiment was abandoned. This was a fortunate outcome of the venture in one respect, for when electric traction was introduced in Kansas City to stay, it was not necessary to discard a large amount of expensive and obsolete apparatus. It may be stated that the specific reason for abandoning the original electric system was the great loss of power in transmission, owing to the uneconomical apparatus of the early experiments.

After the electrical system had been, for the time, as it proved, abandoned, Mr. Holmes converted the Grand avenue line into a cable road, organizing the Grand Avenue Railroad company for the purpose. This road was constructed in 1887. W. H. Holmes was president, and his brother, C. F. Holmes, was general manager of the Grand Avenue Railroad company. The extension of cable lines was rapid and the construction excellent. A few years later the Kansas City Cable Railway company was formed, and by 1895 this company owned half of the street-railway lines in Kansas City. Walton Holmes was made president of this company, and a year later practically all the street-railway companies of Kansas City were consolidated in one company, known as the Metropolitan Street Railway company. Mr. Holmes was at first vice-president and general manager of the Metropolitan company, but last year he was made president, which office he now holds.

Mr. Holmes is married and has a son 14 years old, whom he is training to follow in his footsteps as a street-railway man. He is resourceful and energetic and an excellent example of that American self-made manhood which has played such a conspicuous part in the development of the West. He and his brother, Conway F. Holmes, the general manager of the Metropolitan company, are closely associated in business and have been of great mutual assistance to each other.

Mr. Holmes was elected a vice-president of the American Street Railway association at the Boston meeting of 1898. At Boston Mr. Holmes also read a paper entitled "To What Extent Can Street Railways Afford to Encourage Amusement Attractions?" This paper attracted much attention among street-railway men for its sensible suggestions. Mr. Holmes is a modest man, but there is no doubt that his administration of the affairs of the association will be a successful one. Any man who can successfully grapple with the difficult street-railway problems of precipitous Kansas City, as Mr. Holmes has done, can guide the destinies of the American Street Railway association with good judgment.

Electrolytic Die-sinking.

A new process for sinking dies has been invented by Joseph Rieder of Leipsic, Germany. The method, as described, is to mold the design in relief on a block of plaster-of-paris. This block is saturated with a solution of chloride of sodium and placed in an electrolytic cell, and the block of steel laid upon it, while a current is passed through the cell, plaster and steel. At the points of contact between steel and the model, dissolution of the metal occurs. It is necessary, of course, to maintain a proper supply of the electrolyte and to clean the face of the steel at frequent intervals. This is done automatically. The inventor claims that hardened steel can be wrought by the process as easily as ingot metal.

Motors Wanted for Box Factory.

The Kansas City and Southern Lumber company of Springfield, Mo., is contemplating building a large planing mill and box factory in Kansas City, and it is the intention of the company to equip this plant with electric motors. The equipment will comprise either motors for each individual machine or one motor for every three or four machines. The company would like very much to hear from manufacturers of electric motors.

The Jacksboro (Texas) Light and Power company has been incorporated, with $6,000 capital stock.

AMERICAN STREET RAILWAY ASSOCIATION.

In the Kansas City convention of 1900 the American Street Railway association added another to a long list of successes, so far as large attendance, marked enthusiasm, profuse entertainment and extensive exhibits of street-railway appliances constitute a success. Four papers were read, and of these but one was really discussed. Thus the practical street-railway operators did not receive so much benefit from the interchange of ideas as at some previous meetings. This was due partially to the lack of one paper, owing to the illness of the gentleman who was to have prepared it, and to the absence of the authors of two others, thus limiting the discussion, and partially to the drawbacks of the meeting place of the association, which was a portion of the lofty and unheated roof garden of the Convention Hall, partitioned off by canvas. On the first day, especially, it was difficult for the speakers to make themselves heard, owing to the noises in the exhibit spaces below, and the gentlemen sat with their hats and overcoats on to avoid catching cold. But Convention Hall was a capital place for the exhibition, and the show was an unqualified success, as may be judged from the pictures presented in this issue of the Western Electrician. Delegates and visitors obtained new ideas and hints of up-to-date apparatus and methods from the exhibits of the manufacturers and supply men. The attendance was estimated at 1,500, of whom perhaps 400 were from Kansas City, not counting those visitors who paid an admission fee to see the exhibits. The street-railway men of Kansas City, from the highest to the lowest, were most kind and hospitable. The Metropolitan company of that city seems to have a high grade of employes to do the careful railroading required in Kansas City, and many of the men examined the exhibits with interest and intelligence.

WALTON H. HOLMES, PRESIDENT OF THE AMERICAN STREET RAILWAY ASSOCIATION.

Opening Business.

President John M. Roach of Chicago called the association to order on Tuesday, October 16th. He introduced Mayor Reed of Kansas City, who delivered an extended speech of welcome. His honor made a pleasant reference to the Messrs. Holmes and the local street-railway system, but his speech was mainly a panegyric of Kansas City. He said that Kansas City was a good place to invest money and that it was the most typically American city on the continent. One of his striking sentences was this: "In the progress of the nation every time that the milk of humanity has been skimmed, the West has been favored with the creamy side of the dish." In closing, the mayor referred to the recent rebuilding of the great Convention Hall in 90 days, after the fire, and said that "lobsters" do not do that kind of work.

President Roach thanked Mayor Reed for his eloquent speech and then delivered his annual address.

President Roach's Address.

It gives me great pleasure to meet with you in this magnificent western city. I have every assurance that nothing will be left undone to make our visit most pleasant and profitable. There is a breadth of character and freedom of personality in this young metropolis of the plains which is peculiarly appealing to the business man who has large interests entrusted to his care, and I believe the members of this association will show their appreciation of the many pleasant things provided for their entertainment while in this community. When this nineteenth annual convention of the American Street Railway association shall have finished its labors, I am sure I may safely say to Mayor Reed that none of you will have regretted the acceptance of the hospitality of the people of Kansas City, so graciously extended by him.

I see before me representative men from all the leading cities of this country. To your hands is entrusted street-railway investments aggregating hundreds of millions of dollars and the welfare of over a million persons. From the single-track, one-horse car of 40 years ago, the business in which you are engaged has grown to a magnificence where nearly all fields of human endeavor are called upon to perfect its equipment or aid in its management. It has outgrown ridicule and financial instability, and in the rapid whirl of events has built cities, enriched its promoters and made possible a freer, healthier and happier life for its patrons. Each day the street car is entering more and more into the business life and pleasure of the community, and each day its benefits are becoming more apparent to the general public.

The street railways of America now represent the enormous investment in bonds and stocks of $1,800,000,000, upon which American investors are receiving annually over $70,000,000 in dividends and interest. Salaries and wages amounting to $250,000,000 a year are distributed among the 300,000 employes necessary to equip, operate and manage great industry, repair its 20,000 miles of track, handle its 60,000 cars and meet the ever-pressing demands for improvement. Directly and indirectly, over 1,200,000 persons depend upon the traction interests of America for their livelihood.

An industry of such proportions penetrates and, more or less, affects all other enterprises in the country which sustains it. Nine-tenths of the business men and women of the United States look to the management of street-railway companies to furnish them with swift, comfortable and safe transportation to and from business. Still a greater per cent. of pleasure-seekers demand and receive from the same management to and from theater, casino, park and suburb transportation of such elegance of equipment and efficiency in service as to satisfy the most exacting. It has required heroism and patience on the part of street-railway men, with so little friction, to meet the demands of a critical patronage in so excellent a manner as is being accomplished by them at the present time.

On all sides we hear the cry of improvement, and in every direction we hear the sound of the busy car shop, as it responds to the demand for more modern equipment. The public is becoming more exacting, and there is need for the most perfect knowledge and the widest experience to cope successfully with the ever-changing situations which confront the street-railway manager. Street-railway companies have frequently, at great cost, increased their miles of tracks and added to an expensive equipment, primarily for the sole purpose of accommodating the public by penetration into outlying districts, unwarranted by additional business to be acquired in such territory. This policy has proved wise in nearly every instance. It requires considerable pluck on the part of a company to back a temporary loss in order to please its patrons. Those companies which have pursued such a course have generally been rewarded by more liberality on the part of municipalities, more good nature and praise from patrons and an early increase in the new districts acquired, which soon brought those lines to a paying basis.

In thus catering to the wishes of the public the street-railway industry of the United States has been brought to a high standard of excellence and has kept safely in advance of traffic. The aggregate of miles of track has grown from a few hundred miles of single track, confined mainly to business centers, to many thousands of miles of thoroughly equipped double tracks, which have brought the country districts within quick and active touch with the larger cities. Such energy and management must and will be appreciated and fairly treated by the communities benefited.

It may be declared that corporations are without soul, but it cannot truthfully be said that street-railway corporations are lacking in good sense or business principles. False economic doctrines yield to, and flee before, rapid development and prosperity. A well-equipped street railway with modern service, which seeks to oblige the people, operated in any community, will develop the best resources thereof and bring prosperity to its people with such rapidity as to utterly confuse and put to flight all false economic doctrines.

Newspapers, reviews, magazines, periodicals and journals of this country, indeed, of many parts of the world, are entitled to the thanks of this association for the fair and generous treatment accorded in their columns to the street-railway men and their interests during the year. It is the province of these publications to exploit the great industries of the land. If upon one day we are able to congratulate ourselves upon their unstinted praise, we should patiently bear the publicity of our faults, if any there be, in the next issue.

The last year has been a period of a notable activity and healthy progress, with but few disturbances of a serious nature. The managers of large street-railway properties should shape their policy toward their employes and the public so that disturbances between employer and employe will be entirely eliminated from their history. The management of the great corporations of the country can best retain the adherence and loyalty of employes by adopting toward them a policy at all times just and, at the same time, courteous, kind and conciliatory. The good will of your employes and of your patrons will be found an asset of great value in the days of trouble and most desirable at all times.

A business so widespread in its usefulness, holding and judiciously employing, as it does, so great a portion of the capital of the country and so essential to the best interest and prosperity of the trade centers, should, and I believe in good time will, possess the very necessary good will and hearty support of the municipalities it so faithfully serves. Our interests and those of the public are inseparably interwoven and naturally harmonious. If such interests become strained and in conflict, such conditions are unnatural and illogical; therefore, it should become one of the leading features of our association to suggest a uniform policy for street-railway companies of so broad a gauge that the mutuality of the best interests of the public and of the company shall be as apparent to the people as to the street-railway managers themselves.

I take pride in announcing that the condition of your association, both as to membership and finances, is improving each year. I wish to urge you to make this gathering of use to our association and of importance to the street-railway industry. This may be accomplished by a full attendance upon and participation in the business meetings. The executive committee has selected members who have prepared papers on important subjects, and I urge upon you the advisability of entering into full discussions and analysis of those subjects, so that a clear understanding of all questions presented may be carried home with you. I also urge the association to show appreciation for our friends, the supply men, who have produced for this annual meeting their splendid exhibit.

Allow me to request your hearty support in the work of the Accountants' association, which meets in annual convention here at this time. Its work is of great importance and is worthy of the most serious consideration.

To the secretary and members of the executive committee our thanks are due for the satisfactory manner in which they have assisted in conducting the affairs of this association. Personally, their efforts have been highly appreciated.

The honor of having acted as your president for the last year has been most gratifying to me and shall ever remain one of the pleasant recollections of my life as a street-railway man. For my successor I bespeak the same courtesy and cordial cooperation which it has been my good fortune to enjoy.

Reports of Committees and Officers.

Secretary Penington read the report of the executive committee, giving in detail the routine matters considered since the previous annual meeting. The resignation of C. K. Durbin of Denver as a member of the executive committee was mentioned. Mr. Durbin has gone out of the street-railway business and was succeeded by W. H. Holmes of Kansas City. A sub-committee had audited the accounts of T. C. Penington, secretary and treasurer, and had found them correct.

The secretary and treasurer's report showed cash in bank to the credit of the association on October 10, 1900, to the amount of $7,000.75. The amount of cash on hand a year before was $5,658.87. In October, 1895, the association was $3,000 in debt. Now it has $7,000 on hand. Truly, the association

and Mr. Penington have reason to be proud of this record.

The company membership is 163. The following-named companies acquired membership at and since the meeting of 1899: Atchison (Kan.) Railway, Light and Power company, Aurora (Ill.) Street Railway company, Atlantic Coast Railroad company of Asbury Park, N. Y., Bridgeton (N. J.) and Millville Traction company, Chicago (Ill.)Electric Traction company,Conestoga Traction company of Columbia, Pa., Detroit (Mich.) and Pontiac Railway company, Dayton (Ohio) and Western Traction company, Elgin (Ill.) City, Carpenterville and Aurora Railway company, Knoxville, (Tenn.) Traction company, Galesburg (Ill.) Electric Motor and Power company, Cincinnati and Hamilton (Ohio) Electric Street Railway company, Chicago (Ill.) and Milwaukee Electric Railway company, Joliet (Ill.) Railway company, East Side Electric Railway company of Kansas City, Mo., Knoxville (Tenn.) Traction company, Montreal (Canada) Street Railway company, Oakland (Cal.) Transit company, Los Angeles (Cal.) and Pasadena Electric Railway company, Consolidated Traction company of Pittsburg, Pa., Peoria (Ill.) and Pekin Terminal Railway company, Pueblo (Colo.) Traction and Electric company, Schenectady (N. Y.) Railway company, Sioux City (Iowa) Traction company, St. Louis (Mo.) Transit company, Seattle (Wash.) Electric company, Indiana Railway company of South Bend, Ind., Vicksburg (Miss.) Railroad, Power and Light company, Venice (Ill.), Madison and Granite City Railway company, Cleveland, Painesville and Eastern Railroad company of Willoughby, Ohio, Norfolk Western Street Railway company of Westwood, Mass., Dallas (Texas) Consolidated Electric Street Railway company, Danville (Ill.) Street Railway and Light company, Detroit (Mich.) Rochester, Romeo and Lake Orion Railway company, Jackson (Miss.) Railway, Light and Power company, East Side Electric Street Railway company of Kansas City, Mo., Kansas City-Leavenworth (Kan.) Railway company, Lebanon (Pa.) Valley Street Railway company, Meridian (Miss.) Street Railroad and Power company, Schuylkill Traction company of Norristown, Pa., Hoosac Valley Street Railway company of North Adams, Mass., Ottawa (Ill.) Railway, Light and Power company, Ottawa (Ont.) Electric Railway company, Holmesburg, Tacony and Frankfort Electric Railway company of Philadelphia, Monongahela Street Railway company of Pittsburg, Rockford (Ill.) Railway, Light and Power company, Saratoga (N. Y.) Traction company, Terre Haute (Ind.) Electric company.

The withdrawals were nearly all owing to consolidations.

The deaths during the year were those of Philip T. Begley, superintendent Lowell and Suburban Street Railway company, Lowell, Mass., December 24, 1899; Amos Breed, president Lynn and Boston Railroad company, Lynn, Mass., May 22, 1900; Garrett A. Hobart, president Paterson Railway company, Paterson, N. J., November 21, 1899; John McNulta, receiver Calumet Electric Street Railway company, Chicago, Ill., February 22, 1900; Volney C. Turner, ex-president North Chicago Street Railway company, Chicago, Ill., December 2, 1899; J. H. Vander Veer, superintendent motive equipment, Brooklyn Heights Railroad company, Brooklyn, N. Y., December 3, 1899.

Papers Read.

The first paper of the meeting was read on Tuesday by Daniel B. Holmes, general counsel of the Metropolitan Street Railway company of Kansas City, whose subject was "Consolidation of Street Railways and Its Effect Upon the Public." Mr. Holmes' paper, which is given on page 276 of this issue of the Western Electrician, was closely listened to, and at its conclusion the author was tendered a vote of thanks.

On Wednesday Mr. C. F. Bancroft's "Comparison of the Various Systems of Electrical Distribution for Street Railways" was read by the secretary, in the absence of the author. The paper is printed in this issue of the Western Electrician, beginning on page 274. There was practically no discussion.

Mr. F. T. C. Brydges of Chicago was also absent. His paper on "Painting, Repainting and Maintenance of Car Bodies" was read by Secretary Penington. Mr. Brydges' paper was of a practical character and was discussed by W. E. Harrington of Camden, N. J., who gave some interesting figures, referring to a statement which he had prepared. "I have prepared these figures," said Mr. Harrington, "from work actually done and took five different operations—took them from our detailed sheet. For instance, the first-class operation, which was for an 18-foot car body, included the entire repainting of the car, the roof and the trucks. Under the contract price, piece-work system, the cost was $28 for labor and $19.79 for material, the total cost being $47.79. On a second-class operation, same work, on a 16-foot car body, the total cost was practically the same. On a third-class operation, cutting in of paintwork, varnishing, etc., the total cost was $24.21, the material being $10.21 and labor, by contract, $14. The fourth-class operation was outside painting of vestibules and cutting in dashers, touching up main body, blacking off of ironwork, one coat of finishing varnish, one coat of paint on roof, dashers, floors and platforms, and one inside coat of finishing varnish. The contract price for this work was $8.50 and the materials $7.71, making a total of $16.21. The simplest operation is probably the fifth-class operation, outside touching up dashers and main body of car, outside blacking off of ironwork, one coat of outside finishing varnish, one coat of roof paint and one coat of paint on inside of dashers, floors and platform. The contract price for this work is $4 and the material $5.13, making a total of $9.13 as an average. This work is done on the piece-work system. Under the usual system of hiring labor, we usually found our work cost in labor 50 to 100 per cent. more than under the piece-work system. I have taken these figures from our books, and have had some talk on the subject with other street-railway managers, and they think that the figures are very satisfactory." Answering a question, Mr. Harrington stated that the painters received 25 cents an hour under the contract system.

The paper that attracted most attention was read on Thursday by Colonel N. H. Heft, president of the Meriden (Conn.) Street Railway company. It was entitled "Double-truck Cars: How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions." The speaker described a new type of car and presented drawings to illustrate it. He asserted, in effect, that his car was the best all-around type for street-car traffic, with a dead weight of but 473 pounds for each passenger. But some of his theories were vigorously combated by several of the gentlemen present, who doubted whether Colonel Heft's car was strong enough. Those taking part in the discussion were E. C. Foster of Lynn, Mass.; E. Chamberlain, Brooklyn; W. E. Harrington, Camden, N. J.; C. W. Wason, Cleveland; J. I. Beggs, Milwaukee; E. G. Connette, Syracuse, N. Y.; H. H. Vreeland, New York; C. S. Sergeant, Boston; Ira A. McCormack, Cleveland, and Robert McCulloch, Chicago.

It was announced that N. S. Hill, Jr., of Charleston, S. C., was ill and had been unable to prepare a paper on "Storeroom Accounts."

Next Meeting to Be Held in New York.

Cincinnati and New York were the candidates for next year's meeting, and the latter city "won out," although Cincinnati sent invitations from the mayor, the president of the Cincinnati League and J. Kilgour, president of the Cincinnati Street Railway company. However, two conventions in succession had been held in the West, and it was almost a foregone conclusion that an eastern city would be chosen. The matter was decided by a committee consisting of John A. Rigg, Reading, Pa.; E. C. Foster, Lynn, Mass.; E. G. Connette, Syracuse, N. Y.; D. B. Dyer, Augusta, Ga., and Robert McCulloch, Chicago, Ill. This committee also nominated the

New Officers.

The nominating committee's list of officers was adopted, the secretary casting the ballot. It is as follows:

President—Walton H. Holmes, president Metropolitan Street Railway company, Kansas City, Mo.

First vice-president—Herbert H. Vreeland, president Metropolitan Street Railway company, New York, N. Y.

Second vice-president—N. H. Heft, president Meriden Electric Railroad company, Meriden, Conn.

Third vice-president—J. B. McClary, general manager Birmingham Railway and Electric company, Birmingham, Ala.

Secretary and treasurer—T. C. Penington, treasurer Chicago City Railway company, Chicago, Ill.

Executive committee—The president, vice-presidents and John M. Roach, Chicago; F. L. Fuller, Wilkesbarre, Pa.; George W. Baumhoff, St. Louis, Mo.; John R. Graham, Quincy, Mass., and John Harris, Cincinnati, Ohio.

STREET-RAILWAY EXHIBITION IN CONVENTION HALL, KANSAS CITY.

Closing Business.

This important resolution was adopted:

Resolved, That the next meeting of the American Street Railway association be limited to three days instead of four, and that the day set apart for the personal examination, by members, of the supply men's exhibit be the middle day of the interval.

After the usual resolutions of thanks, the association adjourned to meet at the banquet of Friday evening, when the new officers were installed and the final adjournment for the year was taken.

The exact date of next year's convention will be fixed by the executive committee.

Entertainment Features.

Kansas City entertained the visiting street-railway and supply men lavishly. The association badges were honored for free transportation on all street-railway lines, and not only street-railway men but everybody in town seemed to deem it a pleasure to show attention to the visitors. The Kansas City, Elks and Country clubs threw open their rooms to the possessors of the magical buttons, and private hospitality was unstinted. The newspaper reports and hotel service were excellent, and in all respects the city of hills and bluffs left a pleasant impression on the minds of all sojourners within her gates.

On Tuesday the executive committeemen of the association were the guests of W. H. and C. F. Holmes, in a drive around the city, and at lunch at the Country Club. In the evening there was a reception at the Midland Hotel, at which many of the visitors became acquainted with the warm-hearted people of Kansas City. Light refreshments were served.

A tally-ho ride for the ladies, a trip to the Armour packing-house and a theater party at the Coates Theater were the scheduled features of Wednesday.

All of these entertainments were thoroughly enjoyed. "A Runaway Girl" was presented at the theater, and Mr. Dunn, the leading comedian of the company, took a few liberties with the names of members and visitors that were greatly relished by the audience.

The principal entertainment feature of Thursday was the excursion to Fort Leavenworth, Kan. About 400 persons took advantage of it and inspected the fort, barracks and military prison and later the Soldiers' Home. Lunch was served, and all pronounced the outing to have been most instructive and enjoyable. In the evening many of the convention people attended a vaudeville performance at the Orpheum.

Friday, the last day of the convention, was a busy one in the entertainment line. First, there was a trip over the East Side line to Electric Park and the Heim breweries. This was a jolly event, and in the afternoon there was a vaudeville entertainment from a stage in Convention Hall. This was given with the supply men's compliments to the association. In the evening the convention was wound up with the banquet, at which there were over 200 guests. D. B. Holmes of Kansas City was toastmaster, and speeches were made by W. S. Gilbert, Judge McAnany of Kansas City, Kan., J. Harry Stedman of Rochester, N. Y., Frank B. Walsh and Chester Snider. The officers were installed and an hour was devoted to dancing. The dinner was an elaborate one and pronounced a great success.

Two Large Street-railway Exhibits.

In the Convention Hall at Kansas City by far the largest and most conspicuous exhibits of last week were those of the General Electric and Westinghouse Electric and Manufacturing companies. These companies had conspicuous spaces, of 1,500 square feet each, in the center of the hall, and each one had a large force of men explaining the machinery and apparatus displayed. A general idea of each exhibit may be gained from the accompanying illustrations.

Westinghouse Exhibit.—The apparatus displayed by the Westinghouse Electric and Manufacturing company made five carloads and had a total weight of 375,000 pounds. The heaviest piece shown weighed 30,000 pounds, but as there is no excavation under the Convention Hall, no special foundations were necessary. The most conspicuous feature was a 650-kilowatt, direct-current, engine-type railway generator, complete with armature. This is one of three generators of the same type sold to the St. Louis Transit company. The latter company has also ordered from the Westinghouse people three 2,250-kilowatt machines of similar design. The exhibit also included a 200-kilowatt rotary converter, wound for 7,200 alternations, for street-railway work. This machine gives an output of 550 volts on the direct-current end. There was also a Westinghouse marble switchboard for railway service, having five panels fitted with automatic circuit-breakers and direct-current voltmeters, ammeters and rheostats. Other features of the display were various types of Westinghouse car motors, Wurts lightning arresters for stations and lines, and an assortment of switches, circuit-breakers, fuse blocks, measuring instruments and diverters for street-car equipments. But perhaps the most important feature of all was the new No. 56 railway motor which the Westinghouse company has just brought out. This motor is especially designed to meet the requirements of interurban, suburban and city service, where it is desired to operate heavy cars at high speeds. It has long been recognized that the horsepower rating of a railway motor gives only a comparative idea of its capacity. The Westinghouse company now proposes, with this new motor, to give, in each of the standard sizes, complete information in relation to the output under any particular conditions. This is a most interesting advance, but space will not permit a complete description in this place of the curves of time, current strength, speed, tractive effort and other factors by which the actual performance to be expected of the motor is shown. The Westinghouse staff at the convention included F. H. Taylor, sales manager; N. W. Storer, electrical engineer; G. Berentsen, mechanical engineer; W. M. Probasco, publishing department; P. N. Jones and H. C. Ebert, all of Pittsburg; R. S. Brown, Boston; C. S. Powell, Cleveland; C. A. Bragg, Philadelphia; J. R. Gordon, Atlanta; C. B. Humphrey, Cincinnati; G. Pantaleoni, St. Louis; W. S. Rugg and T. A. Hall, Chicago; W. H. Wells, sales manager of the British Westinghouse company, and F. C. Newell of the Westinghouse Air Brake company.

WESTINGHOUSE EXHIBIT AT THE KANSAS CITY STREET-RAILWAY CONVENTION.

General Electric Exhibit.—The exhibit of the General Electric company was constantly the center of the group of association members and convention visitors who examined the apparatus critically and went away with new ideas and new information. The display comprised one GE54 25-horsepower railway motor, one GE67 38-horsepower railway motor, one GE57 50-horsepower railway motor, one GE73 75-horsepower railway motor, one K10 series-parallel controller for two-motor equipment, one K12 series-parallel controller for four-motor equipment, one B23 electric brake controller for two-motor equipment, one 600-kilowatt, 500-volt, rotary converter, three 250-kilowatt air-blast, step-down transformers, one alternating-current and direct-current panel for the 600-kilowatt rotary converter, and a full line of overhead material and supply parts for railway motors. The following-named representatives were present: J. R. Lovejoy, A. H. Armstrong, W. G. Carey and J. G. Barry of Schenectady, N. Y.; S. W. Frawick, Atlanta, Ga.; J. C. Calisch, Buffalo, N. Y.; T. P. Bailey, F. N. Boyer and R. A. Swain of Chicago; C. C. Pierce, Boston, Mass.; R. E. Moore, Philadelphia, Pa.; F. H. Shieby, Cincinnati, Ohio; H. E. Russell, San Francisco, Cal.; George D. Rosenthal, St. Louis, Mo., and J. F. Schaefer and W. T. Osborn of Kansas City, Mo.

GENERAL ELECTRIC COMPANY'S STREET-RAILWAY EXHIBIT AT KANSAS CITY.

Convention Notes.

Elmer P. Morris was "on deck."

The Street Railway Review of Chicago exhibited commendable enterprise in printing a daily edition.

W. E. Pimlott, vice-president of the J. M. Atkinson company of Chicago, was one of the busy men who attended the convention.

"Fifteen million feet underground" is a record the McRoy conduit may well be proud of. John T. McRoy and James M. Graves did the honors.

W. N. Mathews, manufacturers' agent, came up from St. Louis and looked after the interest of the Cling-surface Manufacturing company, for which Mr. Mathews is St. Louis agent.

George E. Boylston, secretary and treasurer of the Western Kieley Steam Specialty company of Chicago, was in attendance at the convention.

Blue buttons were given to members of the association, orange to the accountants, red to the supply men and exhibitors and white to the ladies.

H. A. Wagner, the well-known electrical engineer of St. Louis, attended the convention and renewed acquaintances with many of his street-railway friends.

Morgan Brooks, professor of electrical engineering of the University of Nebraska at Lincoln, Neb., was a visitor, accompanied by a number of students from that institution.

The Streator Brake Shoe company of Chicago was represented by George W. Evans, who made himself decidedly popular with the convention people, particularly the ladies.

F. E. Donohoe and E. H. Hammond from the Chicago office of the American Electrical Works needed no introduction to any of the thousand and one delegates and visitors.

"Jim" Cummings, the conduit man, did not put in an appearance. Mr. Cummings was so recently married that he had a good excuse, but there were many inquiries about him.

The Frank Ridlon company's exhibit was in charge of C. N. Woods of Boston, P. Harten of the Cincinnati Railway Equipment company being on hand to show their new slow-speed controller handle.

Commodore T. C. White, representing the Central Union Brass company of St. Louis, was a busy man at the convention, mingling with friends as the opportunity offered, but always having his weather eye open for business.

James Partridge, a pioneer in the carbon business, was on hand with a complete line of the Partridge self-lubricating motor brushes, leaving a lasting impression of his generosity by the presentation of a handsome souvenir to all callers.

Frank H. Clark of Chicago needed no assistance in representing the Electric Storage Battery company of Philadelphia. Mr. Clark is an electrical salesman of wide experience and pronounced success, and he found many of his friends at the convention.

Of course, Luther Stieringer was there. There are not many electrical conventions that get away from Mr. Stieringer, and, of course, the street-railway conventions are electrical nowadays. Mr. Stieringer has been ill, but is now enjoying fairly good health.

The W. R. Garton company, Chicago, through Manager W. R. Garton, had several railway specialties on exhibition at space 91. The Fiest trolley head attracted much attention, while the United States fender elicited much favorable comment from the street-railway people.

Many inquiries were made for Martin J. Isaacs, the popular manager of K. McLennan & Co., Chi-

cago, manufacturers of Gale's commutator compound, who was compelled to forego the pleasure of meeting his many friends at the convention owing to pressing business at home.

F. W. Darlington, promoter of the Darlington Electric Fountain and Supply company of Philadelphia, was busy interesting railway men in his company's new electric-fountain products, which seem to be a happy solution of the perplexing question of amusement attractions.

Clement C. Smith, the second vice-president of the Falk company of Milwaukee, represented that company with the kindliness and unfailing courtesy for which he is noted. The Falk company had no exhibit in Convention Hall, but received its friends in a parlor at the Midland Hotel.

A frequent convention visitor was L. A. Scovil, assistant general manager of the Kansas City Electric Light company. Mr. Scovil has been located in Kansas City since the first of the year, and is assisting in the reconstruction which is going on in the central-station plant in that city.

W. A. Smith, general manager and passenger agent of the Los Angeles and Pasadena electric railway, came all the way from Pasadena, Cal., to enjoy the benefits of the meeting. Mr. Smith is interested in an enclosed-arc lamp which has been especially designed for street-car lighting.

The interests of the Creaghead Engineering company of Cincinnati were ably looked after by G. R. Scrugham, the company's superintendent. The exhibit consisted of a full line of the company's products, including flexible brackets, overhead line materials and fittings for iron and wooden poles.

Charles K. Knickerbocker and G. D. Casgrain, two popular representatives of the Griffin Wheel

GARL EXHIBIT AT KANSAS CITY.

company of Chicago, presided over the large and attractive booth of this company, in which was displayed sections of car wheels, showing chills, and also test pieces of wheels for record purposes.

Walter H. Baker, assistant controller, St. Louis, George T. Faxon, manager of the Kansas City office, and W. R. Boyd of New York were in charge of the National Lead company's exhibit. The products of this company include a full line of babbitt metal, solder and white lead, also red lead and litharge.

E. J. Pietzcker and H. L. Thompson presided over the attractive booth of the American Steel and Wire company of Chicago, whose exhibit consisted of Crown bonds and all kinds of electrical wires and cables; also woven-wire fencing for suburban and steam railroads. A handsome leather pocketbook, containing reference tables of dimensions and weights of wires, was distributed during the convention.

No street-railway convention would be complete without the smiling countenance of G. S. Bigelow, who looks after the interests of the Chicago Varnish company in his own inimitable way. One of the most sought-after souvenirs at the convention was the pretty calendar distributed by Mr. Bigelow to his many friends.

CUTLER-HAMMER EXHIBIT AT KANSAS CITY.

One of the well-known figures at electrical conventions is W. Worth Bean of St. Joseph, Mich. Mr. Bean is president of the St. Joseph and Benton Harbor Railway and Electric Light company, and has a wide acquaintance in the electrical field. He always has a cheery word for everybody and is one of the most popular of convention visitors.

B. S. Barnard of the American Vitrified Conduit company, New York, had sections of vitrified glazed conduits on exhibition. These conduits have a number of exceptionally good points. They are smooth, glazed and vitrified. They are also acid, fire and waterproof, and adapted to all possible conditions. R. W. Lyle, general manager of the company, met many satisfied users of the conduit.

The sight of Irving P. Lord's pleasant face put one in mind of the Waupaca convention of the Northwestern Electrical association last June. Mr. Lord is the president of the Waupaca (Wis.) Electric Light and Railway company, and was a whole host in himself at the recent Northwestern convention in his town. He was greatly interested in the extensive street-railway display in Convention Hall.

The Ohio Brass company of Mansfield, Ohio, showed a full line of overhead-railway material for electric railways for span-wire and bracket construction. Attractive souvenirs, in the form of miniature Brooklyn strain insulators, were freely distributed and much sought after by visitors and delegates at the convention. C. K. King, secretary; R. A. Byrnes, manager New York office; G. A. Meade, engineer, and A. L. Wilkinson looked after the company's interests.

J. C. Shainwald, the ever-popular western sales manager for the Standard Paint company of New York, and J. H. Hicks of the Chicago office, had charge of the exhibit of this company. They had an attractive booth in which were displayed samples of P. & B. paint, compound and armature varnish, rubberoid cloth and rubberoid roofing. The advertising matter distributed by the company was unusually attractive, and as is usual at all conventions which this company attends, its souvenirs were much sought after.

George O. Nagle, formerly general superintendent of the Chicago City Railway company, nearly lamed his right arm in shaking hands with friends who greeted him at the convention. This year Mr. Nagle did not have the cares of a local committeeman on his shoulders, as he did last, and in consequence he was free to enjoy the business and social sessions, which he did to the utmost.

Colonel E. J. Spencer of St. Louis, the western manager of the underground department of the Safety Insulated Wire company, was warmly welcomed by many friends at the convention. He was accompanied by Mrs. Spencer, Master Tritle Spencer and Miss Katharine Spencer. Colonel Spencer did not have an exhibit this year, but put in an appearance to greet his social and business acquaintances.

E. A. Barth, electrical engineer of the Kansas City Electric Light company, found time to drop into the Convention Hall once or twice. Mr. Barth is busily engaged in the reconstruction plans of his company, and was much interested in the attention attracted by the large rotary converter for the Kansas City Electric Light company, which was on exhibition in the space of the General Electric company.

Charles W. Cobb, sales manager of the Chicago Mica company of Valparaiso, Ind., was ably assisted by "Cobb, Jr.," in the duties of showing visitors the products of this company, which were artistically arranged in one of the prominent booths in the hall. A full line of mica insulation for street cars and motors was shown. Small sample books of Champion cloths and papers and Mica bond insulators were distributed liberally.

Every exhibitor at the convention owes a debt of gratitude to W. A. Satterlee, general superintendent of the Metropolitan Street Railway company

CHICAGO MICA COMPANY AT KANSAS CITY.

of Kansas City, who was chairman of the local committee on exhibits and who devoted a great deal of time and attention to the assignment of space and the care of exhibitors. Not a little of the credit for the smoothness of arrangements for the exhibition is due to Mr. Satterlee.

The popularity of Bullock apparatus has never been questioned, and it is safe to say that through the efforts of the company's popular sales manager, Frank G. Bolles of New York city, the name "Bullock" is instilled into the minds of every delegate and visitor who attended the convention. In anticipation of a good time, Mr. Bolles had with him a large supply of unique souvenirs, which were not only much sought after, but in some instances even begged for by the gentlemen, one of whom earnestly suggested a medal of honor for Mr. Bolles in recognition of his meritorious and heroic work as a "life saver."

James A. Brett, general manager of the Electrical Installation company of Chicago, was right in his element at the convention and was so busy, presumably, in securing business for his company, that he was not often seen about Convention Hall, although he was in Kansas City all the week. Mr. Brett's business is largely with street-railway com-

EXHIBITS AT THE KANSAS CITY STREET-RAILWAY CONVENTION.

panies, and he found at the convention many friends and customers. Mr. Brett was assisted by F. H. Fitch.

The Phœnix lubricating pump is manufactured by the Phœnix Metal Packing company, Chicago, and was shown in complete operation by Manager C. H. Thompson. J. H. Ward, vice-president and general manager, was also in attendance. The Phœnix pump has demonstrated its usefulness for all requirements in practical operation on all classes of engines, being adapted to all sizes and styles of engines, pumps, air compressors, steam stamp mills and gas and vapor engines.

"Dick" Pierce and "Bob" Richardson, more formally known as Mr. R. H. Pierce and Mr. R. E. Richardson, were daily attendants at Convention Hall. In Chicago these gentlemen are partners in the engineering firm of Pierce, Richardson & Neiler, but in Kansas City Mr. Pierce was a visitor, while Mr. Richardson is general manager of the Kansas City Electric Light company. They are both good engineers and good fellows. Mr. Pierce was accompanied by Mrs. Pierce and his son.

Secretary T. C. Penington was the guide, philosopher and friend of everybody, as usual. It is generally admitted that the American Street Railway association is one of the best managed organizations of the kind in the country, and, as other officers come and go, while Mr. Penington remains, the credit for this state of affairs is very largely due to him. Mr. Penington is a prompt, energetic and reliable business man, and his clean-cut business methods have told in the affairs of the organization.

The Weber Gas Engine company of Kansas City occupied one of the prominent booth spaces, showing a gasoline hoisting engine and a stationary engine for lighting plants and commercial use. L. H. Weber had charge of the company's exhibit, and in explaining the merits of his company's products, said that inside of 30 days it would have on the market a special two-cycle, direct-connected engine for lighting purposes that it believed would fill a want really long felt for the particular class of work for which it is constructed.

The fine exhibit of the B-R Electric company of Kansas City was under the personal supervision of F. M. Bernardine and E. R. Royer, who were in constant attendance explaining the merits of the several specialties represented by this enterprising company, which is selling agent for the Ohio Brass company, the R. D. Nuttall company, the Hazard Manufacturing company, the New York and Ohio company and the Cutter company of Philadelphia. The B-R company has rapidly taken the front rank among electrical supply houses.

The exhibit made by the Garl Electric company of Akron, Ohio, attracted the attention of all street-railway men and visitors at the convention. Besides a complete line of street-railway and intercommunicating system of telephones and fire and burglar-alarm devices, the company showed by actual demonstration the operation of a new automatic signaling apparatus for use on electric and steam roads, a brief description of which appeared in the Western Electrician of last week. Max Schumacher and M. Garl did the honors for the company.

The only arc-lamp manufacturer to exhibit at the convention was the Lea Arc Lamp company of Elwood, Ind., whose attractive booth was presided over by William M. Porter, general sales agent. Its line comprised a new automatic headlight for electric roads, miniature arc lamps and a new 110-volt lamp with a new-style case, which opens by a spring pressure, the two case pieces assuming a horizontal position, permitting of easy access to the adjustments. Souvenirs and advertising matter of a high character were distributed to the many interested visitors.

The Garton-Daniels company, Keokuk, Iowa, had an elaborate exhibit. Its line of improved Garton lightning arresters covered the larger part of the space. These arresters are now widely used for electric-light, power and railway circuits, and are made for any voltage, direct or alternating current. The automotorneer, a controller-regulating device, attracted much attention on the part of the railway men. It is designed to prevent "fast feeding" on electric-railway cars, and will no doubt meet with extensive adoption on trolley lines. The extension

Fig. 1. Manville Covering Company. Fig. 2. Weber Gas Engine Company.
Fig. 3. Lea Electric Manufacturing Company. Fig. 4. Dearborn Drug and Chemical Works. Fig. 5. Creaghead Engineering Company.
Fig. 6. American Steel and Wire Company. Fig. 7. Standard Underground Cable Company. Fig. 8. Standard Paint Company.

EXHIBITS AT THE KANSAS CITY STREET-RAILWAY CONVENTION.

face, and, by looking at it long enough, one could see the da-go, according to Mr. Allen.

R. F. Carr and C. A. Stanfield did the honors for the Dearborn Drug and Chemical company of Chicago. They had an attractive booth, showing samples of scale from boilers, tubes and connections, illustrating extreme corrosion and deleterious action of boiler-feed waters. They also showed a line of various oils and lubricants for high-duty work. The main business of this company is the analysis of waters and treatments to overcome different troubles. Unique souvenirs were much sought after, and the ladies in attendance at the convention were fortunate in securing attractive gifts in the shape of handsome bottles of perfume.

The Monarch Fire Appliance company of New York showed the great value of Kilfyre by practical demonstrations at the exhibit. General C. Henry ney, assistant general manager of the company, gave an outdoor exhibition on a lot at Thirteenth and Central streets, fronting the Convention Hall, on Thursday at noon. A large and enthusiastic assemblage of spectators was in attendance, the demonstration resulting most successfully, as always. General Barney was assisted by P. L. Wilbur, and the two gentlemen distributed a neat and highly appreciated souvenir in the shape of a little leather-bound book, with waxed leaves, for internal-revenue and postage stamps. It is scarcely necessary to add that Kilfyre is the "ideal fire protection for switchboards and all electrical apparatus."

The Cutler-Hammer company of Milwaukee, Wis., and Westfield, N. J., had a very attractive exhibit at the convention, in charge of C. H. Norwood. Interest centered chiefly in the railroad switchboard composed of standard panels, with instruments mounted thereon, and designed especially for this class of work. Special attention was called to the company's new circuit-breaker, which is just being introduced, and is known as the W. T. L. Another feature of the exhibit was an entirely new system of automatic-booster regulation, which was in actual operation, and proved to be a great drawing card. This is the company's first appearance in street-railway work, and its success in interesting the delegates in attendance far surpassed its expectations.

The exhibits of McGill, Porter & Berg comprised a most complete line of the many high-grade specialties represented by this young and enterprising firm. The most prominent features of this exhibit were the products of the Ohio Brass company, I-T-E circuit-breakers, Morris rail bonds, Speer carbon brushes, National electric heaters, Wilson trolley catchers, Ham sand boxes and a large display of trolley wheels and harps. Max A. Berg and E. R. Mason did the honors, while Mr. Speer talked about the self-lubricating motor and generator brushes. Mr. V. C. Gilpin, New York agent of the Cutter company, was present to meet the many satisfied users of the I-T-E goods. For the entertainment of the throng of visitors a quartet of colored men was provided. "The Convention Menu" prepared by this popular firm was one of the features of the convention, and the variety of good things provided made it an easy matter for any customer to make a suitable selection.

The Manville Covering company's contingent was of good size. S. H. Finney came from Chicago to represent the electrical department, while William A. Buddeck, manager of the St. Louis branch,

[*Continued on page 276.*]

circuit ringers for telephone lines were shown for the first time. G. V. E. Titus and V. J. Van Horne were in attendance and had always a large circle of interested visitors.

W. D. Packard of the New York and Ohio company of Warren, Ohio, was one of the well-known visitors at the convention. The products of the New York and Ohio company were exhibited in the booth of the B-R Electric company of Kansas City. Mr. Packard has recently become interested in the manufacture of gasoline automobiles, and is enthusiastic over the success his company is meeting in building these vehicles. On a recent trip from Warren to Cleveland, 95 miles of sandy and hilly road, the running time was three hours and 50 minutes, which is an excellent showing.

Among the most interesting exhibits was that of the Joseph Dixon Crucible company, Jersey City, N. J. A large number of callers inspected the varied display of graphite products, including Dixon's American graphite pencils and Dixon crucibles. The representatives included Sam Mayer, Dudd Johnson and William Allen from Chicago and A. L. Haasis and Mr. E. A. St. John of New York. Excellent provision had been made for the entertainment and comfort of the visitors, the usual supply of souvenirs being on hand. Quite an interesting side exhibit was an Italian watch, which had a peculiar

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CONVENTIONS AND EXPOSITIONS.

Antomobile Show, New York, N. Y., November 10th to 24th.
Illinois State Electric association, Peoria November 27th.
National Automobile and Sportsman's Exhibition, Washington, D. C., December 10th to 15th.
Roentgen Society of the United States, New York, N. Y., December 13th and 14th.

Electric typewriting machines are about to be put on the market, according to the promises of manufacturers. The idea is to actuate the moving parts by power from an electric motor, a mere touch on the key serving to make contact and imprint the character. The keyboard is unchanged, and the new machine looks like an ordinary typewriter. Although the electric machines will naturally be more expensive, the advantage claimed is practically unlimited speed, with much less fatigue to the operator. However, as the typewriting machine is a rather delicate and complicated mechanism, frequently getting out of order, it may be doubted, perhaps, whether greater complication and a greater number of parts may not offset the advantage of greater ease and speed of operation.

If the Supreme Court of Illinois decide that the city of Chicago has authority to add $2,500,000 to its present bonded indebtedness, or if the Legislature pass a special enabling act, a municipal hydro-electric plant on a large scale may be erected at Lockport to utilize the power of the Drainage Canal to furnish electricity for lighting the streets of this city. The project is an attractive one, and the Sanitary District trustees and the city authorities are agreed upon it, the materialization of the plan depending upon judicial or legislative sanction. The low price of $4 a horsepower a year for the rental of the power has been decided upon, and the contract is to run for 75 years from July 1st next. The city is to build the plant, of course, merely obtaining the power rights from the Sanitary District. The project is an interesting and feasible one, and it will probably be carried out.

Buenos Ayres is a progressive city, and it seems to have taken to the electric automobile with a vim. Not only heavy delivery wagons, but also luxurious carriages, operated by electricity, are frequently to be met with on the streets of that city. The roads are gradually being improved, and a touring club has been formed, with a view to watching over the interests of automobilism. One of the first resolutions of this club, the members of which comprise many merchants and influential amateurs, earnestly recommended the construction throughout all the provinces of the Argentine Republic of roads especially reserved for light motor cars and bicycles. These roads already radiate from Buenos Ayres for a distance of from 60 to 70 miles, it is said, and the work will be continued till a network of similar roads exist all over the country. The automobile will undoubtedly make for good roads in this country in time; but the Argentinians seem to have set the United States an example in enterprise of this kind.

A recent letter from Professor Fleming to the London Times states that Mr. Marconi has succeeded in his long-continued and discouraging attempt to solve the problem of non-interference of simultaneous messages in space telegraphy. The experiments described were conducted between four sets of instruments, two placed at each station, the two stations being 30 miles apart, one near Poole, in Dorset, and the other in the Isle of Wight. Instead of the usual masts, 177 feet high, hitherto used in communication over that distance, metal cylinders only four feet in height are now required, and by such means a syntonic or resonating effect is secured between sender and receiver, whereby all outside vibrations are said to be shut out, privacy of messages being thus obtained. Thus it would seem that an objection against the use of wireless telegraphy for military and commercial purposes, hitherto regarded as fatal, has been removed. Further details of the system used will be eagerly awaited.

Kansas City is in need of an Independent telephone company, if the chief magistrate of that city is to be believed. In his address of welcome before the American Street Railway association last week Mayor Reed said: "We have a telephone system in this town, and I want to say to you, gentlemen, if any of you desire to build a telephone system, we will treat you fairly if you will only give us instruments which will enable us to hear what is said over the wire. We complain only when we have legitimate cause to complain, and we complain loudly against that institution. Someone may be here who owns stock in that company, but I make the statement, nevertheless." Perhaps the mayor has some special antipathy to the Missouri and Kansas Telephone company, as the service in that city seems to be no worse than the average of that of the Bell companies; but, at any rate, Kansas City, a bustling city of 170,000 inhabitants, does seem to offer an inviting field that the Independents have hitherto failed to cultivate.

President Roach of the Chicago Union Traction company is winning golden opinions by his enlightened administration of the North and West Side street-railway systems. He realizes that the interests of the company are best served by conciliating rather than antagonizing the public, and to this end he is endeavoring to secure the highest order of service from the company's six or seven thousand employes. The conductors and motormen are the men who meet and impress the passengers who have the nickels, and Mr. Roach, who was a conductor once himself, sees the wisdom of paying them well and meeting all reasonable demands for their well-being and comfort. Mr. Roach's latest proposition embraces the establishment of two clubhouses for the men and the placing of all employes on a rigid and impartial merit system, by which, in a careful and exact manner, each man's record shall determine his status with the company. Neither of these designs is new in railway work, but if the plan is carried out, it will undoubtedly result in greater co-operation between officers and men and a corresponding improvement in the service. Mr. Roach is entitled to credit for his broad and generous policy.

Only pleasant memories will linger in the minds of those who visited the Kansas City street-railway convention. The town itself, with its hospitable people, busy streets, fine buildings, excellent street-car service, good hotels and first-class newspapers, was an attraction. The convention was well attended and formed the raison d'être for an imposing exhibition of street-railway machinery and appliances. But four papers were read, and of these only one was really discussed. This was rather disappointing to some of the members who had come long distances to obtain new ideas or new light on old problems. But the situation was due to a variety of causes, such as is not likely to happen in combination again. By way of consolation the exhibits furnished a fine school of instruction, at which every visitor was a pupil. The choice of New York as the next place of meeting met general approval, and a highly successful convention in 1901 is anticipated. A full report of the proceedings of the convention, with the names of the members in attendance, a portrait and sketch of the new president and a mass of convention notes and gossip, is given in this issue of the Western Electrician.

Mention is made on another page of the Western Electrician of a movement looking toward the organization of an association of electrical meter experts. The question of standardization and proper maintenance and operation of electric meters used in central stations throughout the country has grown to be a very important one, and there is scarcely a convention of men interested in central-station operation that does not deal directly or indirectly with topics of this nature. Such an association as is now proposed would help to individualize the expert metermen and would tend to place their work on a higher plane. An organization of this character would also be of value to manufacturers of electric meters and to central-station men.

The question of organizing the proposed association as a branch or affiliated society of the National Electric Light association is worthy of consideration. The work of the new society would be along lines to which the national association has devoted much attention, and no doubt the older society would be willing to see this branch of its work specialized. Conventions and exhibits could be held at the same time, much after the manner of the joint meetings of the American Street Railway association and the street-railway accountants. Mr. Ferris and Mr. Clark, the gentlemen who have conceived the idea of organizing the metermen's association, are working earnestly to accomplish their end, and their efforts deserve the serious attention of all who have the good of the industry at heart.

Association Members at Kansas City.

Following is a list of delegates from company members of the American Street Railway association in attendance at last week's convention in Kansas City:

Akron, O.—L. E. Beilstein, general manager, Northern Ohio Traction company.
Asbury Park, N. J.—S. F. Hazelrigg, general manager, Atlantic Coast Line Electric Railroad company.
Atchison, Kan.—J. A. Bendure, general manager, Atchison Railway, Light and Power company.
Atlanta, Ga.—Ernest Woodruff, president, J. R. Gordon, director, Atlanta Railway and Power company.
Augusta, Ga.—D. B. Dyer, president, C. O. Simpson, secretary and treasurer, Augusta Railway and Electric company.
Birmingham, Ala.—J. B. McClary, general manager, D. B. Dimick, electrical engineer, George H. Harris, chief engineer, Birmingham Railway and Electric company.
Boston, Mass.—Charles S. Sergeant, vice-president, Henry L. Wilson, auditor, Boston Elevated Railway company.
Bridgeton, N. J.—H. J. Crowley, vice-president, B. Frank Hires, general manager, Bridgeton and Millville Traction company.
Brockton, Mass.—Elwin C. Foster, general manager, Brockton Street Railway company.
Brooklyn, N. Y.—Clinton L. Rossiter, president, Eugene Chamberlin, superintendent of equipment, William Robbins, Jr., division superintendent, Newton W. Bolen, division superintendent, Giles S. Allison, Brooklyn Heights Railroad company.
Brookfield, Mass.—E. P. Shaw, Warren, Brookfield and Spencer Street Railway company.
Buffalo, N. Y.—C. A. Coons, superintendent, Buffalo Railway company.
Camden, N. J.—Walter E. Harrington, general manager, Camden and Suburban Railway company.
Chester, Pa.—John A. Rigg, president, Joseph C. Luger, superintendent, Chester Traction company.
Chicago, Ill.—H. M. Sloan, general manager, Calumet Electric Street Railway company; Robert McCulloch, general manager, T. C. Penington, treasurer, C. N. Duffy, auditor, C. E. Wilson, chief engineer, M. O'Brien, master mechanic, John Sills, assistant master mechanic, C. E. Lund, draughtsman, Chicago City Railway company; T. A. Henderson, general superintendent, F. L. Roach, Chicago Consolidated Traction company; E. R. Gilbert, general manager, Chicago Electric Traction company; John M. Roach, president, J. Millar, master mechanic, George Voigt, electrician, Chicago Union Traction company; William Walmsley, superintendent, South Chicago City Railway company.
Cincinnati, O.—W. H. Harris, Cincinnati Street Railway company.
Cleveland, O.—John Ehrhardt, assistant secretary, C. B. Easty, master mechanic, Cleveland City Railway company; Ira A. MacCormack, general manager, W. G. McDole, auditor, E. C. Faber, general passenger agent, W. J. White, Cleveland Electric Railway company.
Colorado Springs, Colo.—Frank C. Lawton, superintendent, Colorado Springs Rapid Transit Railway company.
Columbia, Pa.—Frank S. Given, general manager, Cauestoga Traction company.
Columbus, O.—Michael S. Hopkins, general superintendent, P. V. Barrington, secretary and auditor, Columbus Railway company.
Council Bluffs, Ia.—W. S. Dimmock, general manager, W. G. Denny, foreman of shops, Omaha and Council Bluffs Railway and Bridge company.
Dallas, Tex.—G. Van Ginkel, president, Dallas Consolidated Electric Street Railway company.
Danville, Ill.—Samuel L. Nelson, general manager, Harry Evans, Danville Street Railway and Light company.
Dayton, O.—Charles L. S. Tingley, secretary and treasurer, People's Railway company.
Denver, Colo.—J. B. Hogarth, Denver City Tramway company.
Des Moines, Ia.—A. G. Maish, secretary, W. G. Owens, superintendent, E. R. Emmons, J. E. Welch, Thomas Marlow, Des Moines City Railway company.
Davenport, Ia.—James F. Lardner, general manager, John G. Huntoon, general superintendent, John D. Fish, electrical engineer, Tri-City Railway company.
Detroit, Mich.—A. L. Parker, second vice-president, Detroit, Rochester, Romeo and Lake Orion Railway company.
Fall River, Mass.—Robert S. Goff, president, Globe Street Railway company.
Findlay, O.—C. D. Kinney, vice-president and treasurer, Charles F. Smith, manager, Findlay Street Railway company.
Fond du Lac, Wis.—T. F. Grover, president, Fond du Lac Street Railway and Light company.
Hamilton, Ont.—C. K. Green, manager, J. B. Griffith, purchasing agent, Hamilton Street Railway company.
Harrisburg, Pa.—Mason D. Pratt, engineer, Harrisburg Traction company.
Hazleton, Pa.—C. A. Bragg, Lehigh Traction company.
Hoboken, N. J.—W. S. Hall, general superintendent, North Hudson County Railway company.
Houston, Tex.—H. F. MacGregor, vice-president and general manager, Houston Electric Street Railway company.
Indianapolis, Ind.—James M. Jones, second vice-president, W. F. Milholland, treasurer and assistant secretary, Edward P. Burch, consulting engineer, Indianapolis Street Railway company.
Jackson, Miss.—Frank G. Jones, Jackson Railway, Light and Power company.
Jersey City, N. J.—E. D. Hibbs, auditor, G. F. Chapman, general superintendent, A. W. Fratt, roadmaster, North Jersey Street Railway company.
Johnstown, Pa.—H. C. Evans, director, Johnstown Passenger Railway company.
Joliet, Ill.—Samuel G. De Coursey, president, F. E. Fisher, general manager, A. S. Kibbe, engineer, Joliet Railway company.
Kalamazoo, Mich.—J. B. Foote, chief electrician, R. L. Rand, general superintendent, Michigan Traction company.
Kansas City, Kan.—W. H. Gabriel, vice-president, Herbert W. Wolcott, secretary, E. E. Comb, manager, H. E. Gabriel, assistant manager, H. S. De Neefe, superintendent, W. H. Hammond, passenger and claim agent, C. K. Stieg, electrical engineer, Kansas City-Leavenworth Railway company.
Kansas City, Mo.—W. O. Hands, general manager, Charles E. Jack, auditor, H. De Coursey, East Side Electric Railway company; Walton H. Holmes, president, C. F. Holmes, general manager, L. E. James, vice-president, D. B. Holmes, counsel, W. E. Kirkpatrick, secretary and treasurer, J. A. Harder, auditor, W. A. Satterlee, superintendent, J. W. Carter, assistant superintendent, H. C. Schwitzebel, purchasing agent, D. W. Dozier, chief engineer, J. W. G. Becker, master mechanic, Charles Grover, electrical engineer, Edward Butts, civil engineer, Metropolitan Street Railway company.
Knoxville, Tenn.—Robert Kinsell Howard, superintendent, Knoxville Traction company.
Lebanon, Pa.—Dr. Walter A. Rigg, director, K. A. Fichthorn, director, Lebanon Valley Street Railway company.
Lowell, Mass.—E. C. Foster, general manager, Lowell, Lawrence and Haverhill Street Railway company.
Louisville, Ky.—T. J. Minary, president, T. H. Minary, assistant superintendent of construction, Samuel G. Boyle, secretary and treasurer, Louisville Railway company.
London, Ont.—C. E. A. Carr, general manager, secretary and treasurer, E. R. Carrington, London Street Railway company.
Lynn, Mass.—E. C. Foster, general manager, Lynn and Boston Railroad company.
Memphis, Tenn.—Frank G. Jones, vice-president and general manager, Memphis Street Railway company.
Meriden, Conn.—N. H. Heft, president, Meriden Electric Railroad company.
Meridian, Miss.—John Kamper, Meridian Street Railroad and Power company.
Merrimac, Mass.—James F. Wattles, director, Charles S. Clark, director, Haverhill and Amesbury Street Railway company.
Milwaukee, Wis.—John I. Beggs, general manager, T. E. Mitten, general superintendent, G. J. Sunny, special agent, Milwaukee Electric Railway and Light company.
Nashville, Tenn.—F. W. Child, director, Nashville Street Railway company.
New Orleans, La.—W. B. Brockway, assistant secretary and auditor, New Orleans and Carrollton Railroad company.
New York, N. Y.—Herbert H. Vreeland, president, Metropolitan Street Railway company.
North Adams, Mass.—W. T. Nary, superintendent, Hoosac Valley Street Railway company.
Norristown, Pa.—John A. Rigg, president, Samuel D. Missimer, chief engineer, Schuylkill Traction company.
Oil City, Pa.—James H. Ferbush, superintendent, Oil City Street Railway company.
Omaha, Neb.—W. A. Smith, general manager, F. A. Tucker, general superintendent, Omaha Street Railway company.
Ottawa, Ill.—F. S. Donnell, president, Ottawa Railway, Light and Power company.
Ottawa, Ont.—J. E. Hutcheson, superintendent, Ottawa Electric Railway company.
Pasadena, Cal.—W. H. Smith, general manager, Los Angeles and Pasadena Electric Railway company.
Peoria, Ill.—L. E. Myers, general manager, N. C. Draper, superintendent, Peoria and Pekin Terminal Railway company.
Philadelphia, Pa.—John A. Rigg, president, C. C. Long, electrical engineer, Holmesburg, Tacconey and Frankford Electric Railway company; John A. Rigg, president, George Hoeger, superintendent, Roxborough, Chestnut Hill and Norristown Railway company.
Pittsburg, Pa.—George S. Davison, general manager, Monongahela Street Railway company; Charles Fitzgerald, superintendent, Robert T. Todd, general master mechanic, Consolidated Traction company; C. S. Mitchell, auditor, United Traction company.
Port Chester, N. Y.—G. Stanley Heft, electrical engineer, Port Chester Street Railway company.
Portland, Me.—W. R. Wood, president, E. A. Newman, general manager, C. C. Pierce, general electrician, Portland Railway company; William E. Dow, assistant superintendent, George E. Raynes, starter, Portland and Yarmouth Electric Railway company.
Port Huron, Mich.—A. Dixon, president, W. L. Jenks, treasurer, H. A. Dixon, manager, City Electric Railway company.
Quincy, Ill.—W. B. McKinley, secretary, L. O. Williams, superintendent, Quincy Horse Railway and Carrying company.
Quincy, Mass.—John R. Graham, president and general manager, Quincy and Boston Railway company.
Reading, Pa.—John A. Rigg, president, Samuel E. Rigg, superintendent, United Traction company.
Rochester, N. Y.—J. H. Stedman, manager of transfers, Rochester Railway company.
Rockford, Ill.—R. N. Baylies, president, T. M. Stephenson, manager, Rockford Railway, Light and Power company.
Salt Lake City, Utah.—Walter P. Read, superintendent, Salt Lake City Railroad company.
Saratoga, N. Y.—E. A. Noyes, president, F. P. King, general manager, Saratoga Traction company.
Schenectady, N. Y.—J. R. Lovejoy, director, W. Gibson Carey, director, Schenectady Railway company.
Seattle, Wash.—Charles F. Wallace, engineer, Seattle Electric company.
Sioux City, Ia.—J. Henry Ricker, secretary, E. O. Holmes, superintendent, C. M. Feist, master mechanic, Sioux City Traction company.
Spokane, Wash.—L. R. Norbohm, superintendent, Washington Water Power company.
Springfield, Ill.—C. K. Minary, manager, T. H. Minary, electrical engineer, Springfield Consolidated Electric Railway company.
Springfield, O.—John H. Miller, general manager, Springfield Railway company.
St. Joseph, Mich.—W. Worth Bean, president, St. Joseph and Benton Harbor Electric Railway and Light company.
St. Joseph, Mo.—W. T. Van Brunt, vice-president and general manager, J. H. Van Brunt, superintendent, T. G. Smallwood, O. T. Kass, St. Joseph Railway, Light, Heat and Power company.
St. Louis, Mo.—Thomas M. Jenkins, general manager, Herbert O. Rockwell, assistant to general manager, Nathan Smith, electrical engineer, Charles S. Butts, E. J. Smith, T. C. Kimben, St. Louis and Suburban Railway company; George W. Baumhoff, general manager, R. M. Douglass, superintendent, Frank J. Suda, assistant auditor, Frank J. Duffy, paymaster, St. Louis Transit company.
Syracuse, N. Y.—Edward G. Connette, vice-president and general manager, Syracuse Rapid Transit company.
Terre Haute, Ind.—G. C. Tripp, treasurer, M. C. George, electrician, B. N. Grosvenor, master mechanic, Terre Haute Electric company.
Topeka, Kan.—Clifford C. Baker, president and treasurer, J. G. Slonecker, secretary, Charles Blood Smith, director, J. H. McCahan, superintendent of construction, Albert M. Patten, C. W. Hixon, Topeka Railway company.
Toronto, Ont.—J. M. Smith, general manager, M. Powers, Toronto Railway company.
Trenton, N. J.—John A. Rigg, vice-president, Peter Hurley, superintendent, Trenton Street Railway company.
Venice, Ill.—Fred E. Allen, president, E. J. Spencer, secretary, Venice, Madison and Granite City Railway company.
Washington, D. C.—George H. Harrier, vice-president, William F. Ham, treasurer, Columbia Railway company.
Waterbury, Conn.—Charles M. Hemingway, cashier, Connecticut Lighting and Power company.
Webb City, Mo.—A. H. Rogers, president, E. J. Pratt, electrical superintendent, South West Missouri Electric Railway company.
Westwood, Mass.—John R. Graham, Norfolk Western Street Railway company.
Wilkesbarre, Pa.—John A. Rigg, president, T. A. Wright, superintendent, Wilkesbarre and Wyoming Valley Traction company.
Wilmington, Del.—John A. Rigg, president, A. V. Arrowsmith, director, Wilmington City Railway company.
Willoughby, O.—Charles W. Wason, president, Cleveland, Painesville and Eastern Railroad company.
Worcester, Mass.—A. H. Stone, treasurer, Worcester Consolidated Street Railway company.
Youngstown, O.—A. A. Anderson, general manager and treasurer, Mahoning Valley Railway company.

President Roach's Plans for Chicago Union Traction Employes.

When a committee of 16 employes of the Chicago Union Traction company recently called on President John M. Roach to thank him for their increase of pay, the question of the arrangement of the runs to which the men are assigned and the pay involved was presented. According to the present rules, when a man misses his car he is set down from a desirable run and best pay to a less-choice assignment and on a decreased salary. The men in the best places want their positions made permanent, even if they do miss. The men behind them do not want the rule changed, because they feel it precludes all possibility of their advancement. As the men could not agree at the meeting, the question was left in Mr. Roach's hands for solution. In a recently reported newspaper interview, President Roach is credited with saying in this connection:

"Just what to do, I have not definitely decided. It has been my aim to carefully conserve the interests of the men, because by so doing a better system can be had and the public is thereby given a better service. During my administration of the affairs of the company I have tried to satisfy the public. When I assumed control we were faced the other way, and it has been no easy matter to reorganize the service and bring the standard of discipline to a much higher plane, where it is to-day."

The interview brought out an idea which Mr. Roach has in mind for the establishment of a place on the North Side and one on the West Side for the sole use of the employes of the company and their families. It is his plan to have these clubhouses suitable for holding lectures, theatrical and other wholesome forms of entertainment. If founded, they will be built and conducted at the sole expense of the company, and the company will benefit by such an expenditure, as it will afford opportunity for the officers to talk to the men when they are all together.

"If the change in the rules is made, as I now in a measure contemplate," said Mr. Roach, "I will engage a man whose duty it will be to keep the records of the men. A system of 100, signifying perfect, with deductions in points according to the scale to be arranged, with demerits and credit marks for meritorious conduct, will be kept by this man. This will constitute the man's record, and it will show whether he is a good or an indifferent employe. From that record will be made the table of promotions to the best runs and the highest-paid places.

"It has been my consistent belief that great improvements could be accomplished in our street-railway systems in this city. The height of my ambition is to gain credit from the public for the manner in which the roads are conducted which come under our jurisdiction. I want to see the time under my administration when people can come here from any city and say the street railways of Chicago are the best conducted and the most satisfactory in the world. It is possible, and it is not too high a mark at which to aim."

New Electric Railway in Spain.

Mr. Manuel Acebal of Madrid has been authorized by the Spanish government to consider the feasibilities for the construction of an electric railway to connect the city of Oviedo with the port of Gijon. The line would run through an extraordinarily busy industrial district, and there is no doubt that it would prove to be a most successful enterprise. The distance to be traversed is about 2.5 kilometers (1.55 miles), and it is intended to have the line built as a narrow-gauge road. Oviedo is the capital of the province of the same name, and the whole district is far famed for its extensive iron and coal deposits. The pit coal in the mines of Langreo, near Gijon, is considered the best coal found in the whole of Spain. Gijon is the chief seaport of Asturias, and is the principal port of Spain for coastwise traffic. Immense coalfields, of an estimated area of 300,000 hectares (741,300 acres), are near Gijon, 60,000 of which are considered workable, economically speaking, but, owing to want of railway accommodation and narrow-gauge lines to mines, only four to five per cent. are now being worked. But, notwithstanding these drawbacks, about 1,300,000 tons of coal was mined in this district in 1899. When the province is once supplied with more rail accommodation, it may reasonably be expected that the iron-ore deposits of rich quality will be largely developed. The district also abounds in powerful waterfalls, so that all essential conditions for the establishment of an extensive network of electric railways exist.

A serious accident occurred on the Paris Metropolitan underground railway, on October 19th, resulting in the injury of 30 passengers, two of whom died. The disaster occurred between the exposition stations and the Place de la Concorde, and was due to a misunderstanding of orders and improper observance of signals. A train had entered the Place de la Concorde station, when a train following on the same track, late and running to make up lost time, crashed into its rear coach, completely demolishing it. Traffic was interrupted for several hours.

DEVELOPMENT OF THE TELEPHONE FIELD.

Valuations of Ohio Telephone Companies.

The Ohio State Board of Assessors and Appraisers has made the following valuations of telephone companies in the state:

Ada Telephone Exchange company, Ada	$ 3,264
Ashtabula Telephone company	15,531
Barnesville and Woodsfield, Barnesville	1,090
Bellefontaine Telephone company	8,854
Bellevue Home Telephone company	252
Black River Telephone company, Lorain	29,025
Bluffton Telephone company	2,900
Bryan Telephone company	5,090
Bucyrus Telephone company	9,540
Burton Telephone company	2,100
Bartlett and Marietta Telephone company, Vincent	644
Bowling Green Telephone company	9,000
Cambridge Home Telephone company	5,439
Carey Electric Telephone company	1,800
Central District and Printing company, Warren	269,773
Central Union Telephone company	1,824,976
Caldwell Independent Telephone company	1,500
Celina Telephone company, St. Marys	2,310
Chardon Telephone company	4,550
Citizens' Telephone company, West Unity	780
Chillicothe and McArthur Telephone company, McArthur	4,200
City and Suburban Telegraph association, Cincinnati	656,929
Citizens' Telephone company, Berea	5,000
Citizens' Telephone company, Coshocton	7,020
Citizens' Telephone company, Delaware	5,200
Citizens' Telephone company, Tiffin	7,800
Citizens' Telephone company, Washington Court House	8,000
Carroll County Telephone company, Carrollton	2,587
Cleveland Telephone company	974,000
Clyde Telephone company	2,275
Clinton Telephone company, Wilmington	5,800
Columbiana County Telephone company, Salem	60,843
Chagrin Falls Telephone company	1,400
Cuyahoga Telephone company, Cleveland	465,000
Conneaut Telephone company	9,000
R. F. Cappeis Telephone company, Alger	1,720
Crestline Telephone company	2,700
Delphos Home Telephone company	3,000
Doylestown Telephone company	450
Eastern Ohio Telephone company, East Rochester	3,023
Eaton Telephone company	4,480
Elyria Telephone company	13,000
Elyria Southern Telephone company, Elyria	3,600
Edgerton Telephone Exchange company	540
Farmers' Telephone company, Massillon	6,776
Farmers' and Merchants' Telephone company, Warsaw	2,800
Farmers' Co-operative Telephone company, Mansfield	1,680
Flat Rock Telephone company	315
Flushing Telephone company	315
Galion Telephone company	3,750
Gallipolis Telephone company	4,000
Garrettsville Telephone Exchange	700
Graysville Telephone company	90
Greenfield Mutual Telephone company	6,608
Hamilton, Hughes and Monroe Telephone company, Hughes	2,340
Hicksville Telephone company	1,710
Home Telephone company, Chillicothe	19,000
Home Telephone company, Plain City	3,507
Home Telephone company, Pincher	195
Home Telephone company, Tiffin	10,500
Huron County Telephone company, Monroeville	5,422
Inland Telephone company, Bloomville	2,268
Inland Telephone company, New Knoxville	2,625
Jefferson and Warren, Orangeville	9,760
Kenton Telephone company	8,190
Kent Home Telephone company, Kent	2,380
Lawrence Telephone company, Ironton	10,800
Lima Telephone company	10,120
London Telephone company	3,892
Madison Telephone company Warren	5,625
Manchester, Bentonville and West Union Telephone company, Manchester	190
Marion Telephone company, Maria Stein	954
Marysville Telephone company	1,857
Mechanicsburg Telephone company	1,904
Medina Telephone company	7,500
Miami Telephone company	27,510
Millersburg, Wooster and Orrville Telephone company, Millersburg	14,100
Montpelier Telephone company	1,800
Morrow County Telephone company, Mt. Gilead	3,456
Mt. Vernon Telephone company	8,627
Mt. Vernon Telephone company (Gambier lines)	530
Mentor Telephone company	2,100
National Telephone and Telegraph company, Fort Wayne, Ind	1,335
Newark Telephone company	10,115
New Bremen Telephone company	1,050
New Harrison Telephone company, Toledo	18,000
Newton Falls Telephone company	140
Norwalk Telephone company	5,110
North Amherst Telephone company	1,875
Northern Ohio Telephone company, Bellefontaine	3,150
Northwestern Telephone company, Defiance	5,000
Northwestern Ohio Telephone company, Wauseon	2,780
Napoleon Telephone company	6,350
Napoleon Toll Line company, Napoleon	5,292
Oak Harbor Telephone company	2,100
Oberlin Telephone company	2,475
Ohio Telephone and Telegraph company, Cincinnati	536,849
Ohio Telephone Construction company, Butler	2,020
Painesville Telephone company	7,260
Paulding Home Telephone company	1,200
Peebles Telephone company	140
Peoples' Telephone company, Butler	133
Peoples' Telephone company, Bartlett	706
Piqua Home Telephone company	5,530
Port Clinton Telephone company	4,050
Progress Telephone and Telegraph company, West Milton	140
Put-in-Bay Telegraph company, Put-in-Bay	1,389
Putnam Telephone company, Ottawa	7,112
Peoples' Telephone company, Shelby	3,750
St. Paris Telephone company	1,400
Sandusky Telephone company	18,000
Sayers Telephone company, Marits	200
Sharon Telephone company	30
Sidney Telephone company	4,000
Sidwell & Millers Telephone company, Russellville	70
Star Telephone company, Ashland	14,550
St. Marys Telephone company	4,000
State Line Telephone company, New Corydon, Ind	1,802
United States Telephone company, Cleveland	324,987
United States Telephone company, New Lexington	1,380
Upper Sandusky Telephone company	3,600
Urbana Telephone company	11,680
Valley Telephone company, Lebanon	2,632
Van Wert Telephone company	3,250
Van Wert General Electric company	1,200
Wapakoneta Telephone company	2,100
Warren and Niles Telephone company, Warren	19,075
Waterford, Watertown and Vincent Telephone company, Vincent	200
Wellington Telephone company	2,250
Williams County Toll Line company, Bryan	3,300
Youngstown Telephone company	61,300
Zanesville Telephone and Telegraph company	1,001

The Central Union Telephone company was raised from $1,127,586 last year to its present figure and the Cleveland Telephone company was also advanced from $708,022 last year to the amount given above. Nearly all the other valuations are higher than they were last year. The Napoleon Telephone company and the Napoleon Toll Line company will have several years' back taxes to pay, as they failed to report their property. The first-named company has not reported since 1896 and the latter has filed no report since 1897.

Notes from Ohio.

The Andover Electric Telephone company, with a capital stock of $6,000, was incorporated recently. The new company will build a line and system of exchanges extending from Andover, Ashtabula county, into Richmond township in the same county. The incorporators are C. E. Harmen, S. R. Wood, William Graham, V. M. Cole and William Webb.

The fight against the Newark and Granville line of the United States Telephone company has been continued the last week and a number of poles have been cut down by farmers who think they have a right to keep the line away if it is not constructed to suit them.

Manager C. E. Stasel of the Newark Telephone company has resigned his position and James Hamill has been made acting manager until a successor can be chosen. No reasons have been given for the change. This company has recently put in a new switchboard in its Granville exchange, and is prepared to give good service there now.

It is stated that A. R. Warner, acting for the United States Telephone company, has purchased the franchise and all the rights of the Citizens' Telephone company of Mansfield. The Citizens' Telephone company was incorporated some months ago to operate in competition with the Central Union, which was not giving the best of service at that time. After about 1,200 contracts had been made the old company put in a new exchange and made some other improvements, and for some reason the new company ceased work, and nothing has been done since. As Mansfield is a splendid city, it is supposed that the United States company desires to take up the business there and operate an exchange for the present, in order to make a station for long-distance lines, if for no other reason.

A telephone exchange is being put in in the town of Frankfort, Ross County, under the supervision of Manager A. H. Reutinger of the Chillicothe Independent company, and, when finished, it will be under the management of W. A. Putnam. Although the town is small, 75 subscribers have been secured, and many others will be taken. The farmers will also take a number of telephones along the line. It will connect with the United States company's long-distance wires through Chillicothe.

The ordinance granting the Stark County Telephone company a franchise to operate in Canton was laid over at a recent meeting of the City Council. A number of amendments were made to the ordinance, and the company was subjected to some rigid requirements, the hardest one being a proposition that it shall give bond in the sum of $15,000 to insure its complying with the requirements of the franchise. This includes a forfeiture of the bond in case the company sells out to a rival company.

At a meeting of the Retail Grocers' association at Columbus a few days ago, it was decided to use both telephone systems. Some time ago it was decided to use only the Independent system, but the grocers fear they will lose trade by dispensing with either one.

A division has been created in the Amish Church in Winesburg over the use of the telephone. As is known, these people spurn everything that is ornamental or in any way different from the customs of years ago. Some of the younger members of the settlements in Holmes and Tuscarawas counties have outgrown the old ideas, however, and when a telephone line was built through that section some time ago, a number of them had the instruments placed in their homes. This stirred up the older element, and it now seems that there will be a division, and there is a prospect for some of the younger members of the sect to become modernized.

Quite a little interest is being manifested in the injunction case against the Columbiana County Telephone company at Alliance. Because an amendment was tacked on to the ordinance, after its first reading, the enemies of the company there claim that the franchise secured by its passage is irregular, and they have taken this ground to prevent the company from building the plant.

The Findlay Home Telephone company of Findlay now has orders for 500 telephones, and the work of constructing the plant will be commenced at once.

Rev. H. H. Barbour, pastor of the First Baptist Church of Columbus, has introduced an innovation which has created no little interest in that city. He has had a telephone instrument arranged in the pulpit, and all who are not able to attend church, but wish to hear the sermon, may do so by having their telephones connected. The Citizens' Telephone company's instruments are used, and about 30 members of his church have this service. It was tried first last Sunday, with good results, it is said.

The new switchboard for the Dayton (Ohio) office of the Central Union Telephone company has been received from Chicago, and will be put in place in the new office on Ludlow street as soon as possible. The tardy arrival of the switchboard has already delayed the moving to new quarters.

The Central Union Telephone company has installed an exchange at Oak Hill, Ohio, starting off with 35 subscribers. It is said that this company will put in an exchange at Vinton, Gallia County, soon.

An injunction suit has been filed in Common Pleas Court at Canton to prevent the new telephone company at Alliance from constructing its plant, the claim being made that the company is owned by the United States Telephone company, and that this company will put up its own lines in the town unless restrained from doing so. Just where the venom comes in here is not plain to be seen, but it must exist some place, probably with those who wish to see the old company left undisturbed in its business in that town.

O. M. C.

Telephone News from the Northwest.

Efforts will be made to induce the local company at Pembina, N. D., to make improvements to its exchange.

The Wisconsin Telephone company of Marinette, Wis., will move its office into new quarters in the Lewis block about November 1st.

The Bell telephone interests are stringing six additional copper wires from Madison, Wis., to Minneapolis.

The Hutchinson (Minn.) Telephone Exchange company will construct a line to Acoma, Minn.

A line is to be built from Bay City, Wis., to Esdaile, also from Bay City to Hager, Wis., where it will connect with the Pierce County Telephone company's system.

In three years the number of telephones in use in Whatcom, Wash., has increased from less than 100 to 425. In the neighboring city of Fairhaven there were but 18 used three years ago, and now there are 175 in service.

A local company is projected for Elma, Wash., which proposes to connect with neighboring towns and give direct connection with Centralia and Hoquiam.

A new switchboard has been placed in the office at St. Croix Falls, Wis.

The Ida Grove Telephone company of Ida Grove, Iowa, reports a plant worth $5,400 and only $3,575 worth of stock has been sold. The net earnings for the nine months of this year were $814, making a net profit of 18 per cent. When the exchange began operations last January there were 90 instruments in use, and the number has now increased to 160.

The council of Tacoma, Wash., has granted the Sunset Telegraph and Telephone company a franchise to place its wires underground.

The Fort Dodge (Iowa) Telephone company has added a toll-board to its equipment.

The Mutual Telephone company of Des Moines, Iowa, is making good progress with its canvass for placing the increased stock recently voted among its stockholders. The subscriptions are limited to five shares to each purchaser, in order to preserve the mutuality of the company. The company plans to place its wires underground as soon as possible, for the contiguity of alternating-current light wires to its own wires has produced a very changeable telephone service.

The Forman Telephone company of Wahpeton, N. D., has been granted a franchise in Breckenridge, Minn., for a local system.

The Marathon County Telephone company has completed its lines as far as Mosinee, Wis. It will touch Scofield, Marathon City, Rib Falls, Athens, Edgar, Fenwood, Stratford, McMillan, Marshfield. It will connect with the Citizens' line between Wausau and Marshfield. The line is to be completed by November 1st.

The Northwestern Telephone Exchange company has established local stations at Rogers, Hannaford, Dazey and Cooperstown, N. D.

A new line is projected for connection with Fox Lake, Wis., from the towns west of that place.

An automatic telephone system is being installed for Pierz, Minn.

H. J. Pettengill, the vice-president of the Erie telephone system, was in Minneapolis lately, coming almost direct from Galveston. He estimates the loss to his company from the storm there at about $100,000.

The Moravia Telephone company and the Ottumwa Telephone company of Moravia and Ottumwa, Iowa, have filed a formal agreement as to rates for exchanged business over both lines. Heretofore they have had but a verbal agreement.

A local company is being formed at Bertha, Neb., to build a line to Oakland, Neb., and also a connection with Basford.

E. A. Martin, inspector for the Central Union Telephone company at Rock Island, Ill., is experimenting with a device for duplex telephony, and

believes he has accomplished his end. His experiments have been progressing for some weeks, and are successful. He has filed a caveat for a patent, it is understood.

John S. McGroarty of Philadelphia and James P. Gleason of Seattle are applicants at Port Angeles, Wash., for a franchise for a telephone system and an electric-light plant.

The Jefferson County Telephone company has secured new quarters for its central office in Fairfield, Iowa, and will put in a new switchboard with 300 drops. The company now has over 200 instruments in operation.

The council of St. Paul is considering a resolution looking to an investigation of the Mississippi Valley Telephone company's system in that city. It is alleged that the company has not lived up to its promises in the matter of completing its exchange and that the city police-alarm system has been hampered and delayed. R.

Missouri Developments.

The Capital Telephone company of Jefferson City, Mo., is in successful operation, with its new exchange at that place. The line construction is exceptionally good, no expense being spared either in material or workmanship. Fifty-pair cables are used as much as possible, and the circuits are practically all copper-metallic. The North Electric company of Toledo, Ohio, supplied the telephones and switchboard equipment, the North special supervisory system being used. The citizens of Jefferson City are to be congratulated upon their possession of such an efficient exchange.

It is reliably reported that the Lander system of toll lines, covering a greater portion of Central Missouri, is soon to be sold at auction. The lines are controlled by the Standard Telephone company of Missouri, but have been neglected so long that they are practically useless in their present state. It is hoped someone will buy it and rebuild with cedar poles and metallic circuits.

T. F. Teising and Dr. Allee of High Point and Olean, respectively, have just completed a toll line with metallic circuit, between those two places, using 25-foot cedar poles and No. 10 iron wire.

The Capital Telephone company prosecuted a negro for using offensive language over its lines at Jefferson City recently, and he was given 30 days in the county jail. Some talk comes high.

The local exchange in Columbia, Mo., has moved into new quarters and installed a new and large switchboard. Manager Hudson has made preparations to handle several toll lines, which he contemplates building. A. B. M.

Telephone Competition in Chicago.

An ordinance was introduced into the Chicago City Council, on October 15th granting the United Telegraph, Telephone and Electric company the right to extend its territory so as to make it coextensive with the city limits. The corporation, which was formerly the Hyde Park District Telephone and Electric company, has more than 400 subscribers in and in the vicinity of Hyde Park. According to its president, W. T. Block, it has a capital of more than $1,000,000 and a plant worth nearly $200,000.

It is the intention of the company to increase its capitalization, establish lines in the heart of Chicago, Englewood, South Chicago and other suburbs in which the Chicago Telephone company operates, and compete with it. The company agrees to complete the downtown service for 2,000 subscribers in five years, under penalty of forfeiting all lines now owned, in case of failure. The company purposes to charge for residence telephones, $50 a year; for business telephones, $85 a year, and for public instruments, $125. It asks for a 25-year franchise and agrees to pay to the city three per cent. of the gross receipts the first five years, five per cent. for the next 10 years and seven per cent. for the remaining 10. The ordinance was given over to the committee on gas, oil and electric lights of the City Council.

The franchise that the company now has is a valuable one, being unlimited as to time, and no return is asked for the privileges it confers. It allows the company to install and operate overhead and conduit wires for telephone, telegraph, police and fire-alarm systems, and to conduct a messenger service. The territory included extends from Thirty-ninth street to the city limits on the south and is bounded by State street on the west. It has a population, it is estimated, of 250,000.

The company now owns, it says, 500 miles of telephone line in conduits and on poles. One line runs from Thirty-ninth street to Hammond, Ind. The patrons are demanding connections with the stock yards and the downtown districts, and to afford them this, as well as to compete for the city patronage, the new franchise is requested. Mr. Block, the president of the Hyde Park company, was one of the promoters of the Grant Locomotive Works, and was at one time secretary and treasurer of the Siemens & Halske Electric company of America.

Farmers' Telephone Construction Company of Wisconsin.

The Farmers' Telephone Construction company was recently incorporated, under Wisconsin laws, with a capital stock of $500,000. The company has been organized for the purpose of supplying farming communities with telephones at popular rates. By a recent legislative act in Wisconsin, townships and municipalities have the right to issue negotiable bonds for the purpose of purchasing, maintaining and operating their own telephone systems. The Farmers' Telephone Construction company purposes to work under this act and establish telephone systems in different townships throughout the state, connecting them by toll lines and with the exchanges and lines of the Wisconsin Telephone company.

The low rate of $12 a year will be charged each subscriber, it is asserted, and it is expected that the income in a township will be sufficient to maintain and keep in repairs the township exchange, to pay the interest on the bonds and to set aside annually five per cent. of the bonds, so that they can be funded in 20 years. The construction company will build the telephone systems and furnish the bonds. Party lines will be used, four subscribers being connected to each line. Long-distance instruments, manufactured by the Standard Telephone and Electric company of Madison, Wis., will be used. In the prospectus it is stated that the company expects to derive from the enterprise a reasonable percentage on the construction of these township plants, but states further that it has in mind "more particularly the construction and operation in connection with them of a system of toll lines that will in the near future rival and surpass the mileage of the Wisconsin Telephone company."

The headquarters of the company are in Milwaukee. The directors are the following-named gentlemen: F. G. Bigelow, president, First National Bank; Charles F. Pfister, capitalist; George N. Wiswell, president Milwaukee Mutual Life Insurance company; E. A. Wadhams, president Wadhams Oil and Grease company; Thomas H. Gill, attorney Wisconsin Central railway, all of Milwaukee; P. L. Spooner, president Standard Telephone and Electric company, Madison; E. E. Nangle of Naugle, Holcomb & Co., railway builders, Chicago. The advisory board consists of I. M. Bean, president N. W. Iron company; Charles Quarles, of Quarles, Spence & Quarles; H. M. Pillsbury, secretary-treasurer, Land, Log and Lumber company; E. G. Cowdery, manager Milwaukee Gas company, all of Milwaukee; L. S. Tainter, banker Menomonie, Wis. George N. Wiswell is president of the company, E. A. Wadhams is vice-president and Henry G. Goll is secretary-treasurer.

Five-cent Slot Telephones in Chicago.

The Chicago Telephone company is offering service in the North Office district on 10-party lines with nickel-in-the-slot attachments made to the telephones, whereby each call is paid for at the time service is rendered at a rate of five cents for each city connection. Residence users guarantee to the company earnings not less than five cents a day and business places guarantee 10 cents a day. A large number of orders have already been taken, and telephones are being installed rapidly upon this plan, which, while not interfering with other established service, provides telephones for small users at a very reasonable rate. More than 15,000 telephones of this class are in operation in the city of San Francisco, 5,500 in Cleveland and 4,000 in Milwaukee. This service has also been introduced in St. Paul, Minneapolis, Kansas City and other exchanges, and has been found popular for small users. In the general enlargement and extension of the city exchange plants the Chicago Telephone company has been preparing for the introduction of this, as well as all other classes of service, on a large scale. It is thought that the number of city telephones will now increase more rapidly than ever before.

COMMUNICATION.

Telephone Men Needed in Texas.

To the Editor of the Western Electrician:

There is a great need of competent electricians to visit the Independent telephone exchanges in this section and restore or repair their telephones and switchboards. All over this state there is defective apparatus, out of use, and which remains so for the want of repairs. Doubtless there are competent mechanics who would like to go south during the cold winter months and make good money if they only knew of the chance existing.

C. H. FISHER.

Granbury, Texas, October 17, 1900.

The Cumberland Telephone company, of which James E. Caldwell is general manager, has acquired control of the entire system of the East Tennessee Telephone company, and will expend a large amount in improvements in Chattanooga, Tenn. These include the erection of a large building, the installation of a new switchboard and a full and improved metallic service.

Important Franchise Decision in Ohio.

In the case of the city of Zanesville against the Zanesville Telegraph and Telephone company, the Supreme Court of Ohio has declared Section 3461 Revised Statutes of Ohio invalid. This section relates to the action that shall be taken by telephone companies in case they are refused a franchise by the city or village where they wish to construct a plant, and provides, in case of a refusal, that the probate judge of the county shall appoint a commission to locate places for the poles and lines, and that they may thus build without a franchise. This the Zanesville company had done, when injunction proceedings were brought and the case was carried to the Supreme Court for final decision. This tribunal has decided that such powers are legislative in their nature, and cannot be delegated to the probate judge. This decision, of course, defeats the plans of the Zanesville company and likewise the Marion Telephone company of Marion, which has been waiting patiently upon the decision in order to know what move to make next. Likely there are other companies which will be affected by it also, and in the future the officials of the towns and the companies will have to get together upon franchise matters as best they can. There is no other way to settle the disputes, unless they resort to the courts with cause.

It is said that this decision will affect the business of the Independent companies in Cincinnati more than in any of the other large cities of the state, and Senator Foraker was a caller at the rooms of the Supreme Court one day last week in the interests of some of the companies operating in the Queen City.

EXTENSIONS AND IMPROVEMENTS.

The Northern Illinois Telephone company, located at Sandwich, Ill., has certified to an increase of capital stock from $30,000 to $250,000.

The city of Woodlawn, Ala., has granted a franchise to the Southern Bell Telephone and Telegraph company for the construction of a system in that place.

The Allegan Telephone company intends to extend its line from Allegan, Mich., to Otsego. An extension is also planned to Gobleville, to connect with the Kibbie Telephone company, which is connected with almost every small town in Van Buren County. The Allegan company now has connection with the Citizens' company of Grand Rapids, Mich.

The Sparta (Mich.) Telephone company was reorganized on October 11th, with Charles H. Loomis as president, Bruce N. Keister as secretary and treasurer, and Dr. D. J. Wallace, J. Hisey and August Johnson forming the executive committee. The company will install a 100-drop switchboard, and affiliate with the Citizens' Telephone company of Grand Rapids.

MANUFACTURERS AND DEALERS.

Stanley A. Duvall, the well-known telephone engineer, is now associated with the Eureka Electric company, whose interests he will no doubt serve in an efficient manner.

The friends of S. W. Moon, one of the best-known pioneers in the telephone field, will undoubtedly be pleased to learn that he is now associated with the Stromberg-Carlson company as general manager of sales. The accession of Mr. Moon should prove a decided source of strength to the company with which he is now connected.

The Wil-kin Electric company of North Wilkesboro, N. C., has just been formed for building and operating telephone lines and dealing in general electrical supplies. The principal office of the company is in North Wilkesboro, with a branch office in Elkin, N. C. This company has bought out the Wilkesboro Telephone company and put in a number of new telephones in Wilkesboro and North Wilkesboro. It has also bought out the Elkin telephone exchange, and is now rebuilding it and putting in a new switchboard and many new instruments. A 20-mile double line, one wire for local and one for through business, is being built between North Wilkesboro and Elkin. H. W. Norton is manager of the company.

The Western Telephone Construction company of Chicago has just closed a contract with the Greensboro Telephone company of Greensboro, N. C., to furnish a complete telephone equipment, consisting of a 1,200-capacity, central-energy switchboard, distributing board and protective devices. A contract to equip the Creston (Iowa) Mutual Telephone company exchange with a Western express switchboard of 300 lines, and another for a 200-capacity Western express switchboard for the Sheridan Telephone company of Sheridan, Wyo., have been closed. The same company is also furnishing a 300-line addition to the Gordon Telephone company's exchange at Charleston, S. C., and is putting in a 600-line re-equipment for the Shamokin Valley Telephone company's exchange at Shamokin, Pa. The Western has also just completed installing a flash-light transfer system for the Home Telephone company at Fort Wayne, Ind., and, in addition, it has received a large telephone order from the Southwestern Telphone company of New Albany, Miss.

Comparisons of the Various Systems of Electrical Distribution for Street Railways.[1]

By C. F. Bancroft.

In preparing a paper on "Comparisons of the Various Systems of Electrical Distribution for Street Railways," the subject selected by the executive committee, I find that the conditions to be met in the numerous localities where the various systems are in use are so widely different, and each system so generally satisfactory, under certain conditions, and so completely unsatisfactory for meeting other conditions, that comparisons are altogether impossible, except in a very general way.

There are six systems of electrical distribution for street railways at present in more or less general use.

First, what may be called the standard 500-volt continuous-current system, where the current is generated at from 500 to 600 volts and delivered direct to the car motors, usually by means of a feed-wire and a trolley, third rail or underground conduit.

Second, what may be called the alternating-direct-current system, where the power is generated as alternating current, usually at high voltages of from 5,000 to 15,000 volts, and transmitted to sub-stations, where the voltage is usually reduced by means of static transformers, transformed into direct current by rotary converters, and delivered to the lines at about 500 volts continuous current.

Third, the "booster" system, where the current is generated usually at about 550 volts, and where by means of an auxiliary generator, usually series wound, called a "booster," additional voltage is generated and compensates for that lost on the line.

Fourth, the so-called three-wire system, where the current is generated at about 1,000 volts, usually by means of two 500-volt generators connected in series, and is delivered to two motors or two groups of motors in series.

Fifth, the alternating-current system, where the power is generated as alternating current, usually at high voltage, and transformed down to about 500 volts at the trolley wires by means of static transformers, which may be located on the poles supporting the feed-wire and trolleys, the cars being equipped with alternating-current motors.

Sixth, the storage-battery system, where the batteries are carried on the car and charged at the power house or at special points on the line. Storage batteries can also be used to advantage in connection with any of the above systems under certain conditions, and, in fact, combinations can be made of any or all of the above systems.

For any given conditions as to speed, traffic and length of line, some one of the above systems is likely to be much better fitted and more efficient than any of the others; therefore, it seems to me that a comparison of the various systems can best be made by considering the particular conditions most favorable to each. In the distribution of power for street railways the result to be aimed at is usually the maintenance, at variable loads, of an approximately constant pressure of 500 volts on the trolley wire at a minimum total cost for power.

The cost of generating electric power under the same conditions, as regards fuel, depends to a great extent on the amount of power generated and the capacity of the generating apparatus with reference to the average output required. Under ordinary operative conditions, with the same power factor, that is, the same ratio of output to capacity, the cost of power per kilowatt-hour from stations of less than 500-kilowatt capacity increases very rapidly as the station decreases in size. With from 500 to 1,500-kilowatt capacity, the cost of power per kilowatt-hour decreases slowly as the size of the station increases. From 1,500 to 2,500-kilowatt capacity, the cost per kilowatt-hour decreases very little as the output increases, and above 2,500-kilowatt station capacity the cost of power per kilowatt-hour becomes nearly uniform. This is due to the fact that in small plants the labor item is disproportionately large, and the general efficiency less than in larger ones, while in plants of 1,500-kilowatt output and larger the cost of labor remains proportionately nearly the same as the plant increases in size. It follows from this that there is often very little or nothing to be gained from an economical standpoint by substituting one station of 5,000-kilowatt capacity for two of 2,500-kilowatt capacity each, provided the local conditions, as regards cost of coal, water, etc., are the same.

The system of distribution most suitable to a particular road depends, to a great extent, on the location of the power station or stations, and the nature of the load. It is always expensive to transmit power, the expense being either in interest on copper investment or in fuel, or both; and, therefore, other things being equal, the location of the power station or stations should be as near the load or center of distribution as possible. The location of the station is, however, usually governed to a considerable extent by local conditions as regards cost of fuel, water and real estate.

On a large system, requiring an average output of 12,000 kilowatts, even though the load be distributed within a five-mile radius of a practical station location, it will usually be found economical to generate this power at several smaller stations rather than at one large station, provided the conditions as regard cost of fuel, water and real estate are about the same, as the cost of power-station buildings and machinery per kilowatt of capacity and the cost of generating power per kilowatt-hour, with a station of 5,000-kilowatt capacity are about the same as at a station of 10,000-kilowatt capacity. The interest on the saving in cost of feed-wire by having several stations, each located near its load, would more than offset the slight saving in cost per kilowatt-hour, due to the generation of power at one large station, and it also has the advantage that in case of fire or accident to one station the other can usually be so interconnected as to temporarily carry the entire load, and thereby avoid much of the stoppage of traffic which would occur if the road was supplied entirely from one station.

For an example of what was called the first or standard 500-volt, continuous-current system of distribution, a city may be cited in which the street-railway lines radiate west from the center of the city like the spokes of a half-wheel, with a radius of about five miles. Instead of having one large station at the hub of the wheel, the road is supplied with power from seven stations, distributed throughout the system, having an aggregate capacity of over 26,000 kilowatts.

The generating and distributing system in use in one of our most densely populated cities may be taken as an example of the way in which the system of distribution adopted is governed by conditions outside of those indicated for the most economical generation and distribution of power to the car motors. Although this system is compact and will probably require an average station output of over 30,000 kilowatts, which it would seem to the outside engineer could be more economically distributed and almost as economically generated at several stations, the street-railway company is installing a high-tension, alternating-direct-current system of distribution, with a main station of 45,000 kilowatts' ultimate capacity, and five rotary converter sub-stations of from 3,000 to 6,000 kilowatts' capacity each. It is probable in this case that the location of the power station and the system of distribution was governed almost entirely by the great cost of real estate at points suitable for separate power stations.

It frequently happens that several miles distant from a street-railway system much cheaper power is obtainable than at or near the center of the system. This may be due to an available waterpower, or to a difference in the cost of fuel, etc., at the two points. In cases of this kind, the second, or what may be called the alternating-direct-current system, is usually the most applicable. To transmit power at 500 volts in any quantity from a distance of 10 miles, or even less, is very expensive, owing to the large amount of copper required and the great loss. For instance, to deliver 500 amperes at 10 miles' distance will require about 150 tons of copper, allowing a loss of about 30 per cent. in the line. This same amount of power could be transmitted at 5,000 volts by an alternating-direct-current system with about five tons of copper and with a loss of less than 10 per cent. in the line.

The weight of copper required to transmit power a given distance, other things being equal, is inversely as the square of the voltage, that is to say, if it takes 100 pounds of copper to transmit a certain amount of power a given distance at 500 volts, it will only take 25 pounds of copper to transmit the same amount of power the same distance with the same loss at 1,000 volts. It is owing to this fact that the alternating-direct-current system is so applicable where the power has to be transmitted for any considerable distance, as it allows of the use of very high voltages on the line, 10,000 volts or more being in general use, which, by means of transformers and rotary converters, can be reduced to 500 volts direct current for the trolley wire at points where the power is required. For an example of this system of distribution, a street-railway system may be cited which derives its power from a waterfall. Here the power is generated at a pressure of 2,200 volts and is stepped up to 11,000 volts for the line. About 6,000 horsepower is transmitted at this voltage for a distance of about 21 miles. The voltage is then reduced to 500 volts, direct current, by means of static transformers and rotary converters at five sub-stations, located at or near the points where the power is required.

The third system mentioned, the "booster" system, is chiefly applicable on lines where there is a light average load, but where for short periods an extra heavy load has to be taken care of. It would seldom be economical to supply an entire road with power by means of a booster system, as the greater part of the power generated by the booster represents wasted energy, which is usually generated in an extravagant way, as the power required to drive the booster varies as the square of the current in the feeder, that is to say, if it requires 50 horsepower to drive the booster with a load of 100 amperes, it will require 200 horsepower to drive it if the load is increased to 200 amperes. Line losses which necessitate the continuous waste of more energy than could be compensated for by an ordinary compound-wound railway generator are seldom economical, even on a portion of a system, but there are many cases where there is sufficient copper installed to take care of the average load economically, but where for a short time each day, or for a few weeks in the year, owing to local conditions, the traffic is very unusually heavy.

In cases like the above, where the heavy traffic is of short duration, a well-designed booster system may save a large investment in copper at a total cost of much less than would be required to pay the interest on the copper investment. For an example of this method of distribution I might cite a street-railway company which supplies power to its own lines by means of a standard 500-volt, direct-current system, and which also supplies power to a smaller road about 13 miles distant, by means of a three-phase, alternating-current system, using 5,500 volts on the line. Here the booster system is used in connection with the high-tension system. When it became necessary to repair the high-tension line, it was found expensive and inconvenient to do the work between the hours of 12 midnight and 4 a. m., the only time when the power was off, and as it was not considered safe to work on the line when it was in operation, a booster system was arranged to supply power to the distant road for short periods at times of light load. A 200-kilowatt booster was installed at the generating station and was designed to raise the voltage one volt per ampere of current. Switches were installed at the sub-stations, so that the high-tension line could be connected directly with the 500-volt feeders, some eight miles from generating station, and the booster was arranged so that it could be readily connected to the high-tension feeders.

When it was necessary to replace broken insulators or make other repairs on the line, the attendants were notified at the generating station and at the sub-stations, and at a prearranged signal, made by varying the voltage on the line, the alternators were thrown out and the booster thrown on in such a way that the power was only off from the trolley wire for the fraction of a minute. It was thus found quite practicable to make repairs on the line while the booster was in operation, and the system proved very satisfactory for supplying power at times of light load, while repairs were being made, the load on the booster frequently running as high as 500 amperes, at which time the voltage generated by the booster was about 500, which, in addition to the 575 volts of the direct-current system, gave 1,075 volts at the generating end of the line, the voltage at the sub-station averaging about 450. While it would have been very expensive to run this booster for any great length of time, for the short time it was used the total cost was much less than the interest on the copper investment required to build a duplicate line.

The fourth system mentioned, or three-wire system, is most applicable to double-track lines, where one trolley is made positive and the other negative, there being about 1,000 volts' potential difference between the two, the current flowing from the positive trolley wire through the car motors to the rail and from the rail through the car motors and the other track to the negative trolley. The track is usually cross-bound and also connected to the conductor or connecting the two generators which are operated in series in the station. This connection with the track forms the third wire and tends to equalize the voltage should there be more cars on one side of the system than on the other. This method of distribution is usually capable of saving from 20 to 40 per cent. in copper, according to the character of the track return. If well balanced, it also greatly reduces the electrolytic action on buried conductors, such as water pipes, etc., and is most applicable where there are excessive track losses with fair opportunities for a balanced load.

There are few roads in this country using the three-wire system of distribution, although it is used almost universally by lighting companies. This is probably due to the complications introduced in railway systems by the high voltage, usually about 1,000 volts, between the trolley wire and feeders on different sides of the system and the difficulty of balancing the load. The saving in copper, while not as great as in the three-wire lighting system, is still enough to warrant the extra complication, and under favorable conditions may prove very valuable.

I am only familiar with one example of this system of distribution. In this case there is very heavy traffic over a double-track line to a park, about six miles from the power station. It was found impossible to handle the increased traffic on the ordinary 500-volt system with the existing feed-wire. By reinsulating the line and operating it on the three-wire system, the efficiency of the distributing system was very much improved, and they were enabled to easily handle the increased traffic with the existing feed-wire.

The fifth system mentioned, or the alternating-current system, is practically untried in this country. It seems peculiarly adapted to lines having long runs at uniform speed with few stops, such as lines connecting cities, rather than for ordinary street-railway service. The alternating-current motors at present in general use are of the polyphase type, and require at least three working conductors, which is a serious objection in many cases for railway work, as it necessitates the use of two trolley wires in addition to the track as conductors. The disadvantages of this system appear to be the necessity for at least two trolley wires and the probable difficulty in building alternating-current motors suitable for railway work which will have a good power factor.

The main advantage of the alternating-current

1. Paper read before the American Street Railway association at Kansas City, Mo., October 17, 1900. Mr. Bancroft is electrical engineer of the Massachusetts Electric Companies of Boston

system is the possibility of feeding lines with stationary transformers which need no supervision, but which can be considered simply as a part of the feeder, thereby multiplying many times the length of line which can economically be supplied with power from one station. The alternating-current motor also has the advantage of running at fairly constant speed independent of the load. It will not race going down hill if the power is left on, but will return power to the line, nor will it slow down much in going up hill. There are four or five railway companies using this system, and, judging from the reports that appear from time to time in the railway journals, it is giving very satisfactory results.

The sixth system referred to, or storage-battery system, is decidedly more expensive than the usual methods of electrical distribution, owing to the great first cost and the short life of the batteries. Lead is at present the only metal capable of resisting the attacks of sulphuric acid, and modern batteries consist largely of lead, which is very undesirable from a mechanical point of view and is very heavy, so that, unless the present type of storage battery is substantially improved, this system is only likely to be used where other systems are not practicable owing to peculiar local conditions or restrictions. The storage battery, however, has a large field in connection with the other systems of electrical distribution for street railways, and under favorable conditions may considerably increase the station capacity and reduce the fuel consumption, and when used on the line may greatly improve the regulation and increase the copper efficiency.

From this brief outline of the various systems it will be seen that each has its peculiar advantages, and that no one is suitable under all conditions. It will generally be found that where the traffic is heavy and the distance short, the standard 500-volt system is most applicable. For suburban work,

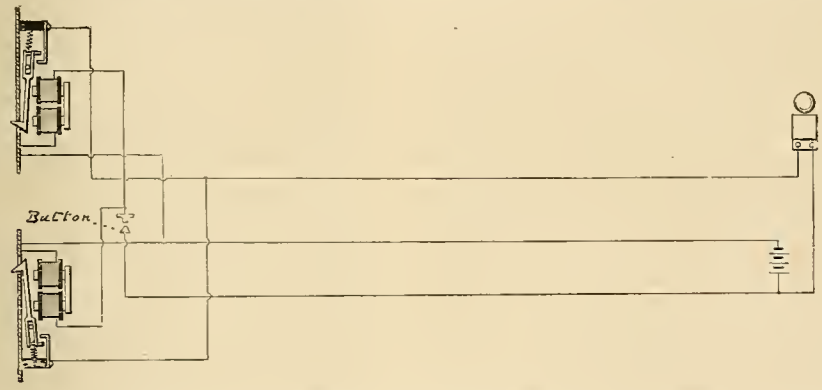


FIG. 3. CARLETON ELECTRIC LOCKING DEVICES.—ORDINARY CONNECTIONS.

where the distances are greater and the traffic less congested, or where it is necessary to transmit the power for some distance, the polyphase alternating-direct-current system will usually be found more economical. In special cases, where for short periods of time an unusually large amount of power is required, the "booster" system will often prove very valuable, while for high-speed, long-distance, interurban work the three-phase, alternating-current system may be attractive. The cars on this system, however, would have the great disadvantage of not being able to run over the ordinary direct-current street-railway lines.

There can be no general rule given that will determine the most advantagous system of distribution to use under the varying conditions to be met in street-railway work. Each case must be considered as a separate problem, and that method selected which will best meet the peculiar conditions involved.

Association of Electrical Meter Experts Proposed.

Robert Ferris of the Somerville Electric Light company, Somerville, Mass., and Ben W. Clark of the Edison Illuminating company of Detroit, Mich., are advocating the organization of an association of electrical meter experts. The general object of the association will be to advance the interests of the electric-light companies with which the members may be connected and also the further enlightenment and mutual benefit of the members. It is proposed that the association shall meet annually and discuss such papers and topics as may be brought before it.

The gentlemen interested in the organization of the association are meeting with encouragement, and they hope that the central-station managers will appreciate a movement of this kind and lend it their support. Central-station managers and meter experts in particular are invited to communicate with Mr. Clark at Detroit or Mr. Ferris at Somerville, so that steps may be taken for immediate organization.

At a special election held October 9th the people of Hempstead, L. I., voted to issue $100,000 in bonds for erecting an electric-light and waterworks plant.

Carleton Electric Locking Devices.

There have been many electric locks put upon the market, and some of them have been more or less successful. A new system of locks has recently been invented by Henry Guy Carleton of New York, which operates on a new principle and contains many unique features. The armature in the Carleton lock is not required to withdraw the bolt, or to hold a detent in locking position, or to do any considerable amount of work. The inventor has devised several forms of locks, some of which are illustrated herewith.

In Fig. 1 is shown the type A of lock (two-fifths actual size) that is designed for use in windows, sliding doors, showcases, tills, etc. It consists of a hook-shaped armature acting, when not retained by the magnet, so as to thrust the hooked end through a slot in the casing and engage with a recess in the window frame or sliding door, thus preventing its further motion. If an attempt is made to open it, the hook merely slides till its end comes against the side, when its further motion is impossible. At the same time a stud on the other end makes a sliding contact with a terminal attached to the insulating block and diverts the current to the alarm bell, giving warning that an attempt is being made to force the lock. When the window is closed, the striking plate, which protects the edges of the recess in the window frame, acts on the cam face of the hook end of the armature in such a way as to throw it back against the poles of the magnet. If now a current be passed through the coils, the magnet will hold the hook in a retracted position and the window may be raised to any desired point. The current then being broken, the spring is ready to throw the hook into locking position the moment an attempt is made to raise the window. By this means a window may be left open a few inches either at top or bottom and yet be securely locked. It may be closed without the application of current, but cannot be opened unless the button is pressed.

Another type of lock, type B, shown three-fourths actual size in Fig. 2, is provided with an armature bar of aluminum, securing great efficiency with little battery power. It is specially designed for showcases and for windows in places exposed to sea air. Type C, for sliding doors, is one-third larger than this lock. The diagram, Fig. 3, shows how each pair of locks is coupled to the push-button, battery and bell. In Fig. 4 are shown circuits for controlling locks from a central point. Additional locks are connected in multiple with the batteries and bell exactly as the pair shown in this cut. By the above arrangement it will be seen that throwing the switch shuts the lock circuit through the relay. Pressing the button then can only result in ringing the bell, as the locks cannot work with such a high resistance in the circuit.

Mr. Carleton claims for his type of lock that it will sound an alarm if attempt is made to force it, that it locks either sash in any position, that it affords ventilation, with perfect safety, and that it is entirely invisible. If the wires are cut the window remains locked. All windows may be controlled from a central point, and an ordinary house battery operates it. The system is simply installed and is said to secure an open window better than any lock secures a closed window.

The Carleton Electric company, which controls the patents and manufactures these devices for the market, is also putting out a type of lock in which an attempt to open by an improper key will sound an alarm. These locks are also designed to prevent their operation by the proper key except when so permitted by a distant controller. By the use of these circuit-controlled locks, it can be seen that all the locks in a building, or any portion of them, may be under such control that after certain hours even those persons who have the proper key will be unable to get access to whatever the lock protects. Another device manufactured by the same company is a time circuit controller, capable of operating a number of lock circuits at variable hours. It also provides for one, two or three holidays. An ingenious feature in this contrivance is that no spark can possibly occur between the contacts of the clock-operated controller. The Carleton Electric company will gladly furnish further information concerning its electric locking devices upon application.

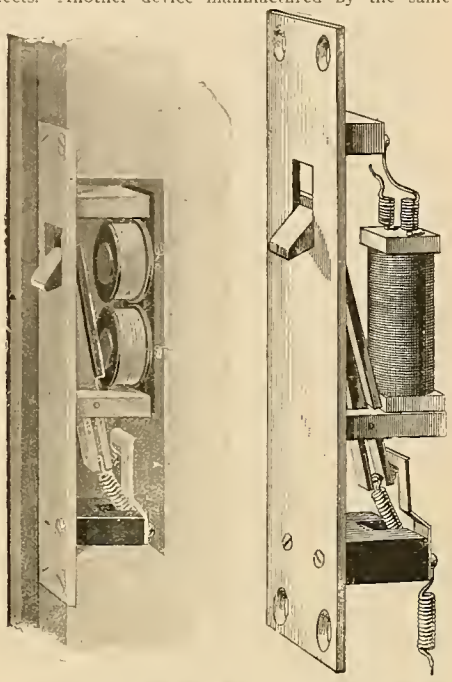


Fig. 1. Type A in Place with Mortising Cut Away. Fig. 2. Type B with Aluminum Armature Bar.

CARLETON ELECTRIC LOCKING DEVICES.

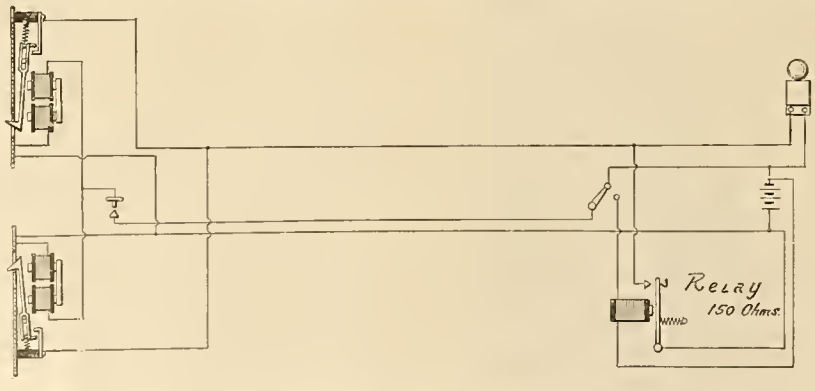


FIG 4. CARLETON ELECTRIC LOCKING DEVICES.—CONNECTIONS FOR CENTRAL CONTROL.

Improvement in Pollak-Virag System of Rapid Telegraphy.

It is announced that Messrs. Pollak and Virag, the inventors of the high-speed telegraph apparatus that was exhibited in this country a few months ago, have devised an important modification in their system. In the original apparatus the signals were received in the form of a wavy line, similar to that traced by the siphon recorder, on a slip of sensitized paper. According to the report, the modification comprises a device by means of which, instead of this record, messages can be actually printed on the photographic paper in ordinary round-hand Latin characters at the rate of 1,000 words a minute.

The Order of Railway Telegraphers has held an election at St. Louis to fill the vacancies caused by the removals made during the recent convention. M. M. Dolphin of Kansas City, formerly first vice-president, has been unanimously elected president, vice W. V. Powell, removed. T. M. Pierson, S. J. Kelly and F. G. Sinclair were elected first, second and third vice-presidents, respectfully. T. W. Baron and C. E. Layman were chosen directors.

Convention Notes.

[*Continued from page 269.*]

left the Mound City for a few days to mingle with the Kansas City throng. W. R. Kendall, from St. Louis, was also there. The Manville Covering company is the selling representative of the H. W. Johns Manufacturing company, which was represented by A. Hall Berry, manager of the electrical department, New York. D. T. Dickkson and J. W. Pay from Philadelphia, Joseph Sachs from New York and E. B. Hatch from the Johns-Pratt company, Hartford, Conn., were present. The H. W. Johns Manufacturing company had an interesting display of its overhead line material, Johns electric heaters and vulcabeston insulating pieces. Mr. Sachs, in able and interesting manner, demonstrated the action of the Sachs' No-arc fuse and car cut-outs. The Manville Covering company's steam-pipe and boiler covering was shown in different sizes, to meet all requirements.

The Standard Underground Cable company had on exhibition the four large handsome cabinets of samples which attracted such attention at the National Export Exposition at Philadelphia, and for which the company received medal and blue ribbon as being the most complete exhibition of its kind ever seen. There is shown in this display, it is said, everything that is made in the way of wires and cables, together with all the accessories and appurtenances that enter into the underground and overhead-construction work as installed by the Standard company. Being a pioneer in underground-cable work in America, this company's present methods are the result of years of experience and experiment. The Standard Underground Cable company is now turning out its product from two new factories, one at Oakland, Cal., and one at Perth Amboy, N. J. The Perth Amboy plant has an output even greater than the original plant at Pittsburg, Pa., which latter has been greatly overtaxed of late. J. R. Wiley of Chicago, western manager, was in attendance during convention week.

N. A. Christensen, F. C. Randall, G. S. Hastings, J. S. Leet, W. J. Richard, J. S. Hamlin, A. Beveridge and J. R. Sutton composed the staff of representatives of the Christensen Engineering company of Milwaukee, Wis., and it is needless to say that they were all kept busy. The exhibit of this company attracted more than ordinary attention, showing, as it did, in actual operation three Christensen compressed-air equipments, as if in regular service. No. 1 comprised the brake mechanism of a five-car train of heavy elevated cars and is a duplicate of the present equipment on 100 cars of the Boston elevated railway. Each car has complete air-brake equipment, and the entire train may be operated from each end of any car or broken into sections of one or more cars, when each car is equipped to take care of itself. No. 2 showed a school equipment of an independently operated motor air compressor, with brake equipment for single cars, straight air. No 3 showed a D4 portable equipment, with compressor and reservoirs, automatic controller, etc., mounted on a truck. This compressor also furnished air for operating a six-inch air hoist and a six-inch air jack.

Painting by Machinery.

The illustration shows a machine, manufactured by the Acorn Brass Works, Chicago, for spraying whitewash, calcimine and cold-water paint, on a large scale.

Machines of this type are used for spraying white-

PAINTING BY MACHINERY.

wash on power houses, warehouses, factories, courts, walls, fences and around coal mines. They have been in use for nearly 10 years. Since the introduction of cold-water paint they have been found valuable in spraying this preparation. The machine spreads the liquid evenly, and the whitewash or paint gets into crevices and corners and into places where a brush will not readily reach. As an insect and germ destroyer it is efficient. It is portable, easily handled, and can be readily mounted on a cart, wagon or handcar, or drawn about as it is.

The Acorn spraying machine is mounted on a wooden platform, two feet by four feet by two inches. It has a reinforced cast-iron frame, a solid, hard-brass cylinder, plunger, poppets, etc., and is provided with a galvanized-iron air chamber, with brass head and bottom, brass faucets and cut-off valve and wrought-iron handle. The equipment comprises supply hose, with metal strainer, discharge hose, spray attachment, high-pressure gauge, shut-off valve, three hard-metal spray cocks, and a special spray for cold-water paint, when desired.

The Acorn Brass Works are managed by young men and was incorporated two years ago. The factory is equipped to do work in various departments, such as iron-machining, tool making, brass finishing, metal spinning, tinsmithing, nickel-plating, brass casting, etc.

Consolidation of Street Railways and Its Effect Upon the Public.[1]

By Daniel B. Holmes

It is no part of the purpose of this paper to enter into an extended discussion of street-railway consolidations from a legal point of view. It is assumed that no considerable number of those present would be particularly interested in that branch of the subject. Suffice it to say that the laws of nearly, if not quite, all of the states of the Union are in such condition that practical street-railway consolidation may be brought about and made effective by union of companies as a technical consolidation, or by purchase and sale of the corporate property or capital stock, or by common ownership of the corporate shares of several companies, or in other ways which might be mentioned. Whatever consolidation is desired by the parties in interest, it may be safely assumed that counsel learned in the law will find little or no difficulty in pointing out the way in which that end may be legally accomplished.

Street-railway companies may be properly classified as public-service corporations, and whenever a union takes place of several such companies, it at once becomes obvious that the interests of the capital invested and of the traveling public may, and probably will, be positively affected thereby. Therefore, these two interests will form the chief basis of what I have thought proper to lay before this convention of practical street-railway men, whose calling is such that they never feel at liberty to disregard either the best interests of their stockholders or the welfare of the dear public, whose constant servants they are. And I may be permitted to add, in the light of an experience and intimate association with street-railway managers extending over a period of upward of 20 years, that no class of men with whom I have come in contact, in the active practice of a profession which brings about the most intimate relations with all sorts of men, are so constantly mindful of the best interests of the public they serve by night and by day as the street-railway men. I am the more pleased to make this acknowledgment because the street-railway man has so many impatient masters among the traveling public that he is much more often the subject of unjust criticism than of the well-deserved encomiums he would surely receive if the difficulties of his situation and his conscientious efforts to faithfully discharge his company's duty to the public were even half-way understood. Above all men, it is his lot to bear the "whips and scorns of time," and if he will but pin his faith to the teachings of the good book, he may expect to receive hereafter that reward which, in but few cases, I am sorry to say, comes in this life in the shape of an adequate salary for so hard and thankless a job.

That the consolidation of street-railway interests affords opportunities for the introduction of many various economics is a truth which is almost axiomatic, and this may be fairly said to have been the controlling consideration which has inspired and accomplished the many consolidations which have taken place in various parts of the country. By this process the managerial force is greatly reduced and the salary list largely diminished. Where three or four presidents, managers or superintendents were required for the successful management of the separate properties, but one officer of each kind is needed in their united state, and while he receives more salary than any one of his predecessors, as of right he ought, because of enlarged duties and more weighty responsibilities, still there is substantial saving over what was previously paid.

But there is in this connection a still more important consideration. As is the case with any other calling in life, the supply of really first-class street-railway managers is more or less limited, and the larger salary offered by the consolidated interests naturally commands, and in all probability secures, a higher order of talent than the separate properties could retain, even where it had been fortunately possessed. In this way the consolidated properties in nearly every instance are managed with greater ability than was shown by the management of the disconnected parts, and this is a positive gain, the value and importance of which can scarcely be estimated. This successful manager, you may be sure, is truly a remarkable man. The relations existing between street-car companies, on the one hand, and the municipality or its citizens, on the other, are the fruitful source of jealousies and complications constantly arising which can be successfully disposed of by nothing short of the possession of genius for diplomacy, and for affairs and finance all at the same time, in order to be able to satisfy the demands of the public without involving the company in irretrievable financial ruin.

In most instances, the consolidation of street-railway properties creates opportunities for marked reduction in the cost of generating motive power. Location is a most important consideration as regards the power station. Unless the power station is so situated that both fuel and water can be delivered to it at minimum cost, the highest degree of economy in developing motive power is altogether impossible. This is greatly facilitated by the union of properties, since the car lines are so situated in most cities that but few of them, if independent, could operate from power stations located near steam-railroad switches and water courses. A greater or less number of high-priced employes are always necessary around every power station, whether large or small, and this is an expense which is greatly curtailed by generating as much power as it is practicable to handle from one station. A company possessed of an extensive system, with large mileage, has thus presented to it the opportunity of producing power at the minimum cost—a thing altogether impossible on a short-line railroad.

But perhaps the most important result from consolidating street-railway lines is the great stimulus it affords to street-railway traffic. Outside of a few of the very large cities where the problem is not how to get business but how to successfully handle that business which, of necessity, must come to the car lines, the street-railway companies are quite generally engaged in efforts of all kinds to create travel on the lines artificially by offering to the public attractions of various and sundry kinds. This is all well enough, but one of the most effective means to this end is the consolidation of the street-car lines. I believe it is the uniform experience that the aggregate travel on the united lines exceeds by a large percentage the business formerly done by the separate properties. This is partially accounted for by the fact that short distances are now ridden which were formerly walked because two fares were then necessary in order to ride, and this was considered too great an outlay for the accommodation afforded.

But how stands the case with the public? I am altogether sure it is no different. Indeed, the immediate benefit to those who ride upon the cars far exceeds the increased returns to the consolidated company. Where, before the union, two and even three fares in some instances had to be paid in order to convey the passenger to his destination, he may now make the same journey for a single fare by means of transfers and through cars which were previously impossible. Take Kansas City as an example. Fifty per cent. of all the passengers who ride on the cars make at least one transfer in every journey, so that it may be truly said that 60,000 passengers save five cents each and every day in the year in Kansas City alone, and this saving is due solely and directly to the consolidation which took place only a few years ago. And who are the people thus benefited? It is chiefly the laboring classes who can least afford to spend their hard-earned gains unnecessarily. The sons of toil who were formerly compelled to shelter their wives and rear their children in the polluted air and noise and smoke, because unable to pay more than a single fare in going to and from their avocations, can and do now dwell in the neat little cottages in the suburbs, where loved ones breathe the pure air of heaven and bask in the sunshine of life all the day long, and when eventide comes smiles and mirth and joy are the companions who have taken the place of sickness, suffering and grief. Who can estimate the value of blessings like these? If the public welfare is the first and highest duty of the state, who can gainsay the immense value to the public of street-railway consolidations, and who can say that the state ought to throw any obstacles in their way?

But it is said that competition is the life of trade and that monopolies are odious. Accepting these as general truths, let us see how it is with the street railroads. Except to a very limited and unimportant degree, there is no such thing as competition in street railroads, and their consolidation is entirely devoid of any objectionable feature of a monopoly. In the very nature of things, street railroads are seldom competitors in business. They were never known to compete in rates, and can only be laid on such public highways as the authorities may determine. The necessity for keeping some streets open for ordinary vehicle traffic keeps the street railroads sufficiently far apart as a rule as to eliminate any matter of choice on the part of the intending passenger. Each line supplies and accommodates its own peculiar territory, and there is no real choice, and hence no real competition. As to rates, these are universally fixed by the franchise ordinances. They are the same on all roads, so that the intending passenger is moved in his choice solely by considerations of convenience to himself. In short, he simply takes the line which carries him to his destination with the least inconvenience. Monopolies are only odious when of a character that they do or have the power to fix their own price for what they alone can sell. Not so with the consolidated street railway. So far from having the power to increase the cost of travel, consolidation always results in a practical reduction of cost, by giving to the passenger the right to ride for the same single fare the increased distance brought about by the consolida-

1. Paper read before the American Street Railway association at Kansas City, October 16, 1900. Mr. Holmes is general counsel for the Metropolitan Street Railway company of Kansas City.

tion. No thoughtful man would condemn a street-railway consolidation, because it neither stifles competition, nor increases cost of travel, nor creates a monopoly, as that term is generally understood.

There can be no doubt that consolidations of this character are greatly beneficial both to invested capital and to the public at large. And, happily, this is so, because the public is never so likely to have its wants provided for as when it is to the interest of capital to do so. There is no tie so strong as common and mutual interest. This is a principle which would render many conflicts and controversies impossible if kept always in mind and strictly adhered to in all dealings between public-service corporations and the municipality in which they dwell. I commend it to the thoughtful consideration of all who are assembled in this convention, as the firm foundation on which aggregations of capital may safely rest, the Gibraltar of justice and right, garrisoned by an always sound and healthy public sentiment, against which the assaults of prejudice, passion and demagogy would be hurled in vain.

CORRESPONDENCE.

London Letter.

London, October 9.—The cars for the Devonport electric tramways, whose system is expected to be open for traffic before the close of the year, arrived from Philadelphia last week. Before being dispatched from the United States the trucks and body parts were packed in big cases for the long trip and the parts will be put together at the depot. The cars, which arrived in perfect condition, have been built by the J. G. Brill company of Philadelphia, and, with the trucks, are specially built for easy traveling. They are also fitted with the latest improved electric motors, brakes and equipment and supplied with the latest appliances. Twenty cars have so far arrived and more are expected shortly. They are of the double-deck type, this class having been adopted at the request of the Town Council, and will present a decidedly handsome appearance.

The advocates of municipal trading are calling attention to the accounts for the half-year's trading of the Leicester corporation in respect to its gas, electric-light and water departments. Leicester, with a population of 187,000, manufactures woolens very extensively. With regard to the gas undertaking, there was a gross profit of $203,585 for the half year. The profits of the electric-lighting department were, after paying interest, $7,150, and the water undertaking showed a profit of $44,615. Altogether, the three undertakings, after paying interest on capital, have added $47,085 to the sinking fund for the redemption of capital and $129,945 to be handed over to the ratepayers as the result of the half-year's operations.

That the time is not distant when electric heaters will come into general use in this country, may be gathered from an article in Chamber's Journal by Mr. A. T. Stewart, who says: "The electric oven roasts and bakes to perfection, and it also possesses many advantages, which, prior to the introduction of electric heating, were considered impossible. The greatest of these is that the food is cooked in a pure atmosphere, with no smoke, smell or dust, thus doing away with a flue. The heat can be regulated to any degree and distributed throughout every part of the oven as desired by merely turning on switches. In about 20 minutes the oven can be heated to a temperature of over 400 degrees Fahrenheit with all switches on. The amount of electricity required to heat it in the first instance may be twice as much as gas or coal, yet the cost in maintaining the heat is only half."

The British Automobile Club is making arrangements for a series of trials of electrical vehicles. The trials will comprise (1) a run over a given course for an unlimited distance on one charge, the driver to declare to the observer when the run is to be considered as finished; (2) a course of 30 miles, to include considerable gradients; (3) a course of 30 miles of average road; (4) a course of 30 miles of flat or nearly flat road. The cars will remain throughout the trials under the supervision of the club judges, and the energy consumed, number of passengers carried, average speed, etc., will be recorded on the certificates. The judges' committee will meet shortly to determine the courses and to consider a suggestion that the trials should be extended to include prolonged battery tests.

A few weeks ago I referred to the recently established pneumatic tool works at Chippenham, near Bristol. It appears that the International Pneumatic Tool company, Limited, objects to being called an American company, for everything associated with the enterprise—capital, machinery and workmen—is, as it states, purely British. It is a fact, however, that the company was organized professedly by the president of the Standard Pneumatic Tool company of Chicago to make in England "a full line of the pneumatic tools and appliances made by the Sandard Pneumatic Tool company" of that city, and that, moreover, the English company cannot sell its products in the United States.

Next to the election, the subject that interests Londoners is the extent to which their streets are torn up just now. The work of laying the telephone cables, which have to run under the main thoroughfares, was begun with the "silly season," when the largest number of people were away from London and when street traffic was least heavy. The work has, in parts like Cheapside and Fleet street, been carried on day and night, but it is feared that the leading streets—taking them generally—will not have resumed their usual appearance before Christmas. It is some consolation to know, however, that the confusion, for once, is not entirely due to the incompetence and want of foresight of the local authorities.

Now that the English vendors have let the parliamentary rights for the construction of the underground railway from Charing Cross to Hampstead pass from their hands, London capitalists are waking up to the opportunity they have lost. The statistics of travel on the Central London railway stimulated the tardy investors quite as much as Mr. Yerkes' serene confidence in the great prospects of his line. Two of London's leading banking houses have offered to buy back the charter. Mr. Yerkes agreed to sell, but stated a sum that staggered the would-be purchasers, who have dropped the subject. Mr. Yerkes' tube is to be a model for the world. English engineers and American equipment form a combination that is bound to produce great results. And it is hoped that the new tube will be such a benefit to the districts connected that the rights for a general extension will be readily granted. Mr. Yerkes has no intention of buying up the street railways of St. Petersburg, as he considers that London offers a sufficient field for his operations. W. H. B.

New York Notes.

New York, October 20.—Deputy inspectors in the city have reported to State Factory Inspector Williams that Degnon & McLean, sub-contractors for sections 1 and 2 of the rapid-transit tunnel, are employing alien labor. Notices have been sent to the contractors and to the Rapid Transit Commission, calling attention to the violation of section 13 of the labor law. The building-trades section of the Central Federated Union has decided to petition the Rapid Transit Commission to insist that the prevailing rate of wages be paid for work done on the tunnel and that only citizens be employed.

Work has begun on the Morris Heights branch of the Union Railway company. This line will be a great boon to residents of Morris Heights, who have been obliged to depend on the New York Central and Hudson River trains to reach the lower part of the city. The road will be really an extension of the Burnside avenue branch, which runs from West Farms, across One-hundred-and-seventy-seventh street, and Burnside avenue to Jerome avenue. It will begin at Jerome avenue and continue west through Burnside avenue to the Morris Heights station of the New York Central and Hudson River railroad.

Frank R. Ford of Yonkers was overcome by the gas of his automobile the other day, while attempting to repair the gasoline motor. Mr. Ford, who is blind, did not notice that gas was escaping from one of the unlighted jets, and as the barn where he was working was tightly closed, he was overcome and rendered unconscious. He was found by members of his family and resuscitated, after much difficulty.

Since March 21st, when the first spadeful of earth was turned on the rapid-transit tunnel, 90,000 cubic yards of earth have been removed, out of the total 1,700,228 cubic yards. Contractor John B. McDonald has obtained so far from the Rapid Transit Commission $165,000 out of the $35,000,000 which it has been estimated the work will cost. The first station to be built on the road will be at Columbus Circle. Steel for this section is under "rush orders," and it is thought the station will be completed before Christmas. Lack of steel work has been the chief cause of delay in the work on the tunnel, although for some of the sections there has been difficulty in obtaining the necessary timber.

Charges have been brought against the engineer of the New York and Staten Island Electric company, at Livingston, S. I., to the effect that the noisy machinery at the power plant constitutes a nuisance which prevents the residents of Bard and Davis avenues from obtaining sleep. The Department of Health has procured the arrest of the engineer, who is held under $500 bail.

President Vreeland of the Metropolitan Street Railway company says that it is the intention of the company as soon as spring opens to begin work on the Kingsbridge franchise, and that the road ought to be in operation during the coming summer. The reason why the road itself has not been built is that at present there is no power to operate it. There will be no power available until next summer, when the full equipment on the Metropolitan electrical stations will be installed. M. L. G.

From the Buckeye State.

Columbus, Ohio, October 20.—Dayton capitalists are planning a new road to connect Circleville with Columbus, and maps and surveys have been furnished them by the surveyor of Pickaway County showing the country east of the Scioto River. It is believed the plan contemplates a line to parallel the Norfolk and Western railway for that distance, while it may be extended on through to the Ohio River, along the same road. J. H. Wilson of Chicago, who is interested in a proposed line from Washington Court House to Columbus, and who made an attempt last week to purchase the franchise of the Chillicothe, Mount Sterling and Columbus Railway company, is at the head of this movement also. He was in Circleville last week, looking over the ground, and he made the assertion that the road will certainly be built, as he considers the route one of the best in the southern portion of the state.

One of the best sections of Ohio for electric-railway men to look after at the present time is Meigs, Gallia and Lawrence counties, along the Ohio River, and Jackson and some other counties bordering on the first-named counties. There are few railroad accommodations in that section, and, although the country is rough, there is a great deal of business, and routes can be found that will not be extraordinarily expensive. It is the belief of the writer that a road in that section, with branches in various directions, can be put on a better paying basis than many of the lines in the level sections of the state. Not only will a road there secure a good passenger business, but much freight can be hauled without competition with the steam railroads. A line would therefore not have the railroad companies to fight in the passenger business because of interfering with freight.

It is reported that the Hocking Valley Railway company has purchased the controlling interest in the electric line now being built from Pomeroy up the Ohio River. If this is true, the new line will give this road an extension up the river from its present terminus, the same as it has from Jackson to Wellston. This latter line has been operated very successfully by the Hocking Valley company for several years, but only in the passenger business. For freight it runs its regular trains over the line.

An Elyria paper had a little sketch of the history of the Cleveland, Elyria and Western road in a recent issue. It says that the system had its start in a little line built at Berea 25 years ago, to carry passengers from the town to the depot, making a trip every time a train arrived. A big bell was used to warn the people of the time when the car would depart from town. The little road made money, and the Pomeroys decided to go into the business on a more extensive scale. The result was a line from Berea to Cleveland, under the name of the Cleveland and Berea line. Since then the road has grown, until it now has a trackage of 65 miles. The old bell is now used at Puritas, where a new branch is just being completed, and General Manager Pomeroy states that he would not attempt to do business without it. In other words, it is his mascot.

The Southern Ohio Traction company announces that it will soon begin the operation of through cars from College Hill, Cincinnati, to Dayton, a distance of 51 miles. It is claimed that this will be the longest continuous route in the state. Manager F. J. J. Sloat has left for California, and Auditor W. N. Bicknell will be acting general manager during his absence.

The decennial board of equalization has notified the Columbus Railway company that it has been decided to list the trackage for taxation at $10,000 a mile. As the company owns 76 miles, this will make the total valuation $760,000. The personal property was listed at $1,250,000 some time ago. O. M. C.

Southern Developments.

Charlotte, N. C., October 19.—Work will soon be started on the new electric-light plant at Tallahassee, Fla. The contract was awarded to Moore & McReady of Atlanta a year ago, but a bill was filed by a rival company, praying for a restraining injunction, which was refused. The matter went to the Supreme Court, and the lower court was sustained, with the result that the work will be pushed forward.

A special committee has been appointed by the Town Council, Oxford, N. C., on ways and means and to hear proposals for the establishing of an electric-light and waterworks plant in that town.

At Huntsville, Ala., local capital is agitating the question of an electric railway to Whitesburg, 10 miles distant.

The Birmingham (Ala.) Railway and Electric company has stopped work on its new line to Owenton, on account of the scarcity of cross-ties. Work will be abandoned until the present lack is supplied.

The Roanoke Navigation and Waterpower company will build an immense plant to furnish electrical power for Roanoke Rapids, N. C., and for a number of cotton mills. Morton, Reid & Co. have the contract. The city of Weldon, five miles distant, may also be supplied with light.

The Berkley Street Railway company, Berkley, Va., has nearly completed its line to Money Point, several miles distant.

James Hubbard of Atlanta, Ga., has brought suit for $5,000 against the Atlanta Railway and Power company for alleged damages, the plaintiff alleging that he was forced by a conductor from a moving car and was injured.

It is stated that the Southside Railway and Development company of Petersburg, Va., will recommend at the next meeting of the stockholders for an appropriation of between $100,000 and $150,000 for extending the electric line and establishing a park.

At Atlanta, Ga., H. M. Patty, representing the bondholders, has purchased the old Lakewood electric street railway for $5,000, the minimum sum authorized. The Atlanta Railway and Power company will build a new line to Lakewood. The old line cost about $30,000. D. H. L.

PERSONAL.

Mr. Wyndham J. Davies, chief inspector and superintendent of mails of the Postal and Telegraph Department of Sydney, N. S. W., is now in this country on a tour of inspection of the mail and telegraph service.

George O. Perkins, formerly manager of the United Press in Chicago and for the last three years manager of the Postal Telegraph company's office in El Paso, Texas, has been appointed superintendent of telegraphs of the Mexican Central railway, with headquarters at the City of Mexico.

Ivan M. Johanson has accepted a position as superintendent with the General Incandescent Lamp company at Cleveland, Ohio. Mr. Johanson has been connected with the Columbia Incandescent Lamp company of St. Louis, the De Lavals-Glodlamp Fabrik Swea of Stockholm, and the Beacon Lamp company of New Brunswick, N. J.

Jan Szczepanik of Austria, known as the inventor of the "telectroscope" and a process of photographing patterns on textile fabrics, has been conscripted for three years' service in the Austrian army, despite all efforts to prevent it. Szczepanik, is a native of Poland, and had worked his way through the University of Cracow. When he gave up a teacher's position he became liable for military service.

ELECTRIC LIGHTING.

E. F. Thomas has secured a franchise for installing an electric-light plant at Mount Morris, Ill.

F. D. Hagar and J. F. Small of St. Louis, Mo., are organizing a stock company to build waterworks, an electric-light plant, etc., for Arkansas City, Ark.

The Montgomery (N. Y.) Power company has been incorporated, with $100,000 capital stock, by W. K. Archibald, P. T. Brady, R. E. Drake of Syracuse, W. B. Dunlap, W. B. Charles of Amsterdam, and others. The company will furnish electricity for light, heat and power, for Amsterdam, Johnstown, Gloversville, Florida, Glen, Mohawk, Galway, Keith and other towns.

City Electrician Weissleder of Cincinnati has recommended that the Edison company of that city be compelled to place its poles along Reading road on private property, instead of on the street; that no wires be allowed to run through trees; that special insulation be used, and that the permit be held up until samples of the wire are submitted to the Board of Public Service. He says the application is not in conformity with the ordinance, in that the exact location of the poles is not specified.

ELECTRIC RAILWAYS.

The Union Traction company of Indianapolis, Ind., has filed articles increasing its capital stock from $4,000,000 to $5,000,000.

According to a statement from President Isaac Stephenson of the Escanaba and Lake Superior Railway company of Wisconsin, that road is to be operated by electricity within a year or two. The waterpower of the Escanaba River will be utilized. The line will be completed to Channing in about four weeks.

Citizens of Oklahoma and Indian Territory have filed an application with the secretary of the territory, and a charter has been issued for the Sulphur Springs Electric Railway company. Headquarters will be in Oklahoma City, with branch offices at South McAlester and other points. The road will cost $250,000, and will be 24 miles in length.

An unusual accident occurred on the trolley line between Evanston and Chicago on October 21st, when a trailer collided with its motor car. The coupling pin became dislodged in some unexplained manner, and the trailer was 300 feet behind the motor car before the break was discovered. A passenger pulled the bell cord and the motor car was brought to a sudden stop, and the next moment the trailer crashed into its rear platform. Five persons were severely injured, and many others trampled upon in their efforts to escape.

AUTOMOBILES.

One of the novel features of the Merchants and Manufacturers' Exposition, in progress at the Mechanics' building in Boston last week, was a parade of automobiles, some 200 in number, including pleasure carriages, business wagons, ambulances, fire engines and various other horseless vehicles, through the principal thoroughfares. The management of the exposition and a number of city officials were among the people who rode in the carriages, and a band in an automobile tally-ho headed the procession.

TELEGRAPH.

The Order of Railway Telegraphers, which has been in council in St. Louis for 10 days, has adjourned, to meet in San Francisco, the second Monday of October, 1901. The work of revision of the constitution was completed.

While a detachment of 20 men of the Twenty-fourth Regiment were engaged in repairing telegraph wires on October 10th, near San Jose, Isle de Luzon, a party of 200 rebels attacked and scattered them. Seven of the Americans reached San Jose, but it is thought that the remainder were captured.

A fire started on the fourteenth floor of the Postal Telegraph building in New York, on the night of October 16th, which threatened for a time to destroy the company's switchboard there and tie up the system. Fortunately, the dynamo current was shut off before any water reached the wires, and as the fire above was shortly extinguished, little damage to the lines was wfought. The chief damage was to the Hardware Club rooms in the building, and is estimated at $20,000. Telegraphic service to Chicago was suspended for about two hours.

PUBLICATIONS.

An artistic blotter, sent out by John H. Fowler, of 1705 Fisher building, Chicago, shows in photographic reproduction a train of double cars, carrying a large number of long cedar poles, shipped by Mr. Fowler. The scene is easily recognized as on the Chicago lake front.

An attractive catalogue of belting and rubber goods has just been issued by J. E. Rhoades & Sons of Philadelphia. It is illustrated with views of the factory and special machinery for producing every variety of leather and rubber belting. Twisted belting, rawhide rope, car straps, are also catalogued, as well as a large assortment of rubber hose, packing, coupling, etc., for which the firm is agent. The book is a most complete one in its line.

The Illinois Maintenance company, 1625 Marquette building, Chicago, of which Edwin H. Cheney is manager, has issued a very neat price-list (No. 42) of the apparatus which the company offers for sale. Included in the list are direct and alternating-current generators, arc dynamos, motors, water-tube and tubular boilers, simple, compound and Corliss steam engines, gas engines, pumps, heaters, switchboards, transformers, storage batteries, spare armatures, wattmeters, etc.

The Couch & Seeley company, manufacturer of switchboards, telephones and telephone appliances, of Boston, has issued a 48-page catalogue of its apparatus, for Independent telephone exchanges and the electrical trade. The firm has grown rapidly since its establishment, in 1893, and its aim throughout has been to produce as high a grade of telephone equipment as any on the market. Features of this catalogue are the desk sets and portable telephone sets, made by the company, and its combined telephone and switchboard. The firm supplies the Warner generator and Warner pole-changer.

SOCIETIES AND SCHOOLS.

The enrollment of the School of Science of Purdue University this year is 40 per cent. over that of last. In the special technical courses, both in chemistry and biology, the number of students is larger than ever before in the history of the university. The chemical force has been increased by the addition of Dr. J. H. Ransom, formerly of the Chicago Manual Training School.

The attendance in the Engineering College of the University of Illinois is the largest in the history of the university. The entering class numbers 213, as compared with 125 last year. The three upper classes are larger than in any previous year and the attendance in the Engineering College will doubless exceed that of last year by 100 per cent. The electrical-engineering department now has 93 students, a gain of 30 per cent. over last year.

At New York University a chief mechanic has been appointed for the new workshops in mechanical and marine engineering at University Heights. The shops include machine, carpentering and pattern-making departments, and a blacksmith shop. Floor room is assigned in the old physical building for laying out the frames of ships. Professor Carl C. Thomas, an engineer in the Maryland Steel Works of Baltimore, has accepted the professorship of marine engineering. The Carnegie laboratory has been greatly improved during the summer.

The Roentgen Society of the United States has issued a preliminary announcement for its first regular meeting, which is to be held in New York city at the Academy of Medicine, 17 West Forty-third street, on December 13th and 14th. The announcement is in the shape of a folder and, besides the constitution and list of officers of the society, contains useful information for those interested in the association and its forthcoming meeting. Dr. Heber Robarts of St. Louis is president of the society, while Dr. J. Rudis-Jicinsky of Cedar Rapids, Iowa, is secretary and treasurer.

MISCELLANEOUS.

The coroner of Toledo, Ohio, has rendered his verdict in the case of Herring, who was killed by coming in contact with an electric-lamp cord on September 12th. He concludes that it is the duty of every municipality to provide for a rigorous inspection wherever electricity is used in any form, and recommends the passage of an ordinance creating the office of city electrician of Toledo, to define the duties of such office, and to establish rules and regulation concerning electrical wiring and appliances.

In Chicago last week two boys met with an unusual accident. The youngsters had been playing with a wire cable which was being strung across the telegraph poles, and when the slack of the cable was suddenly drawn up, found themselves clinging to the rope and 25 feet in the air. Before the team of horses which was drawing up the cable, some distance away, could be turned back, the boys lost their hold and fell, one being caught by a policeman as he dropped. The other boy received probably fatal injuries.

A young man by the name of Charles Harrder recently set on foot in Belleville, Ill., an enterprise to raise flowers by electricity. He convinced many of the merchants that he was sincere, and carloads of lumber was hauled to build his modern greenhouse where flowers were to be raised on short notice at a great profit. Last week, owing to his delay in settling bills, the creditors became suspicious, and the material was hauled away by the owners. The lumber merchant who furnished the material has the incomplete hothouse on his hands, and the police are trying to locate Harrder.

TRADE NEWS.

The Electro-chemical Reduction company of East St. Louis, Ill., was incorporated on October 13th, with a capital stock of $2,500. The incorporators are James W. Gammann, Edward L. Anderson and Joseph E. Chambers.

The Economy Electric company of Warren, Ohio, recently incorporated, is licensed to manufacture porcelain-clay insulators, dynamos, motors, fan motors, incandescent lamps, meters, supplies, transformers, telephones and electrical machinery.

The instruments for the electrical clock system invented by A. French Poole of Washington, Pa., are to be manufactured on a large scale. The plant will be located at Wheeling, W. Va. A corporation has been organized, to be known as the Poole Clock company, with a capital stock of $25,000.

The United States Treasury Department at Washington calls for sealed proposals, to be received until November 24th, for the installation of a wiring system for the United States custom house at Portland, Ore. Copies of the drawings and specification may be obtained at the office of the supervising architect at Washington, or at the office of the superintendent of construction at Portland, Ore.

Sealed proposals will be received at the office of the supervising architect, at Washington, until 2 p. m., on October 30th, for the installation of a switchboard for the United States immigrant station, Ellis Island, N. Y. Bids must be in accordance with the drawing and specification, copies of which may be obtained at the architect's office, or at the office of the superintendent of construction at Ellis Island, New York harbor.

Harvey M. Dickson, general manager of the Blue Ridge Locust Pin company, Asheville, N. C., was in Chicago recently. Mr. Dickson visited Chicago in the interests of his company, and states that the demand for pins and brackets was never as great as it is at present. The Blue Ridge company manufactures a line of locust and insulated pins and brackets which is said to have met the approval of many users all over the United States.

M. B. Austin & Co., 56 West Van Buren street, Chicago, have recently been appointed western representatives of the Chase-Shawmut company of Boston. They will handle the latter company's fuse wire, fuse links, enclosed fuses and knife switches, besides continuing to represent the Chase-Shawmut company in its line of conduit fittings, including Chase nipples and boxes. With a complete and varied stock of all these goods, the company feels that it will be well able to supply its western trade promptly.

The Gardner Electric Drill and Machinery company, recently organized in Denver, Colo., with a capital stock of $1,000,000, is about to purchase a site for its factory. It is expected that the company will employ over 100 men. A small plant is now being operated at Eighteenth and Blake streets, but larger quarters must be found immediately. The chief patents owned and controlled by the Gardner company are for the Gardner electric drill and an electric hammer. John McDonough is president of the company and William Gelder and A. J. Clark secretary and treasurer, respectively.

The friends of Charles T. Jaeger, recently with the American Miniature and Decorative Lamp company, New York, and formerly with the American Endoscopic company, Providence, R. I., will be interested to learn that he has entered into business for himself, under the name of the Jaeger Miniature Lamp Manufacturing company, with headquarters in Bible House, Eighth street and Fourth avenue, New York. The company will manufacture a full line of miniature incandescent electric lamps, including series, surgical, candelabra and telephone-signal lamps. With a man as experienced as Mr. Jaeger at the helm, there is little doubt of the success of the venture.

The Sprague Electric company has recently opened a branch office in the Security building, St. Louis. C. B. White, who is well known in the western electrical field, will have charge of the new

office. He was formerly connected with the engineering department of the old Edison Electric company, having been located in Pittsburg and having done considerable construction work in that territory. He was later electrical superintendent in charge of construction work with the Calumet Electric Street Railway company, Chicago, and for the last two years has been connected with the Western Electric company in the engineering and sales department. The Sprague Electric company now has branch offices in Chicago, Boston and St. Louis, and agencies in all of the principal cities in this country and abroad.

In the list of awards at the Paris Exposition was an "honorable mention" for an exhibit by Mathias Klein & Son of Chicago. As the exhibit was made without the firm's knowledge, and as they did not wish to take advantage of the reward without knowing the cause of it, an inquiry was made to the United States commission. F. E. Drake, director of machinery and electricity, replied, stating that the display had been made as a part of the collective exhibit in the United States section, a full equipment of linemen's tools of the Klein manufacture having been purchased by the commission from an agency in New York. The purpose of Director Drake was to carry a complete line of tools and accessories, and to do so it was found necessary to purchase this material, which is, however, entered in the manufacturer's name. The goods exhibited were taken out of regular stock, not intended for exhibition purposes, placing the firm at a disadvantage. At the same time, the award was unexpected and highly complimentary to the grade of goods manufactured by Klein & Son.

Recognition of an excellent railroad appliance was made when the Continuous Rail Joint company of America, 908-911 Lawyer's building, Newark, N. J., was awarded a bronze medal, the highest award in its class, at the Paris Exposition. The continuous rail joint for which the award was made is now in use on 128 railroads in the United States alone. Its value is found in its simplicity, it having very few parts. The base plate is an integral part of the joint, and the horizontal and vertical rigidity is greatly increased. It assures an easy-riding track, with no play between surfaces, and positively holds the rail ends in perfect line and surface. The manufacturer of this rail joint has a complete equipment of special machinery for rolling its joint to fit perfectly any T or girder-rail section used by steam or street railways. The section is now in use on 92 different rail sections. The Continuous Rail Joint company of America is sole manufacturer of continuous patent type of rail joints, step joints and insulating joints. Branch offices are maintained in Montreal, Boston, Chicago and St. Louis.

BUSINESS.

The Electric Appliance company, Chicago, is sending out quotations showing a reduction in price on iron box bells.

A circular sent out by the Central Manufacturing company of Chattanooga, Tenn., gives tables and price-lists for the standard and telephone cross-arms, pins and brackets, manufactured by the company. The company also makes wood thimbles for steel pins and all kinds of electrical moldings. The yellow-pine cross-arms are shown by government tests to be about 40 per cent. stronger than those made of white or northern pine.

That the advantages of mechanical draft are recognized by experts and that it is rapidly assuming its place as a rival and successor of chimney drafts, is clearly evidenced by the fact that several of the technical schools have recently placed orders with the B. F. Sturtevant company of Boston, Mass., for the equipment of their boiler plants with this means of draft production. In several cases the fans have been so installed as to provide opportunity for experimentally comparing the chimney with the fan.

The Scullin-Gallagher Iron and Steel company, St. Louis, has increased its lighting plant and has placed a contract with the Western Electric company, Chicago, for one 100-kilowatt generator. The Western Electric company has also secured a contract for one 125-kilowatt type L generator, to be installed in the Spitzer building, Toledo, Ohio. The company is carrying a large assortment of portables, brackets, stationary and adjustable fixtures, to meet the demands of central stations and construction companies. A 150-page fixture catalogue has just been issued, illustrating these goods in a comprehensive manner, and will be sent on request.

Excelsior Springs, Mo., on the Kansas City line of the Chicago, Milwaukee and St. Paul railway, has become one of the leading all-the-year-around health and pleasure resorts in the United States. The use of its waters is said to have benefited a great many sufferers. The Chicago, Milwaukee and St. Paul Railway company has just issued a finely illustrated booklet, describing the resort and telling of its advantages, which will be sent for a two-cent stamp on application to the general passenger agent, Chicago.

In the October number of the Monthly Bulletin, a newsy 28-page journal, issued by the Chicago House Wrecking company, will be found a complete list, with prices, of electrical supplies and apparatus carried in stock, which includes everything electrical, from a miniature incandescent lamp to a 500-light dynamo. A large repair department for the rehabilitation of second-hand machinery is one of the features of this company's extensive and rapidly growing electrical business, and with its facilities for obtaining standard electrical supplies and machinery at second hand, it is enabled to quote prices that should interest all prospective purchasers in this line. The company's catalogue, No. 156, on monthly bulletins, will be forwarded upon request.

The Crest Manufacturing company of Cambridgeport, Mass., since its entrance in the automobile business, more than a year ago, has confined itself entirely to the manufacture of gasoline motors. Constant demand on the part of its customers for parts, other than motors, that go to make up an automobile, has been an inducement for the company to enter into this additional line of business. Having now increased its facilities, the company proposes to manufacture various accessories that are necessary in the construction of automobiles, and will also buy from other manufacturers the best and most perfect devices that are used for this class of work. It will give the customer all information by which carriages can be built, without any danger of excessive cost or uncertainty of experiment, furnishing working drawings when requested by its customers. Automobiles will also be built, in limited quantities, according to the customers' designs.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 16, 1900.

659,655. Apparatus for the Electrolytic Decomposition of Alkaline Salts. Edwin Edser, London, England. Application filed March 31, 1899.

This apparatus comprises an electric cell having a partition formed of a series of troughs dividing the cell into decomposing and combining compartments, the troughs containing mercury which has its surface exposed to each compartment. Each of the troughs has a portion dipping into and below the level of the mercury in the adjoining trough, and electrodes placed in the compartments.

659,656. Testng Transformers, Etc. Augustine R. Everest, Lynn, Mass., assignor to the General Electric company of New York. Application filed June 25, 1898.

An insulation-testing device comprises a step-up transformer, an adjustable spark gap across the secondary terminals, and termioals for the device to be tested in parallel with the spark gap, whereby the latter may short circuit the dielectric medium of the device to be tested at a determinate potential and prevent discharge through the same.

659,658. Electric Arc Lamp. Richard Fleming, Lynn, Mass., assignor to the General Electric company of New York. Application filed April 4, 1898.

In an electric arc lamp are combined a pair of actuating magnets, capable of a limited amount of vertical movement jointly or separately, vertically exteoding rods for supporting the magnets, and maintaining them in parallel relation, and springs surrounding the rods, and set under the magnets, so that they are compressed when the magnets are energized. With the actuating magnet is also a two-part core, the parts of which are movable with respect to each other. A clutch mechanism is provided, a connection between one of the parts of the core and the clutch and a compensating support for the core and clutch, which is so arranged that as the power of the magnet increases its supporting effect on the core and clutch decreases. (See cut, next page.)

659,660. Apparatus for Periodical Generation of Electric Currents by Motors of Irregular Driving Power. Max Gehre, Rath, Germany. Application filed December 19, 1899.

A device is described for generating an electrical current or for other purposes by means of motors of variable driving power, comprising a motor-driven part, in combination with a power-storing device. This device consists of a chain pulley, a chain having a weighted portion passing over the pulley, a separable driving connection between the motor-driven part and the pulley for transmitting the motion of the part to the pulley for lifting the weight, and also for disconnecting the parts so as to permit the weight to descend. A shaft is driven by the pulley during the descent of the weight.

659,664. System of Electrical Distribution. Charles M. Green and John G. Callan, Lynn, Mass., assignors to the General Electric company of New York. Application filed June 30, 1900.

In a series circuit including undergrouod cables, in which sources of fluctuating electromotive force alternate with groups of translating devices, is placed an inductive connection between points in the circuit, separated by the translating devices. From the commutators of a multicircuit generator a plurality of circuits lead, and an inductive connection is placed between two of the circuits. Means are provided for equalizing the resultant fluctuations of voltages.

659,687. Electric Incandescent Lamp. Frederick Myers, New York, N. Y., assignor to Albert W. W. Miller, South Orange, N. J. Application filed September 26, 1899.

The globe of an incandescent electric lamp has an annular enlargement at or near its base end forming an internal annular seat; a disk with a washer embracing its edge and lying against the upper and lower faces thereof and adjacent to the edge is seated in the annular seat. A radially expansible threaded metallic sleeve is contracted at its lower end, its normal diameter at its upper end being such as to closely embrace the annular enlargement, while the normal diameter at its lower end is such as to embrace a part of the bulb of corresponding dimensions. This sleeve is detachably secured to the neck and serves to clamp the disk in the annular seat in the neck.

659,691. Telephone Transmitter. George B. Perkins, Medford, Mass. Application filed January 16, 1900.

A telephone transmitter is described having a flat circular metal frame hollowed out to form a diaphragm seat, and a diaphragm having a bearing at its center, consisting of a pin whose shank extends through the diaphragm and is secured by a nut. A bridge extends across the rear of the frame and has an adjustable bearing and tension regulator placed centrally to the frame, with a button suspended between the bearings, consisting of two thin metal disk electrodes with outwardly projecting spindles, and faced with carbon plates, separated by and cemented to a porous resilient annulus having smooth faces. This annulus contains granulated carbon in a loose and free state.

659,694. High-potential Trolley System. William B. Potter, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 11, 1898.

The trolley base consists of a plate for attaching the base to the car, while a second plate carries the trolley, and a body or bodies of insulating material separate the plates. A conducting cord is shown grounded at one end, and attached to and insulated from the pole at the other.

659,697. Power-transmitting Mechanism. Charles W. Richards and Winthrop M. Chapman, Needham, Mass. Application filed August 17, 1899.

A dynamo is shown supported on the body of a car and gearing supported by and driven from the car axle; a gear case is also supported upon the car axle and affords a bearing for the driven member of the gearing. Shafting is provided with universal and slip joints connecting the gearing with the dynamo.

659,702. Means for Suspending Incandescent Electric Lights. Theodore Smith, Georgetown, Ill. Application filed February 26, 1900.

In an incandescent lamp support are combined a rigid member provided with means of attachment to, and supported by a flexible cord, a lamp socket connected with the rigid member by means permitting the horizontal angular adjustment of the socket with reference to the rigid member.

659,705. Clutch for Electric Arc Lamps. Henry C. Spinney, Lynn, Mass., assignor to the General Electric company of New York. Application filed April 4, 1898.

In a clutch for an arc lamp are combined a collar which is secured to the actuating mechanism of the lamp, and a pair of forked clamping jaws suspended from the collar. Two angular faces on each jaw are for gripping the carbon, the faces on one jaw being adjustable laterally, independent of the faces on the other jaw, so that they will automatically adjust themselves to irregularities in the carbon, and means are provided for tripping the clutch.

659,711. Electric Arc Lamp. Georg E. Stevens, Lynn, Mass., assignor to the General Electric company of New York. Application filed May 31, 1899.

An arc lamp is described, having a fixed guide for the movable electrode, a carbon holder having an extension thereon, and a contact device carried by the carbon holder. This contact device is provided with elastic arms shod with contact rollers engaging the guide, the extension being arranged to surround the arms and limit their outward movement.

659,716. Adjusting Reluctance of Magnetic Circuits. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed July 20, 1898.

A body of magnetic material forming part of a magnetic circuit of a multipolar dynamo has openings formed in it, while bodies of laminated magnetic material of the same cross section as the openings are placed within these openings, and are adapted to assume different positions in the openings. The laminæ are arranged longitudinally of the opening for each position.

659,717. Contact Device. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed May 6, 1899.

In an electric arc lamp are combined a carbon tube, a holder arranged for movement within the tube, a carbon pencil mounted in the holder, and a coiled chain composed of links which are of less diameter than the tube, for conveying current between the tube and the holder. The weight of the chain is utilized to force the carbon and its holder downward, while a carbon-feeding device is carried by the tube. (See cut, next page.)

659,725. Electric Time Alarm. Simon Wolf, Essen, Germany. Application filed February 7, 1900.

An alarm is described composed of a bed, a mattress frame, a contact spring for yieldingly supporting the frame, a contact on the bed beneath the spring, an alarm in circuit, and means for setting the alarm.

659,729. Control Apparatus for Electric Carriages. Howard F. Eaton, Quincy, Mass. Application filed March 25, 1899.

In an electrically propelled vehicle having a body, running gear, batteries and motor-driving mechanism, are included an electro-mechanically operated motor speed-controlling drum and contact keys for controlling the drum-operating circuits.

659,759. Telephone-exchange System. James L. McQuarrie, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed November 10, 1898.

A telephone-exchange system is described comprising a relay associated with a telephone line at the exchange and having a retaining helix included in a circuit. A visual indicator is connected in parallel with the circuit, while a relay switch is adapted to open and close the parallel circuits including the helix and visual indicator. This relay switch and source of current form part of a conductor common to both of the parallel circuits. A second helix is upon the relay in circuit with the telephone line, while a magneto-generator at the substation of the line is adapted when being operated to send current through the second helix. A cut-off relay controls contacts included in series with the retaining helix, and line-connecting apparatus is included, adapted to operate the cut-off relay to open the circuit through the retaining helix of the first-mentioned relay, to release the switch controlled thereby and thereby open the circuit. (See cut, next page.)

659,766. Automatic Electric Cut-out. John H. Robertson, Morrison, Ill. Application filed June 22, 1899.

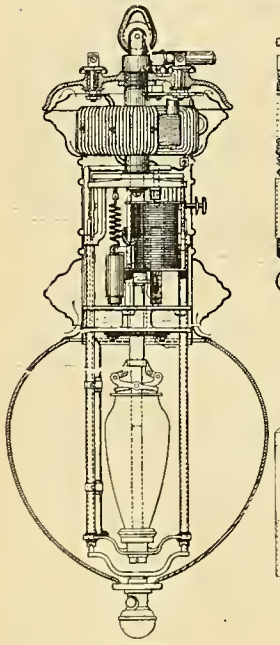
The invention consists of the combination of an electrical switch, a pivoted arm for making and breaking the circuit, and having a slot therein, and a mechanism for operating the arm. This mechanism comprises a part having a finger working in the slot, a rotatable device for operating the part, and a motor set into operation by the turning of the rotatable device for turning the same in the reverse direction.

659,768. Pilot Signal for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed March 11, 1897.

Pairs of plugs and their plug circuits are described, adapted for uniting lines having means for determining the flow of current in the lines during the use of the telephones. A supervisory relay in each plug circuit is responsive to such current, and a supervisory signal is included in a local circuit, while a shunt of the signal is controlled by the relay. An electro-magnet controlling the pilot signal is placed in a conductor common to several local circuits, and circuit connections of the shunts and the signals are adapted to cause the excitement of the pilot-signal controlling magnet when either is closed, but to render it inert when both are closed.

659,789. Signal for Telephone Trunk Lines. Henry M. Crane, New York, N. Y., assignor to the Western Electric company, Chicago, Ill. Application filed January 10, 1900.

A telephone trunk line extends from a spring-jack at an answering board to a terminal plug at a receiving board, while a clearing-out signal and a circuit including the same with a source of current is shown, the circuit being closed in registering contacts of the terminal plug and the spring-jack of the called subscriber's line. Two relays control the clearing-out signal, and a circuit through one relay controlled by the other relay forms a shunt for the clearing-out signal. A circuit is adapted to be closed by one of these relays when the same is energized. This circuit includes the winding of the relay to establish an independent circuit through it, the circuit being in shunt with the clearing-out signal. A circuit for the other relay is



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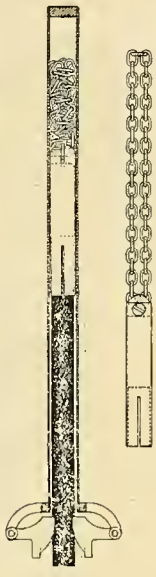


NO. 659,717.

completed by connection with the trunk-line spring-jack at the answering board, whereby the clearing-out signal is continuously shunted while the terminal plug of the trunk line is connected. The shunt about the clearing-out signal is removed and the signal displayed when the connection with the trunk line is removed at the answering board.

659,793. Electric Alarm System and Testing Apparatus. Leonard H. Des Isles, Cambridge, Mass., assignor to Roscoe F. Hersey, St. Paul, Minn. Application filed January 10, 1900.

In this apparatus with one or more circuits, each comprising two parallel branch circuits, are combined a test-indicating device, connections distinct from the circuits between the test-indicating device and one terminal of a battery, and means for electrically connecting the device with the other termieal of the battery through each of the branch circuits separately.

659,824. Circuit Controller for Electrical Mechanism. William A. McCallum, Cincinnati, Ohio. Application filed April 17, 1900.

A circuit controller is described consisting of a switch spindle, a cylindrical hub adapted to removably fit over and engage the same and provided with ratchet teeth spaced apart correspondingly with the resistance contacts of the switch apparatus. A rotating handle is seated on the hub and engages therewith by one or more yielding pawls.

659,828. System of Electrical Distribution. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 16, 1899.

This system combines a multiphase source of supply, single-phase rotary converters fed from different phases of the source, and direct-current mains fed by the rotary converters.

659,882. Spool for Electromagnets. George L. Weaver, Boston, Mass., assignor to Horace E. Harriman, Georgetown, Mass. Application filed April 30, 1900.

As an article of manufacture, a spool for electromagnets is described comprising a barrel and heads, one of the heads having an external annular recess in its outer end surrounding the end of the barrel extended through the head, and presenting an outwardly extended annular flange. The recess is adapted to receive a reserve portion of the inside wire wound upon the barrel, the flange forming the side wall of the recess, and a removable cap is centrally apertured to receive the end of the barrel and adapted to rest on the external wall to cover and protect the reserve portion of the wire in the recess.

659,891. Adjusting Device for Vacuum Tubes. Thomas B. Kinraide, Boston, Mass. Application filed December 26, 1899.

The invention relates to a vacuum tube having an electric conductor, an electrode, connections between the conductor and the electrode including a device slidingly mounted in the tube and normally retarded frictionally from movement. Means are contained within the vacuum tube for moving the sliding device and thereby adjusting the electrode.

659,940. Telephone Switch. Alfred Stromberg, Chicago, Ill. Application filed June 13, 1900.

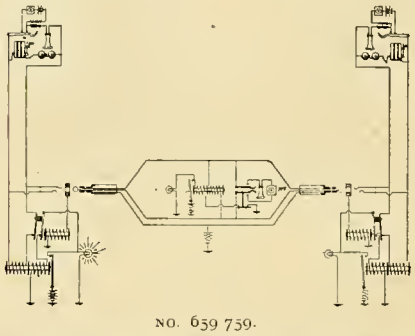
In a telephone switch is a bell-crank lever, provided with a long arm having a hook for holding the receiver and a short arm, while a roller is provided upon the free end of the short arm. Contact springs are shown provided with sloping portions for engagement with the roller, one of the contact springs being connected with one side of the telephone line, while the other constitutes a terminal of a transmitter circuit. Contacts are located above the contact springs, one of the contacts constituting a terminal of the branch including the receiver, while the other constitutes the remaining terminal of the transmitter circuit, while a lower contact is adapted for engagement with the contact spring which is connected with the line when the spring is depressed through the agency of the receiver. The latter spring also engages the contact terminal of the receiver when elevated upon the removal of the telephone receiver.

659,946. Electric Switch. George H. Whittingham, Baltimore, Md. Application filed February 5, 1900.

An electric switch comprises a switch blade pivoted loosely between the terminals, and a tappet pivotally mounted on the pivot pin of the blade and movable independently of the blade, the tappet being provided with a pin and a stud projecting above the pin. A spring-pressed rod is pivotally and slidably mounted at one end on the base plate and has a bifurcated head engaging the pin, while a lever is pivotally mounted on the base plate and formed with an open frame in which the stud is located and has movement.

659,958. Telephone System. William M. Davis, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing company, Chicago, Ill. Application filed June 28, 1900.

An interior telephone system is described wherein are combined with a plurality of telephone lines extending between the stations of the system, a source of calling current connected, or adapted for connection, with the telephone lines, line contacts connected with the telephone lines and a signal at each station included between its corresponding telephone line and one terminal of the source of calling current. One termioal of each signal is permanently connected with its corresponding line contact, while a line-connecting switch mechanism is placed at each station to enable each subscriber to connect his station with another. A normally open key or switch is included in a conductor uniting the line-connecting apparatus and the other terminal of the source of signaling current.



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659,959. Telephone-exchange System. William M. Davis, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing company, Chicago, Ill. Application filed June 28, 1900.

In this multiple-switchboard telephone-exchange system, each line extends from a subscriber's station to a plurality of sections of multiple switchboard, sides of the telephone circuits being connected with tip contacts of jack-switches. A common battery is included, having one terminal also connected with the sides, and a cord circuit having sleeve and tip strands, the sleeve strands being connected with the remaining terminal of the common battery. The jacks of the switchboard are provided with electrically connected test thimbles or contacts adapted for electrical connection with the sleeve strand through the agency of the inserted plugs. A telephone key is adapted to include the operator's telephone set in circuit between the tip strand and the terminal of the battery connected with the tip contacts of the jacks, the tip strand being continuous to battery current between the telephone key and the tip of the connecting plug, but discontinuous to the current between the telephone key and the answering plug.

660,006. Shutter Adapted for Use in Apparatus for Exhibiting or Viewing Animated Pictures. Eugene L. Doyen, Paris, France. Application filed July 18, 1900.

In an apparatus of the character described, a pair of pivoted shutters are adapted to alternately open and close view openings. Means are provided for effecting the alternate shifting movement of each of the shutters as well as means for automatically returning the shutters to their initial position.

660,021. Electricity Meter. William M. Mordey and Guy C. Fricker, London, England. Application filed May 19, 1900.

An electric meter is described comprising a pivoted armature and a coil or winding adapted to be traversed by the electric current, or a proportion thereof, to be measured. The current directly magnetizes and operates the armature so as to tend to bring the axis thereof into the same plane as the axis of the coil or winding. Means are provided for mechanically imparting a sufficient auxiliary impulse to the armature in each direction of its stroke, or throw, to carry it past the axial plane of the coil or windieg.

660,043. Electrical Furnace. Wilhelm Borchers, Aachen, Germany. Application filed December 22, 1898.

The invention relates to an electric furnace, wherewith are combined a feed chute for the material operated upon, two electrodes adjustably arranged in the furnace to form an arc, one of the electrodes being disposed between the feed chute and the other electrode, and gradually tapered to a point. Means are provided for feeding the material from the chute in a mass gradually decreasing in cross-sectional area over and past the tapered electrode to the arc.

660,045. Electrically Actuated Sawmill Set Works. William M. Carroll, Beaumont, Texas. Application filed May 12, 1900.

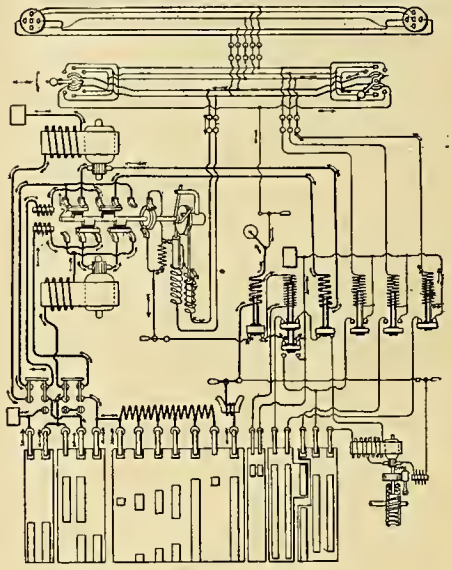
With sawmill set works, having a set shaft and means to actuate the same, are included an electromagnetic clutch having one member fast on the shaft and one member loose thereon, means for magnetizing the clutch and thus carrying the loose member therewith. The clutch may also be demagnetized and the loose member may be moved in one direction independently of the set shaft when the clutch is thus demagnetized. The movement of the loose member may be arrested, and means are provided to predetermine the extent of the rotary movement of the loose member.

660,047. Electric-lighting System. Joseph I. Conklin, New York, N. Y. Application filed March 28, 1900.

An electric-lighting system for railway cars is described embracing a dynamo, storage battery and lamps, a drive shaft connected with the dynamo, a governor operated by the shaft, and three circuits, one connecting the storage battery and lamps, another the dynamo and lamps, and the third the dynamo and storage battery. A manual switch is included in the circuits and an automatic circuit-closing switch independent of the governor and in conjunction with the manual switch controlling all three circuits. A contact device is carried by the governor for operating the independent circuit-closer.

660,054. Controlling Brake for Motors. Arthur C. Eastwood, Ensley, Ala., assignor to the Electric Controller and Supply company, Cleveland, Ohio. Application filed May 14, 1900.

In a motor controller, two series of concentrically placed resistance blocks are provided, and a contact arm having four sets of fingers thereon constructed to bear on the blocks. Two series of brake blocks are placed similarly to the resistance blocks in the path of the contact arm,



NO. 660 065.

connected to the motor circuit and disconnected from the line, whereby the motor is made to act as a series generator when running under its own momentum, thus retarding the motion of the armature without using current from the line.

660,057. Astatic Armature for Electric-supply Meters. Sydney Evershed, London, England, assignor to himself and the Evershed & Vignoles, Limited, London, England. Application filed July 21, 1900.

In an electric-supply meter of the motor type, an astatic armature is included, consisting of coils coupled in succession in the usual order and in the usual relative angular positions as regards azimuth, but having alternate coils wound upon the upper and lower of two "formers" upon the motor axle. The coils on the upper former are so connected as to cause the current in them to flow in the opposite sense to that flowing in the lower coils.

660,065. Traction System. Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric company of New Jersey. Application filed April 30, 1898.

An electrical train system is described, embracing the combination of translating devices and circuits therefor in parallel relation with each other, and a governing train line independent of the other circuits. In the governing train line are relays connected in parallel circuit with each other, and one or more operator's switches included therein for actuating the controllers. One or more operator's switches or master controllers are connected to the train line, and separately actuated contacts operated or controlled from the master controllers for reversing the motors. Ind pendent means are also provided for controlling the speed of the motors. (See cut.)

660,066. Method of Regulating Motors. Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric company of New Jersey. Original application filed April 30, 1898. Divided and this application filed June 23, 1900.

The method is one of regulating and equalizing the operation of a number of motors in a system, each provided with a controller, which method consists in varying the operation of each of the controllers with the current in the motor controlled thereby. The method prevents any motor of a system of motors connected in multiple from consuming more than its due proportion of the energy delivered to the system. This is accomplished by checking the operation of any controller when the current in the motor controlled thereby exceeds a predetermined limit.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, NOVEMBER 3, 1900. No. 18

Electrical Features of the Evening Star Building at Washington.

During the last two or three years Chicago contractors have been quite active in securing contracts for the construction of tall office buildings in the East. This is true, not only in regard to general contracts, but also in regard to the various divisions of the work, and a great many of the large eastern general contractors are in the habit of receiving competing bids from Chicago firms on their large work. As an example of this, the con-

FIG. 1. EVENING STAR BUILDING AT WASHINGTON.

tract for the construction of the Evening Star building, Washington, D. C., was awarded to the George A. Fuller company, which, in turn, sublet a contract for the electric wiring and switchboard to the Chicago Edison company of this city.

The accompanying illustration (Fig. 1) gives some idea of the building, which is of fireproof construction, with an outside facing of white marble. The clear, clean atmosphere of Washington is especially adapted to such a building. Situated, as it is, at the corner of Pennsylvania avenue and Eleventh street, nearly opposite the new Postoffice building, it is without doubt the most conspicuous office building in the city of Washington. The building has a frontage of 55 feet on Pennsylvania avenue and extends along Eleventh street for 126 feet. It is nine stories (130 feet) in height from the sidewalk to the top.

The contract for the electric wiring included, not only the wiring for electric lighting, but also power wiring, wiring for bells and telephones, connections from switchboard to a battery, and a complete power and lighting switchboard. The wiring throughout the building is of braided Simplex caoutchouc wire, drawn into lined iron-armored conduits, manufactured by the Sprague Electric company.

The cut-out cabinets for each floor are built of heavy sheet-steel, with cast electro-bronze doors and facings. The conduits for the tap lines terminate in these cut-out cabinets, and are firmly fastened to the sides by lock nuts. Within the iron cabinet is a marble cabinet on which are mounted bus-bars, which connect through double-pole knife switches and D. & W. enclosed fuses, to the various tap-line circuits. These circuits are all numbered, and on the inside of the cabinet door, under a glass plate, is the name of every circuit, with its corresponding number. Not only is the wiring for light and power throughout the building run in iron-armored conduit, but there are also conduits for telephone and special-call wires, all of these conduits being installed so that the wires may be withdrawn and new ones inserted at any time.

The basement, the first and mezzanine and the seventh, eight and ninth floors are used by the Evening Star company for the editorial, business and mechanical departments of its newspaper. The five floors intervening between the mezzanine and the seventh story are used for offices, which are rented out to various tenants. As this building is a newspaper building, and as all power for running the presses and supplying the light for lighting the building is furnished by means of electricity, it became of the utmost importance that this power should be supplied without interruption. It is interesting to know what special provisions were made to secure that end.

In the first place, there is located in the basement of the new building a generating plant (Fig. 2), consisting of three 50-kilowatt, 110-volt American Ball dynamos, direct-connected to 12 by 12-inch engines of the same make. These dynamos are connected to a main switchboard by lead-covered cables run in iron pipe.

In the second place, there is a storage battery a few feet from the switchboard, beneath the sidewalk, manufactured by the Electric Storage Battery company of Philadelphia. It consists of 62 cells (type F, No. 17), with a rating of 160 amperes for eight hours and 320 amperes for three hours. The battery is charged through a booster having a capacity of 200 amperes at 40 volts. This booster is driven by a direct-connected Eddy motor.

Thirdly, the switchboard has been so arranged that connection from the street circuits can be made to the lighting and power bus-bars, in case of a failure of either of the above-named sources of supply.

Another source of supply is a large and complete isolated lighting plant in the basement of the Raleigh Hotel, which is located on the opposite corner of the block, facing Pennsylvania avenue. From the main switchboard of this Raleigh Hotel plant a set of 700,000-circular-mil cables is run to the power switchboard in the annex to the Evening Star building, where the main presses are now located.

In the fifth place, there is a connection from this power switchboard to a belted dynamo located in the Evening Star annex building.

In order to understand fully this arrangement, which provides five different sources of current supply, it will be necessary to give a somewhat detailed description of the two switchboards. The main switchboard, shown in Fig. 3, is located in the new engine room, and the other switchboard, the pressroom switchboard, an elevation of which is shown in Fig. 4, is located in the pressroom in the basement of the Evening Star annex.

As can be seen from the illustration, the main switchboard, located in the engine room, is one of the finest of its kind in the country. It has seven panels, two feet in width by six feet in height by 1½ inches thick, of white Italian marble, mounted on an angle-iron frame, the whole surrounded by a heavy ornamental border finished in electro-bronze. This border is of very handsome design, and in the center at the top is a large eight-day clock. At each end of the board are heavy grille doors, providing easy access to the back of the switchboard. The top and rear of the board is provided with a cover of sheet-steel, to guard against dirt or injury. This sheet-steel is drilled and the iron conduits are brought through and fastened on each side by means of lock nuts, with approved hard-rubber bushings. At the rear of the switchboard there are four sets of bus-bars. There is a power bus and a lighting bus for use of current from the main plant, also power and lighting buses for the use of current from outside supply.

The center studs of all switches for light and power feeders are connected by copper bus-bars to a marble slab at the top and rear of the main switchboard, on which slab are placed the cut-outs, with D. & W. cartridge fuses protecting the various feeders.

Referring to the illustration of the main switchboard (Fig. 3), the first panel to the left is the battery-discharge panel. It is provided with a 10-point, 500-ampere end-cell switch, a 500-ampere Cutter circuit-breaker, a 500-ampere, double-pole, double-throw switch and a differential Weston central-station ammeter, reading from 0 to 1,200 amperes in one direction and to 300 amperes in the other.

The second panel is the battery-charging panel, and is provided with the following-named instruments: A 200-ampere, 10-point end-cell switch, used in charging, a rhestat for booster, a 200-ampere, double-pole, double-throw switch, a 50-ampere double-pole, double-throw switch for booster motor, a 150-ampere, double-pole, over and under-load Cutter circuit-breaker, a six-point voltmeter switch, a Wagner illuminated-dial voltmeter, reading from 0 to 175 volts, and a Wagner illuminated-dial ammeter, reading from 0 to 200 amperes.

The next two panels are the generator panels, and

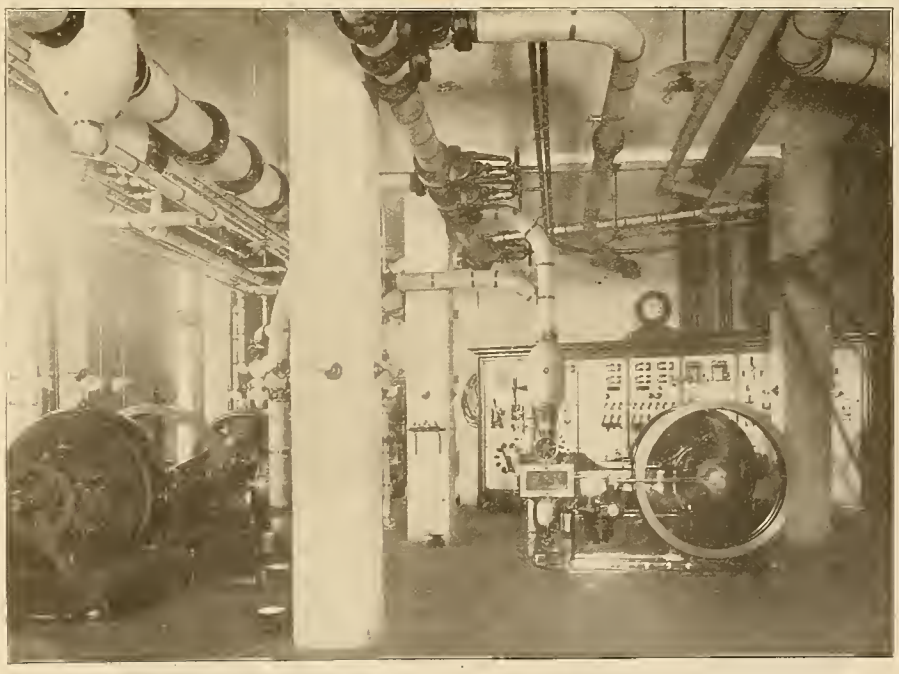


FIG. 2. ELECTRICAL FEATURES OF THE EVENING STAR BUILDING.—ENGINE ROOM.

are provided with three Wagner illuminated-dial ammeters, reading from 0 to 750 amperes, three Wagner illuminated-dial voltmeters, reading from 0 to 150 volts, three triple-pole, 500-ampere dynamo switches, three 35-ampere, double-pole, double-throw field switches, three field rheostats, and three single-throw, single-pole switches for short-circuiting the series winding on the compound-wound machines, in order that the machines may be transformed to shunt machines when running in multiple with the battery. There is one pilot light provided for each dynamo, directly in front of the operator, and so connected that should the polarity of the dynamo be reversed the operator will be notified of it by the fact that the lamp will not come up to normal candlepower.

The remaining three panels are the power and lighting feeder panels, and contain, besides the power and lighting wattmeters, the various switches for the different feeders. These latter include the switches controlling four 700,000-circular-mil cables which run over into the next building, called the annex, in the basement of which are located the four main printing presses.

In this main pressroom is a second switchboard, a diagram of which is shown in Fig. 4. On the left-hand panel are mounted four double-throw, 300-ampere switches, controlling the leads to the four presses. On the right-hand panel are two 600-ampere switches, which control the leads from the main Evening Star switchboard over to this switchboard. The bus-bar connections are shown by the heavy broken lines.

There is one 500-ampere switch controlling the lead from the belted dynamo in the annex building, one 1,200-ampere, double-pole switch, controlling the lead from the Raleigh Hotel, and one 1,200-ampere, double-pole switch, used as a tie switch connecting the leads from the Raleigh Hotel and from the Evening Star switchboard together. By this arrangement the Evening Star dynamos can supply current for any one or more of the press-room motors, or, in case of a complete breakdown of the Evening Star plant, by throwing in the tie switch, the Raleigh Hotel can supply, not only current for the motors, but also feed back to the main lighting switchboard; and, conversely, by throwing in the main tie switch and at the same time throwing in another 1,200-ampere switch at the Raleigh Hotel switchboard, the Raleigh Hotel can secure current from the Evening Star building.

At the top of the panel is a Weston differential voltmeter, reading to 1,200 amperes in each direction, and as this ammeter is connected in the main circuit, the operator in the pressroom can see at a glance the amount of current which is being fed to the Raleigh Hotel or taken from the hotel plant. This system has been in operation now for about eight months and has worked thus far with perfect satisfaction.

As all the power throughout the building is furnished by means of electricity, the various machines are, of course, all run by motors. In Fig. 5 may be seen some of the type-casting or linotype machines on the eighth floor. These are run by direct-connected Sprague motors, and the wiring for these machines is carried in iron-armored conduit from the cut-out cabinet on that floor. There are also a number of other motors on this floor used in running matrix machinery, saws, lathes, etc. Each of the linotype machines is connected with an electrical indicator in a nearby machinist's room, so that when the services of an expert are needed in the care of a machine, the man may be summoned by pushing a button on the frame of the machine.

In the basement there is a 20-horsepower Westinghouse motor, connected to a pneumatic-tube blower,

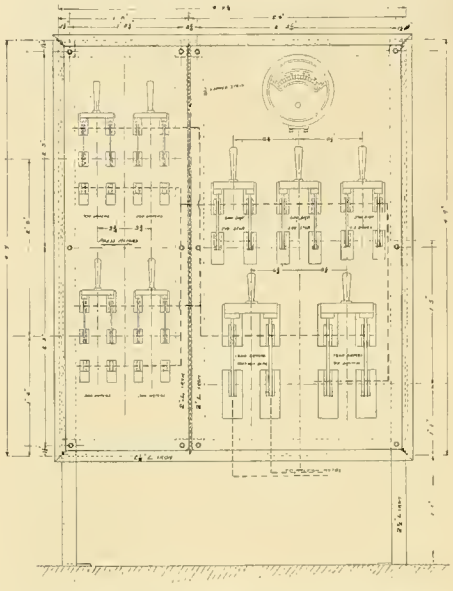


FIG. 4. ELECTRICAL FEATURES OF THE EVENING STAR BUILDING.—DIAGRAM OF PRESS-ROOM SWITCHBOARD.

a three-horsepower Sprague motor, with automatic controller, directly connected to a house pump, two four-horsepower Sprague motors, directly connected to Sturtevant fans, and two 25 and one 30-horsepower Sprague motors, used for the two passenger and one freight elevator. The presses in the annex are driven by four 35-horsepower motors.

A special feeder is run from the basement to the roof of the building in iron-armored conduit, to be used for decorative lighting or for searchlight. In short, the wiring provides for a total capacity of about 1,600 16-candlepower lights and 300 horsepower in motors.

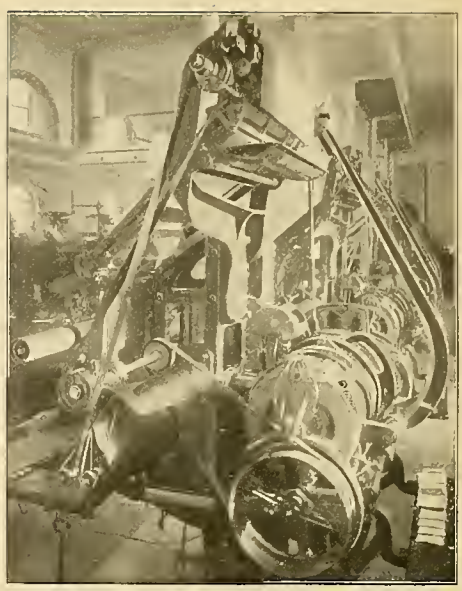


FIG. 5. ELECTRICAL FEATURES OF THE EVENING STAR BUILDING.—ELECTRICALLY DRIVEN LINOTYPE MACHINES.

As can be seen from the foregoing, the problem of this plant was not only to provide current from five different sources, but also to distribute the supply in a safe and economical manner. The architects and owners have expressed themselves as well satisfied with the way in which the Chicago Edison company has secured this desirable result.

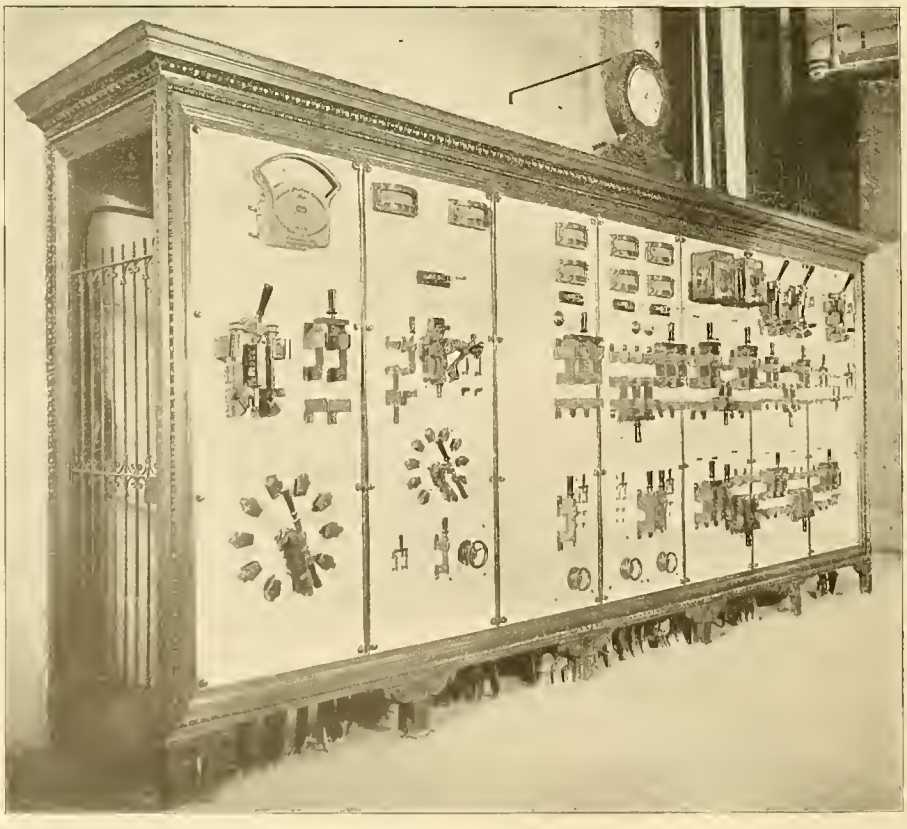


FIG. 3. ELECTRICAL FEATURES OF THE EVENING STAR BUILDING.—MAIN SWITCHBOARD.

Power Plant at Georgetown, Colo.

The formal opening of the light and power plant of the United Light and Power company of Georgetown, Colo., took place recently. The station is one of unusual interest, as it will supply power for operating mines, and as many obstacles were encountered in the installation. The power house is a well-built structure and has just been completed, as the old station was outgrown. The plant is constructed to be operated either by waterpower, derived from Clear Creek, or by steam. For about eight months in the year sufficient water is available, and will be used. Besides furnishing power for the mines, the plant will supply illumination for the towns of Georgetown and Silver Plume.

The waterwheel equipment was furnished by Daniel Nug of Denver. During more than half the year 1,000 horsepower will be available. The boilers are of the Babcock & Wilcox type. All the engines will be of 500 horsepower, compound and non-condensing. The electrical equipment throughout was furnished by the General Electric company. At present there are installed two three-phase, 2,300-volt generators. A step-up transformer raises the voltage to 10,000 volts, and at this potential current is transmitted to the mines, where a step-down transformer is located. The transformers are of the oil-cooled type.

The principal mine to which power is carried is the Lamartine. The line wires are No. 4 B. & S., and the construction was expensive and attended with difficulty. The cost was over $1,000 a mile, and the distance is about six miles. The line is protected from lightning by two strands of galvanized wire and one of barbed wire. The terminals are equipped with General Electric lightning arresters. The power is used for general mining purposes. It is expected that the plant will be increased within a year by the installation of a 250-kilowatt and a 150-kilowatt generator.

At the time the plant was started Mr. F. E. Himrod of New York city, owner of the Lamartine mine, closed the switch that set the machinery in motion. Mr. C. L. Noon, manager of the United Light and Power company, superintended the entire installation at Georgetown and at the Lamartine mine. Mr. Thomas B. Whitted, district engineer of the General Electric company, had general charge of the work.

The Wabash (Ind.) River Traction company has filed its bond for the sum of $10,000 to begin construction work on the interurban line from Wabash to Peru. F. C. Boyd is interested in the line.

Electric Elevators for Safe and Economical Operation at High Speed.[1]

By Hayward Cochrane.

Part I.

The design of controlling apparatus for slow or medium-speed, direct-current electric elevators has been a comparatively simple matter; the demands for high-speed elevator service have, however, brought up some interesting and difficult problems. The usual requirements of an electric-elevator controller may be stated briefly: That the full speed of car shall be attained in from five to eight seconds' time, depending on load and rated speed of elevator; that in attaining speed the acceleration shall be smooth and gradual, so that no jerk or jump will be felt on the car; that the rush of current in starting the car shall be as small as possible, consistent with the rate of acceleration, and its rise from initial rush to maximum value be steady and gradual, so as to cause little drop of voltage, and thus allow the machine to be run on incandescent-lighting circuits; that the controller be so constructed as to operate easily with either cable, or lever device; that the speed be variable from minimum to maximum, at the will of the operator, and that the design of contacts and connections be such as to obtain a minimum of sparking, with a long life of the contacts.

With worm-geared winding machines experience has shown that, with a gearing of low ratio and high efficiency, there is a tendency for the load to drive the motor as a generator under certain conditions. With winding-drum elevators it has been good practice to have the counterweight heavier than the car by an amount equal to about half the load to be lifted at full capacity, depending on the circumstances in any given case. If the gearing is highly efficient, the counterweight may drive the motor as a generator when the car is going up, with little or no load. Or, if the car is descending with a load sufficiently large to overbalance the counterweight, the same thing may occur. With a winding-drum machine it seems to be necessary to employ a worm gearing, with teeth of steep angle, and low ratio, to get a very high car speed, without employing an abnormally large diameter of drum or very high motor speed, and the steep angle of teeth and low ratio gives a higher efficiency than a more acute angle and higher ratio.

Assuming that a gear wheel has 96 teeth, with 1.25 inches' circumferential pitch, then the pitch circumference will be 120 inches, or 10 feet. In Fig. 1 (M), (G), (D), (C), (W) and (W') represent respectively the motor, gearing, drum, car and counterweights of an ordinary winding-drum elevator outfit. If the worm is single-threaded, as indicated by end view of (G), with a pitch of 1.25 inches, it will have to revolve once to move the worm-wheel circumference one tooth, or 1.25 inches, and 96 times to give the wheel one complete revolution. If the motor runs 800 revolutions per minute at highest speed, the worm wheel will revolve 800 divided by 96, or 8.333 times. With a drum diameter of four feet, or circumference of about 12.75 feet, the car speed will be 8.333 multiplied by 12.75 feet, or about 106.25 feet a minute, which is too slow for passenger service. A larger diameter of drum would give greater speed, but would increase the pressure between gear teeth. Any lost motion or back lash between gear teeth would also be disagreeably magnified in a jumping or jerking of the car in stopping, because the radius of the drum would be greater than that of the gear wheel. It is desirable, therefore, to use a reasonably small drum. To do this, a double-threaded worm, having a steeper angle of teeth, may be employed, which, in revolving once, will move the worm wheel two teeth, or 2.5 inches.

With 800 revolutions per minute of the worm, the wheel will revolve 800 divided by 48, or, approximately, 16.66 times. With a drum of 12.75 feet circumference, the car speed will be 16.66 multiplied by 12.75 feet, or about 212.4 feet a minute. By employing a worm of three threads, in a similar way, a car speed of about 318 feet may be obtained with the same worm speed and drum, but the angle of gear teeth is more obtuse. With a four-threaded worm and the above worm, speed and diameter of drum, a car speed of about 425 feet a minute may be obtained. It is assumed in the above that the worm shaft and worm-wheel shaft are at right angles with each other. The same diameter of drum and same worm speed may be used in connection with a smaller diameter of worm wheel to get higher car speeds.

One of the first things to be attained in elevator service is safety of operation, which should not be sacrificed for any other object. Efficiency of operation is to be desired in any machine, and should be made as high in an elevator machine as possible consistent with safety of operation. If a compound motor is used with a gearing of low ratio and high efficiency, there may be times when the motor will be driven by its load sufficiently to generate quite a large current. If the series winding of the motor in such a case happens to be cut out of circuit, the armature will simply have to generate its electromotive force in the strength of field given by the shunt winding. If the series winding happens to be partly or wholly in circuit while the load drives the armature, there may be a balanced condition, so that no effective current will flow in the series coils in either direction, or the current in the series winding may be reversed in direction and will, in such a case, act to weaken the field given by the shunt winding, the result being that there is an increasing speed on account of the field exerting a less torque on the armature. That is, the power to drive the motor is able to drive it at a gradually increasing speed, since the dynamic braking effect of the magnets is gradually decreasing. This speed is practically equivalent to a runaway in some cases, so far as the operation of the car is concerned, and becomes both undesirable and dangerous, especially if the elevator mechanism is already designed for a high normal speed. It is therefore desirable to have the controller so designed that it will automatically prevent this weakening of the field, irrespective of the running position of the operating device whenever the load may drive the motor. It is also desirable to be able to slow up the speed of the car when descending with a heavy load, or to run at varying speeds at will, according to the position of the operating device, no matter what the size of the load is.

By means of an automatic commutating device, working in connection with a compound elevator motor controller, these advantages may be obtained. The series winding of the field may be made to work accumulatively in starting the motor, so as to give a relatively large torque, with a minimum rush current. It may be partly or wholly removed from circuit, at the will of the operator, so as to give varying car speeds. In cases where the load is of such an amount as to cause no flow of current in the series circuit after reaching full speed, the series winding may be kept out of action. If the load is such as to drive the motor and generate a current in the series circuit, the connections of the series windings may be reversed, so that this current, which would otherwise tend to neutralize the effect of the shunt field windings, may act accumulatively with the shunt windings to strengthen the field. This causes the load to drive the armature at a slower speed than it would have if the shunt windings alone were in action. The heavier the load, therefore, the larger the reverse current in series coils, the stronger the field and the slower the speed of the elevator. As soon as the operating device is brought to the central or "off" position, the normal starting conditions will automatically be resumed.

It will be seen, therefore, that if the car is descending with a heavy load, it will run at highest speed when the operating device is thrown to the full "on" position, because the series coils will be short-circuited by the automatic movement of the controller plate (a), as shown in Fig. 2, plates (b) and (a) being arranged to short-circuit automatically the terminals (O), (O^1), (O^2), etc., and (R), (R^1), (R^2), etc., gradually when starting. If the operating device is not thrown to full "on," part or all of the series winding may be in circuit, according to its position; then if the load is such as to generate a reverse current in the series coils, the automatic commutating device represented by (C), (l), (l^1), (l^2), will act to strengthen the motor field according to the number of sections of series coils in circuit, and thus regulate the car speed. If, for any reason, the controller proper does not automatically cut the series coils out of circuit at the full "on" position, the automatic commutating device will act to strengthen the field to the greatest amount, so that the car will run at a low speed. It will be seen that, whether the car is carrying a full load or less, it will be possible to get partial speed by a partial movement of the operating device toward the "on" position. This is a desirable thing to accomplish, and is hereby done in a comparatively simple manner.

Fig. 2 shows diagrammatically the arrangement of a reversing switch, an automatic starting switch and an automatic series-coil commutating device connected up with a compound motor. The line terminals are represented by (2) and (3); (M), (M^1), (M^2), etc., represent the reversing switch; (a), (b), (R), (R^1) (R^2), (R^3), (O), (O^1), etc., the automatic starting switch; (C), (l), (l^1), (l^2), etc., the automatic series-coil commutating device, and (e), (e^1), (e^2), (e^3), (e^4), the motor. (M^5) and (M^8), (M^4) and (M^7) represent the movable plates of the switch which connect the terminals (M) and (M^1), respectively to the shunt field and armature terminals.

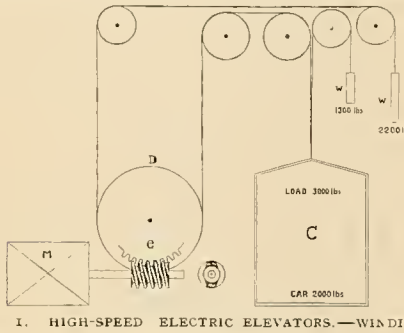


FIG. 1. HIGH-SPEED ELECTRIC ELEVATORS.—WINDING-DRUM MECHANISM.

(b) and (a) represent contact plates, insulated from each other electrically, but connected rigidly together mechanically.

When starting the motor the plate (b) moves as indicated by arrow (X), so as to short-circuit step by step the terminals (O), (O^1), etc., and as soon as this is done, the plate (a) begins to short-circuit step by step the terminals (R), (R^1), etc., provided the reversing switch is thrown to full "on" position. This action is regulated in speed by a dash-pot. The terminals (O), (O^1), etc., represent an armature rheostat, and (R), (R^1), etc., the terminals of the series winding upon the motor. (l), (l^1) and (l^2) represent contact plates fastened upon the insulating form (C). (l^3), (l^4), (l^5) and (l^6) are terminals connected respectively to terminals (R), (R^1), (R^2), (R^3); (t) and (t^1) are solenoids or magnets, for controlling the movement of the form (C), (t^1) being fixed in position, while (t) is connected to form (C), and with it is free to move within limits.

At times, when the load upon the elevators is not such as to generate a current in the series circuit, the form (C) will have the position shown in Fig. 2. This is because the connections of the coils (t^1) and (t) are such that the magnetism set up in (t) opposes that set up in (t^1), and if no current is flowing in (t) in either direction, it will neither be attracted nor repelled by coil (t^1). If the load drives the motor so as to generate a current in the series circuit, the coil (t) will be attracted toward coil (t^1), against the action of a spring (k). The movement of plates (l), (l^1), (l^2), in the direction indicated by the arrow (W), tends gradually to short-circuit terminals (l^6), (l^5), (l^4) and (l^3), of the series coils, and then to reinsert them into the circuit with reversed connections, section by section, provided the generated current is strong enough. The strength of the generated current will determine the position of the commutating device, therefore. The fixed solenoid or magnet (t^1) is connected in series with the shunt-field coils of the motor, so that it is practically of uniform strength under all conditions of running. The moveable solenoid or magnet (t) is connected between terminal (2) and plate (l), so as to be in series with the motor and whole controlling outfit.

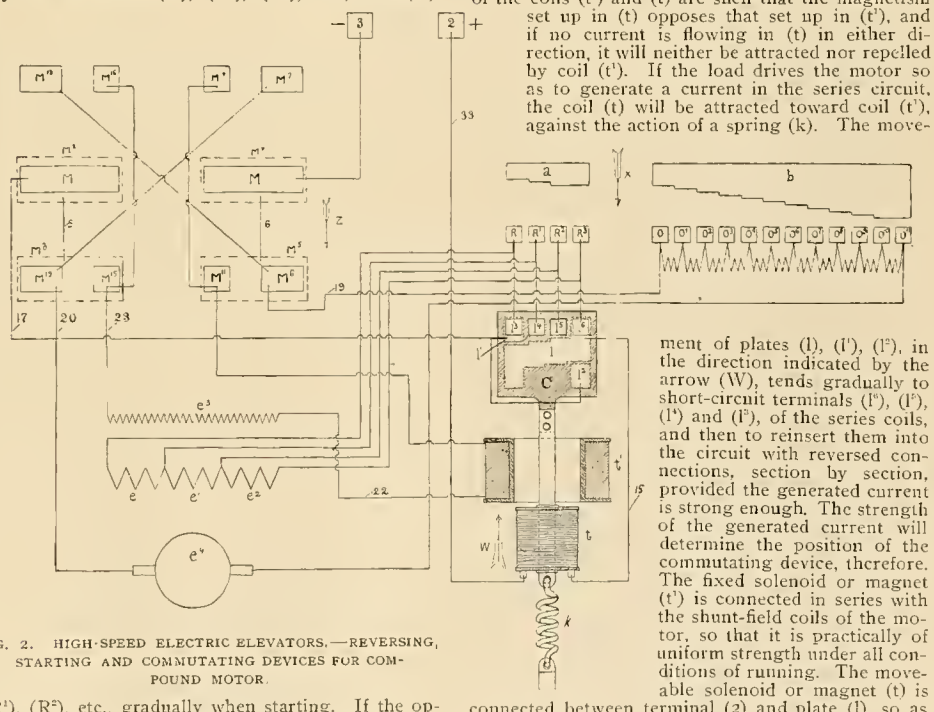


FIG. 2. HIGH-SPEED ELECTRIC ELEVATORS.—REVERSING, STARTING AND COMMUTATING DEVICES FOR COMPOUND MOTOR.

In the starting position, as shown, the circuits are as follows: Going from (2), the circuit leads through (t) to (l), out at (l^6) to (R^5), into coils (e^5), (e^4) and (e), out at (R), to (l^5) into (l^1) to (M). If (M^5) and (M^7), (M^4) and (M^8) are thrown in direction of the arrow (Z), one path will be through (M^{15}) to solenoid (t^1), through (e^5), and back to (M^{11}), plate (M^5), plate (M^4), terminal (M^1) to (3). The other path will be through (M^{10}) from (M^7), to (e^4), thence to (O), (O^1), (O^2), etc., and back to (M^6), plate (M^8), plate (M^4), terminal (M^1), to (3).

It will thus be plain that the current through (t) will be either in one direction or the other, according as the motor is working as a motor or as a dynamo. The movement of the reversing switch in either direction from the central or "off" position allows the starting switch plates (b) and (a) to short-circuit sections of resistance and series field

1. Paper read before the Chicago Electrical association, October 5, 1900.

coils, respectively, the rate of cutting out being regulated by a dash-pot. The return of the reversing switch to the central or "off" position brings the starting switch plates (b) and (a) positively back to their initial position. The shutting off of current allows the spring (k) to act upon the form (C), returning it with the solenoid (t) to the initial position, the tension of the spring being adjusted to perform this duty only. The operator of the car can, therefore, control the speed with heavy loads with equal ease and safety, whether ascending or descending, simply by moving the controlling device, partially or wholly, toward the "on" position.

Fig. 3 shows, in connection with the above general arrangement, an electrical method of control. The operating shaft (S), which we assume operated the reversing switch (M), instead of being connected by cables to a lever or mechanical controlling device, has keyed upon it the lever (n). To the lever (n), by means of links (f) and (f^1), are attached the cores (F^1) and (F^2) of two solenoids (f^4) and (f^5). These are so set that if core (F^2) is drawn into solenoid (f^4), the shaft (S) will be rocked so as to throw the reversing switch (M) in one direction, while if core (F^1) is drawn into solenoid (f^5), the reversing switch (M) will be thrown in the opposite direction.

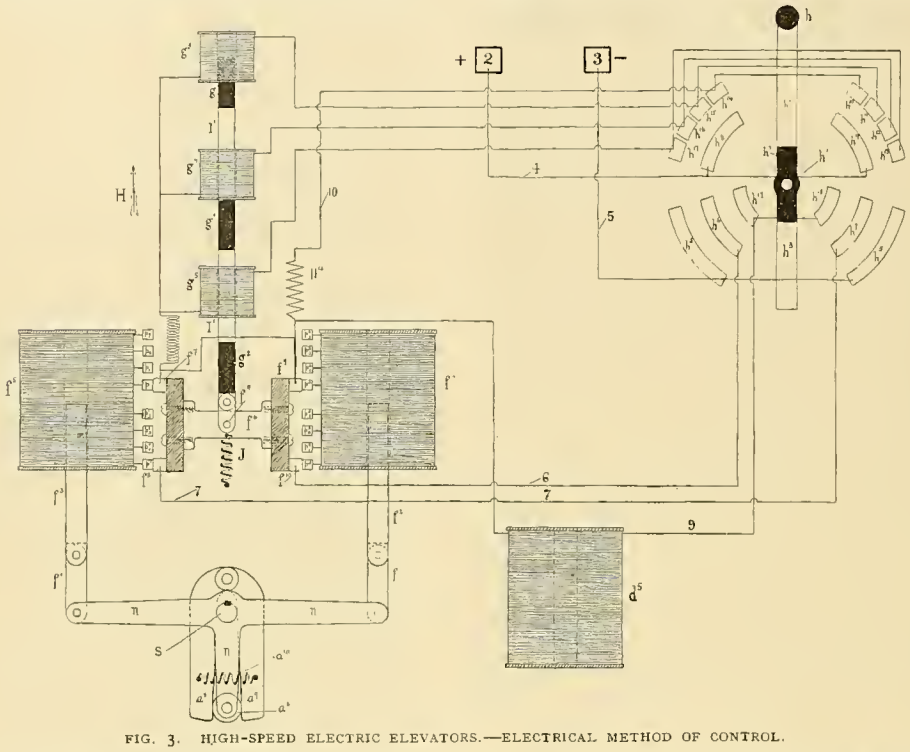


FIG. 3. HIGH-SPEED ELECTRIC ELEVATORS.—ELECTRICAL METHOD OF CONTROL.

The solenoids (f^5) and (f^4) are wound in sections which are connected to terminals or contact plates (p), (p_1), (p^1), ($p^1{}_1$), (p^2), ($p^2{}_1$) and (p^3), ($p^3{}_1$). The terminals (p), (p_1) and (p^1), ($p^1{}_1$) are arranged in a line, while (p^2), ($p^2{}_1$) and (p^3), ($p^3{}_1$) are set in another line, as indicated in the figure. Between the two lines is a cross-head (f^6), carrying insulated plates at each side, upon which are fastened contact plates or brushes (f^7), (f^8) and (f^9), (f^{10}), (f^7), to bear upon terminals (p) (p_1), (f^8) upon (p^1), ($p^1{}_1$), (f^9) upon (p^2), ($p^2{}_1$), and (f^{10}) upon (p^3),($p^3{}_1$), etc. To the cross-head (f^6), by means of link (f^{11}), is attached a line of solenoid cores (g), (g^1), (g^2), insulated magnetically by pieces (I^1) (I^1).

Arranged to act upon the cores (g), (g^1), (g^2), are solenoids (g^2), (g^1), (g^2), set so that when brushes (f^8) and (f^{10}) are set upon the lower indicated terminals (p^1) and (p^2), respectively, the core (g) will be in position to be easily drawn into solenoid (g^2). When core (g) is drawn into solenoid (g^2), then will core (g^1) be ready to be drawn into solenoid (g^4). When core (g^1) is drawn into solenoid (g^4), then will core (g^2) be ready to be drawn into solenoid (g^5).

When core (g) is drawn into the solenoid (g^2), then will the cross-head (f^6) carry the brushes (f^7), (f^8) and (f^9), (f^{10}), to a set of the terminals (p_1), ($p^1{}_1$), ($p^2{}_1$), ($p^3{}_1$), one step away from the position indicated in the figure. This movement will cause a shifting of the magnetic field of the solenoid (f^5) between the brushes (f^7) and (f^8), also a shifting of the magnetic field of the solenoid (f^4) between the brushes (f^9) and (f^{10}).

The controlling switch (h), located in the car, is so designed and connected to solenoids (f^4) and (f^5), (g^3), (g^4) and (g^5) that either solenoid (f^4) or (f^5) may be energized through a resistance (11^a), or any solenoid (g^3), (g^4), or (g^5), at will, according to which way and how far the switch arm (h), (h^2), (h^3) is thrown from the central or "off" position. Suppose the switch arms (h^2), (h^3), which are insulated electrically, but joined mechanically, to be rotated counter clockwise on the pivot (h^1), by means of the handle (h), till the arm (h^2) comes into contact with plates (h^5) and (h^{11}). Then the arm (h^2) comes into contact with plates (h^6) and (h^7). Assuming that (2) and (3) represent line terminals, the circuit will be from (2) by conductor (4) to (h^6), through (h^2) to (h^{14}), thence by conductor (10), through resistance (11^a), to brush (f^7), then to (f^7), terminal (p), solenoid (f^5), terminal (p^1), brush (f^8), conductor (7) to plate (h^7), thence by arm (h^2) to plate (h^6), and by conductor (5) back to (3).

If the arms (h^2), (h^3) are rotated clockwise till the arm (h^2) comes into contact with plates (h^4) and (h^{10}), then the arm (h^3) comes into contact with plates (h^6) and (h^5). The circuit will then be from (2) through conductor to (h^6), through arm (h^2) to plate (h^{10}), then to (h^{14}) and conductor (10), through resistance (11^a), to brush (f^9), by terminal (p^2) through solenoid (f^5) to terminal (p^2), brush (f^{10}), through conductor (6) to plate (h^6), across arm (h^2) to plate (h^5), and by conductor (5) back to (3). If the arm (h^2) comes into contact with plate (h^{15}), then will the circuit be through solenoid (g^3), instead of resistance (11^a), into solenoid (f^5). If the arm (h^2) is moved into contact with plate (h^{11}), the circuit will be through solenoid (g^3), instead of resistance (11^a), but into solenoid (f^4), instead of solenoid (f^5). If the arm (h^2) is moved into contact with either plate (h^{16}) or (h^{12}), the circuit will be through solenoid (g^4), into either solenoid (f^5) or (f^4), respectively. If the arm (h^2) is moved into contact with either plate (h^{17}) or (h^{13}), the circuit will be through solenoid (g^5), into either solenoid (f^5) or (f^4), respectively.

By increasing the number of terminals of the solenoids (f^5) or (f^4), together with the number of solenoids (g^3), (g^4), (g^5) and the number of the plates of the controlling switch (h) a greater number of speeds between the lowest and highest limits can be obtained. The resistance (11^a) is practically equal to the resistance of any solenoid coil (g^3), (g^4), or (g^5). The strength of solenoids (g^3), (g^4) and (g^5) is only that required to move the cross-head (f^6) in the direction of the arrow (H) against a spring (J), the spring being used to return the cross-head to its initial position, as shown, when the solenoids (g^3), (g^4) and (g^5) lose their magnetism.

The operating shaft (S) of the elevator-machine controller is brought to the central or "off" position by the spring (a^{10}), acting through lever (n) and roller (a^8), and the links (a^9), (a^9), whenever the solenoids (f^5) and (f^4) lose their magnetism.

If a brake is used which is released magnetically and applied mechanically, the solenoid or magnet may be connected between the brush terminal (f^9) on the cross-head (f^6), and the plates (h^{15}), (h^{10}), on the car switch (h). It is simpler and more economical in the consumption of current, however, to use a brake, which is operated mechanically from shaft (S). The power required to operate the brake is thus offset or balanced in large measure by the power required to operate the starting switch of the controller in case the starting switch is controlled by the cam and roller method.

The shifting of the magnetic field in either solenoid (f^5) or (f^4) by the movement of cross-head (f^6) therefore determines the position of the cores (f^5) and (f^4). Thus the controller shaft (S) is operated at will for either direction of running, by means of one or the other of the two solenoids (f^5) and (f^4), through the same set of solenoids (g^3), (g^4) and (g^5). This arrangement allows of ample speed variation, while it requires no pilot motor, and the changes in speed are effected by the use of a very small number of electromagnets. With this method of electrical control, there is only one large solenoid (f^5) or (f^4), together with one small solenoid (g^3), (g^4) or (g^5) in circuit at any one position for running. This means a small consumption of energy for the controlling device, the amount being very little more than that taken by the solenoid of an ordinary magnetically released elevator brake. Most other devices for electrical control consume energy in a brake solenoid in addition to that used for operating the controller or starting switches. A controlling method which employs a starting resistance in the armature circuit, together with a commutated series field winding on the motor, when arranged with the right proportions of each, gives probably the best all-around running economy and efficiency of service.

[*To be concluded next week.*]

Storage-battery Plant of the Kansas City Electric Light Company.

When the reconstruction of the plant of the Kansas City Electric Light company, now in progress under the direction of Mr. R. E. Richardson, is completed, the old Edison station at 604 Wall street will be a rotary-converter and storage-battery substation. The storage battery and a new marble switchboard are now installed, and this part of the plant is worthy of attention, as it is the latest and one of the largest storage-battery installations west of the Mississippi River. The cells were made, placed in position and connected up by the Helios-Upton company of Philadelphia and Chicago, and this fact adds interest to the plant, as the equipment constitutes the first large stationary battery to be installed by this company.

The general appearance of the battery room is shown in Fig. 2. This room is on the second floor of the building and is 75 feet square. The cells are arranged in two series of 70 cells each, and each cell contains 20 positive and 21 negative plates, each nine inches wide and 14½ inches high. The old floor of the battery room is of iron and concrete construction. On top of this was laid a covering of sand and cement, two inches thick at the sides and arranged to slope from all sides to the center, where a drain connects to the sewer in the street. Over this sand and cement there is a layer of sheet-lead, three-sixteenths inch thick, and weighing 12 pounds to the square foot. This is turned up at the sides, making a leaden pan 75 feet square and one foot deep.

The battery is capable of discharging 2,000 amperes at a 400-ampere rate for five hours. In one hour it can discharge 800 amperes. It is charged by a set of Edison bipolar dynamos at a rate of 300 amperes at 175 volts. These dynamos are so connected that they may be thrown either on the outgoing feeders or on the battery, as occasion may require. The battery is used to take the peak of the load on this station and has already demonstrated its usefulness in this service.

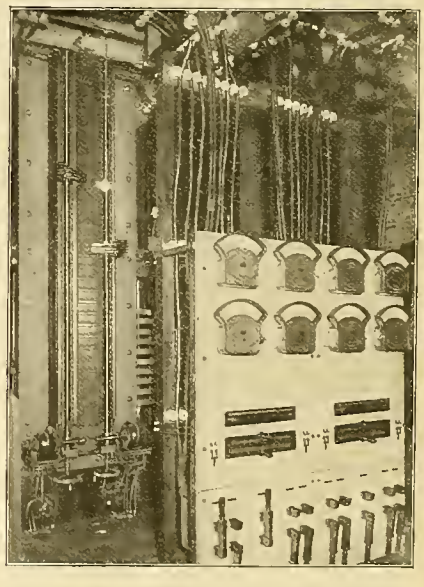


FIG. 1. STORAGE-BATTERY PLANT OF THE KANSAS CITY ELECTRIC LIGHT COMPANY — END-CELL SWITCHES AND SWITCHBOARD.

In Fig. 1 are shown the new switchboard and two of the vertically disposed end-cell switches. The end-cell switches were especially designed for this plant by Thomas Spencer, general superintendent of the Helios-Upton company. There are two sets, one for each series of cells, and each set consists of duplicate switches arranged for hand regulation or automatic motor operation. Each series of cells is controlled through 20 end cells,

and each end-cell switch is arranged to provide for 30 cells. All battery connections are made with heavy lead-covered copper bars, three-eighths by two inches in section. The end-cell switches are connected to the main switchboard by 1,000,000-circular-mil cables, and the cable leads to the outgoing circuits are of the same size.

Vermont marble is used for the switchboard, which is seven feet eight inches high, six feet wide and 2½ inches thick. The instruments are of the Weston illuminated-dial pattern. There are four ammeters, with a charge and discharge range of 0 to 1,000 amperes. Two voltmeters read up to 150 volts, and two others range from 0 to 5 volts for measuring the potential of end cells. Switches for controlling the motors of the end-cell switches are mounted on the board, and there are also an indicator to show how many end cells are in service and a sliding scale used in testing the voltage of end cells.

FIG. 2. STORAGE-BATTERY PLANT OF THE KANSAS CITY ELECTRIC LIGHT COMPANY.

The entire equipment is up-to-date and well constructed. It was installed under the direct supervision of George E. Brett of the Helios-Upton company, and will be in charge of C. H. Tinklepaugh, superintendent of the station.

Permanent Automobile Exhibition in Berlin.

American automobile manufacturers will be interested to learn that there has been organized in Berlin a permanent exhibition of automobiles, which will offer exceptional facilities for the motor-vehicle builders of all countries to bring their products before the people of Germany under highly advantageous conditions and at a minimum cost. The association includes among its founders several prominent capitalists and business men of Berlin, and its purpose is not to make money, but to provide a permanent, legitimate basis of encouragement to the motor-vehicle industry in Germany and to automobilism as an adjunct of sport, business and recreation. The managers of this enterprise realize fully that German manufacturers are as yet in some important respects behind those of France and the United States; they appreciate the advantages that will result from bringing the leading motor vehicles of all countries into practical, side-by-side competition, and they therefore offer to foreigners and their machines precisely the same privileges and conditions that are vouchsafed to those of their own country.

The association is a limited stock company, entitled "Die Automobil Ausstellung," with offices at No. 6 Dorotheen Strasse, and exhibition grounds and driving school on Georgen Strasse, Berlin. The space for permanent exhibits includes 1,200 square meters (12,902 square feet), with offices and all the features of a well-arranged exposition. Floor space will be rented to exhibitors at a uniform half-yearly rate, this being the only expense involved. An illustrated catalogue of all exhibits will be issued and corrected from time to time, so as to include new articles received for display. The public will be admitted gratis to all parts of the exhibition, which will thus become a permanent, open, international business display of motor vehicles and parts and materials pertaining thereto.

The Imperial Physico-technical Institution in Charlottenburg.[1]

By Henry S. Carhart.

I. Historical.

Through the courtesy of Professor Kohlrausch, president of the Reichsanstalt, and the Curatorium or governing body of the institution, the writer was accorded the privilege of working in the Physikalisch-technische Reichsanstalt as a scientific guest during the last few months of 1899. An unusual opportunity was thus afforded of learning rather intimately the methods employed and the results accomplished in this famous institution for the conduct of physical research, the supply of standards, and the verification of instruments of precision for scientific and technical purposes.

It is well known that the Reichsanstalt is situated in Charlottenburg, a suburb of Berlin, just beyond the renowned Thiergarten. The buildings occupy an entire square, the larger part of which, valued at 500,000 marks, was the gift of Dr. Werner Siemens. In making this gift, which was offered in land or money at the option of the government, Dr. Siemens declared that he had in mind only the object of serving his fatherland and of demonstrating his love for science, to which he avowed himself entirely indebted for his rise in life. The gift was made as a stimulus to the government to establish an institution for physical research. The kind of institution desired had been amply described in suitable memorials prepared by himself, Professor von Helmholtz and others of scarcely less distinction. The first memorial bears date of June 16, 1883. It relates to "The Founding of an Institution for the Experimental Promotion of Exact Natural Philosophy and the Technical Arts of Precision." It points out the need of such an institution, details the benefits likely to accrue from it, lays great stress on the intimate relation existing between scientific investigations and their application in the useful arts, and sets forth somewhat in detail a plan of organization. The memorialists had in mind at that time a "Physico-mechanical Institution," but in a memorial of the following year (March 20, 1884) the title was changed to the one which the institution now bears—"Physikalisch-technische Reichsanstalt." From this second memorial it is learned that the first steps toward the furtherance of exact science and technical precision in an institution to be founded and maintained by the state were taken as early as 1872. This movement had the support of the crown prince, the late Emperor Frederick, and the matter was taken in hand by Count von Moltke as chairman of the Central Bureau for Metrology in Prussia. He called together a commission near the end of the year 1873, and in the following January this commission reported a series of propositions for the improvement of the scientific, mechanic arts, and of instruments of precision. These propositions formed the foundation for a memorial on the same subject to the Chamber of Delegates of the Prussian government in 1876. The result was that appropriate rooms were set aside in the new building of the Technical High School in Charlottenburg for the organization of an institution for the cultivation of the arts of precision.

The general plan of the Reichsanstalt was adopted in 1887, and an appropriation of 868,254 marks was made and spread over the budget for three years. The main building for the first or scientific division was completed in 1893. The second or technical division was housed in a portion of the Technical High School till the buildings for this division were completed in 1897. All departments of activity of the Reichsanstalt are now accommodated on the square facing on March Strasse in Charlottenburg. They include the division for pure scientific research, mechanical measurements of precision, electrical measurements and instruments, the measurement of large direct and alternating currents and electromotive forces, the optical department, the department of thermometry, the department of pyrometry and the department of chemistry.

To these as auxiliaries should be added the power plant and the workshop.

II. Organization.

The two divisions into which the Reichsanstalt is divided correspond to the two paramount objects which the founders had in view, viz., research in pure science, and the cultivation of precision in the technical applications of science. The same idea is embodied in the very name of the institution—The Imperial Physico-technical Institution. If the sole purpose of the Anstalt had been the promotion of improvements in the mechanic arts, in engineering and in instruments of precision, the first or scientific division would still have been essential to secure the ends sought. All the applications of science rest on the foundation of pure scientific discovery. The creation of new and improved methods and instruments for physical measurements requires the most exhaustive and painstaking investigations as a preliminary to a steady and confident advance. The practical value of research in pure science is no longer in question. The wise founders of the Reichsanstalt made no mistake in coupling an institution for the promotion of technical precision with one for the prosecution of research in physical science.

The governing body or curatorium of the Reichsanstalt is appointed by the emperor. At its head is Herr Weymann, imperial privy counselor. The function of the curatorium is the appointment of the officials and the general management of the institution. The chief officer of the Reichsanstalt is the president, and the most distinguished physicist of the realm is sought for this position. Helmholtz was taken from the university in Berlin to become the first incumbent of the office; after his death in 1894, his successor as professor of physics in the university, Professor F. Kohlrausch, became his successor as president of the Reichsanstalt.

The president, who is at the same time director of the first division, is held responsible for the successful work of the Reichsanstalt. All other officials are therefore subordinate to him. In his absence the duties of his office devolve upon the director of the technical division. Subordinate to the director of this second division are the professors, associates and assistants of various grades. A professor in charge of a department has the direction of all those employed in it, including a skilled departmental mechanician.

The specific duties of the president may be briefly enumerated. He must lay before the Curatorium at its annual meeting the following:

1. A report on the work executed in both divisions.

2. The plan of work for the undertakings to be carried out the ensuing year.

3. Propositions relative to the money to be expended for scientific and technical work; also for salaries and remunerations.

4. Propositions relative to the rank of permanent associates and assistants; also relative to the bestowal of places to work in the Reichsanstalt as scientific guests.

He takes a vote on the propositions in (3) and (4), and reports the conclusions of the Curatorium to the government for approval. It is also the duty of the president to sign vouchers for all payments, and he is held responsible for the proper expenditure of the money appropriated for the maintenance of the institution.

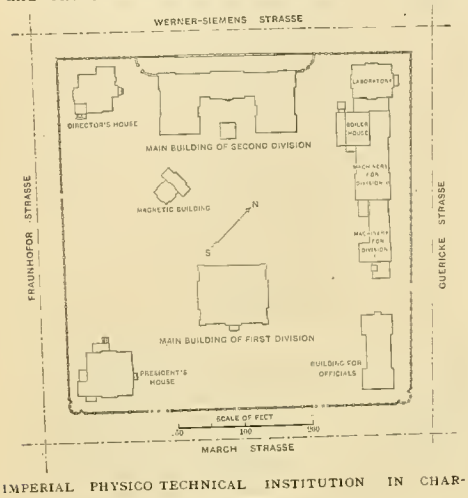
The different functions of the two divisions composing the institution are defined in rather broad terms. It is the duty of the first division to carry out physical investigations requiring more uninterrupted time on the part of the observer, and better accessories in the way of instruments and local appliances, than private individuals and laboratories of institutions for teaching as a rule can offer. These investigations shall be carried out partly by officers of the Anstalt and partly, under their oversight, by scientific guests and voluntary workers. By scientific guests in general are meant the holders of scientific positions in the German empire, who wish to prosecute scientific researches, the plan of which they have submitted, and for which they have not at home the necessary appliances. They must be recommended by the state in which they reside and must be accepted by the Curatorium.

Young men may be accepted as voluntary workers who have proved their ability by scientific publications. They will undertake researches which have been determined upon by the Curatorium or the director, or they may investigate subjects which they themselves suggest, and which appear to the director to be practicable and worthy of execution. The scientific results obtained must be published only at the discretion of the authorities of the institution,

1. Paper presented at the meeting of the American Institute of Electrical Engineers, New York, September 26, 1900. Dr. Carhart is professor of physics and electrical engineering in the University of Michigan.

who reserve also the right to publish them in the researches of the Reichsanstalt. Provision is made that voluntary workers shall not use the institution for private ends nor to obtain patents.

The second division of the Reichsanstalt is placed under a director, who is subject to the higher authority of the president. Such a director was considered necessary on account of the special work of this division, as well as because of the intimate relations into which it is brought with many persons engaged in industrial pursuits. He should, therefore, not only be a scientific man, but should at the same time have some technical knowledge of the applications of science. Under the director are placed the permanent heads of the subdivisions of the technical department, one having the oversight of thermometry, one of optics, two of electricity and one of mechanical measurements of precision.



IMPERIAL PHYSICO TECHNICAL INSTITUTION IN CHARLOTTENBURG.

Along with these and of the same rank and compensation is the director of the workshop. Under him at present are eight mechanics, and the shop is provided with the finest tools for the execution of the most exact work required by the institution. For example, it has a circular dividing engine that cost $2,500. The founders of the Reichsanstalt foresaw the necessity of such mechanical aids for the furtherance of the exact work to be undertaken. They wisely concluded that such special constructions and new types of instruments as they might require from time to time could be more conveniently and more cheaply built in their own shop than by private instrument makers.

III. Cost and Maintenance.

[The author gives the official accounts of expenditures for the grounds, buildings, furniture and instruments for the two divisions, as well as the yearly expenses. These detailed figures are here omitted.]

The receipts for calibrating instruments, testing materials, verifying standards and the like now amount to about 40,000 marks annually. This sum should be deducted from the yearly expenditures, leaving a net sum of about 30,000 marks.

In round numbers, the Reichsanstalt has cost $1,000,000, and the annual appropriation for its maintenance is $75,000.

IV. Results.

A very pertinent inquiry is, What are the results of all this expenditure? Might not more good be accomplished by state aid to some existing technical school or university? The results attained must be set by the side of the objects which the founders of the institution had in view in order to ascertain whether the sequel has justified their predictions. In the memorials, to which reference has already been made, Professor von Helmholtz and Dr. Werner Siemens pointed out the advantages likely to accrue to Germany from the maintenance of an imperial institution for research, which should at the same time assume the cognate function of fixing and certifying standards of mechanical and physical measurements. Attention was drawn to the fact that other countries, notably England, had enjoyed great renown in science because of the brilliant researches and discoveries of some of her scientific men, who had the good fortune to be possessed of leisure and large private means, and the scientific spirit to devote them to investigations demanding both as a sine qua non.

These conditions, the memorialists declared, were lacking in the fatherland. Her scholars who had the enthusiasm and the capacity for exact scientific investigation possessed neither the private fortune to devote to it, nor the uninterrupted time for the execution of the work. They were to be found among the men engaged in teaching, but their professional duties absorbed their time to such an extent that only an inadequate residue remained; and even that little was divided into fractions too small to admit of the sustained and continuous attention which any important investigation demands.

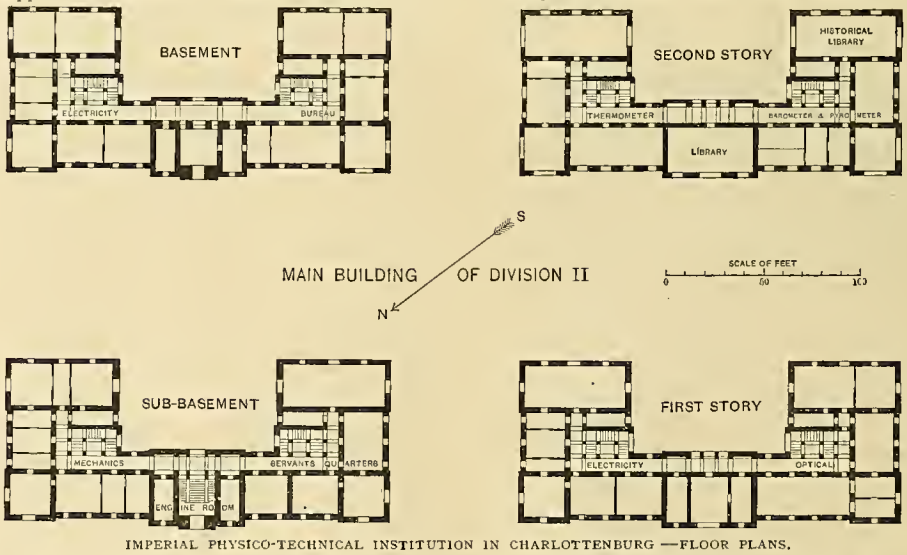
It was further pointed out that if the government would supply the conditions favorable to scientific discovery, the men could be found whose work would reflect great credit on the state, while the interaction between pure science and its applications to arts and manufactures would put Germany in the forefront of scientific renown and of the intelligent application of science to useful purposes.

It was further urged by von Helmholtz that the brilliant investigations of Regnault and other French physicists many years ago should now be repeated with the superior methods and instrumental appliances available at the present time. These investigations drew the attention of the scientific world to France and made it the focus of scientific interest. Her instrument makers, even up to the present, have reaped a rich reward in foreign orders for instruments made eminently desirable and almost indispensable by these distinguished French investigators.

Others problems, too, needed solution, problems forced to the front by modern requirements and discoveries. The applications of electricity, for example, present new questions for science to answer, while the interests of the consumer at the same time call for some form of control by the state of the instruments employed in fulfilling contracts. The very units in which such measurements are made need to be authoritatively settled—a task demanding the highest manipulative skill in experiment and the most refined appliances which experience can suggest and money purchase.

The German government admitted the force of these considerations and made splendid provision, both for pure science and its technical applications, by founding the Imperial Institution at Charlottenburg. The results have already justified in a remarkable manner all the expenditure of labor and money. The renown in exact scientific measurements formerly possessed by France and England has now been largely transferred to Germany. Formerly scientific workers in the United States looked to England for exact standards, especially in the department of electricity. Now they go to Germany. So completely has the work of the Reichsanstalt justified the expectations of its founders, and so substantial are the products of this already famous institution that other European nations are following Germany's example. Great Britain has already made an initial appropriation for a National Physical Laboratory, to be organized on a plan similar to that of her Teutonic neighbor. Mr. R. T. Glazebrook, who has long served as secretary of the electrical standards committee of the British Association for the Advancement of Science, has been appointed director and has entered on his duties. The new institution will absorb the old Kew Observatory, and other buildings will be added at once for the extension of the functions of this observatory, so as to include the larger enterprise contemplated in the establishment of the new National laboratory.

Russia, also, has a number of large and well-equipped laboratories in connection with her Central Bureau of Weights and Measures. One of these is devoted to the verification of instruments for electrical measurement. It employs 14 men, and the budget is about $45,000 per annum.



IMPERIAL PHYSICO-TECHNICAL INSTITUTION IN CHARLOTTENBURG —FLOOR PLANS.

France is also moving in the same direction. The great service of France in fixing standards of length and mass has long been freely recognized by the civilized world. But her national bureau for this purpose is now considered to be too limited in scope to solve the new problems presented. Quite recently a committee of learned men from Paris, under the leadership of Minister Bourgeoise, visited Charlottenburg for the purpose of examining into the working of the renowned institution located there. Professor Violle, one of the most illustrious physicists of the French capital, accompanied the committee. What better evidence of the success of Germany's great institution can be demanded than the consensus of favorable opinion among those best qualified to judge that its fruits are already of the highest order of merit, and its imitation by other European nations—the sincerest form of flattery.

It would not be just to form an estimate of the success of the Reichsanstalt without taking into account is scientific publications. These are numerous and of great value. Most of the reports of work done are made public with official sanction in various scientific and technical journals. During the past year 30 such papers have been published. The detailed accounts, however, of the most important undertakings thus far completed are contained in three quarto volumes of investigations. Among those contained in the first two volumes may be mentioned papers pertaining to thermometry and to units of electrical resistance.

The investigations in thermometry comprise such topics as the influence of gases on the indications of the mercurial thermometer, division of the thermometer and determination of the errors of division, determination of the coefficient of outer and inner pressure, determination of the mean apparent coefficient of expansion of mercury between 0° C. and 100° C. in Jena glass, and investigations relating to the comparison of mercurial thermometers.

Four papers of exceptional value relate to normal standards of electrical resistance. They are, the probable value of the ohm according to measurements made up to the present time, the determination of the caliber correction for electrical resistance tubes, the normal mercury standard ohm, and the normal wire standard ohm of the Reichsanstalt. When one recalls that the ohm as a practical unit of measurement is defined in terms of the resistance of a specified column or thread of mercury, it will readily be seen that the work done at Charlottenburg in this particular field is fundamental in character and of the most universal importance.

In passing, it is worthy of remark that all the standard resistances designed and constructed at the Reichsanstalt are carefully compared with the mercurial standards early in each year. This custom is in accordance with the action taken by the electrical standards committee of the British Association at Edinburgh, in 1892, when the mercurial standard was definitely adopted. At this meeting of the committee, representatives of American, French and German physicists (including von Helmholtz) were invited to sit as members. The methods employed in these comparisons and the forms of the standards are original with the Reichsanstalt. The new forms and methods admit of a combined accuracy and convenience not previously attained.

In addition to the work done in electrical resistance, the investigation of the silver voltameter and the electromotive force of standard Clark and Weston cells has been highly productive of useful results for the other two fundamental electrical measurements. Much remains to be done in this latter direction, for the electromotive force assigned to the Clark and the Weston cell, even in the latest report of the Reichsanstalt, is derived from measurements by the silver voltameter, while the electrochemical equivalent of silver is in doubt to a greater extent than the electromotive force of the Clark cell.

Perhaps the best indication of the valuable work of the Reichsanstalt is to be found in the annual "Thätigkeitsbericht." This report of the year's activity is published in the "Zeitschrift für Instrumentenkunde," and the reprint for 1899 forms a pamphlet of 25 large, closely printed pages. The following abstract will convey some impression, though an imperfect one, of the extent of the work accomplished:

First (Physical) Division.

I. Work in Heat: Determination of the density of water between 0° C. and 40° C.

Determination of the pressure of water vapor at low temperatures.

Determination of the pressure of water vapor near 50° C.

Investigation of thermometers for temperatures between 100° and 200° C.

Investigation of the nitrogen thermometer with a platinum-iridium bulb for very high temperatures.

Investigation of thermometers for low temperatures.

Determination of the thermal and electrical conductivity of pure metals.

(These determinations are to be extended down to the temperature of liquid air and up to 1,000° C.)

Investigations with the Fizeau-Abbe dilatometer.

Investigation of the transmission of heat through metal plates.

II. Work in Electricity: Comparison of the normal wire resistances of Divisions I. and II.

[*Continued on page 289.*]

Large Helios Unit at Paris Exposition.

Some of the largest engines have been exhibited at the Paris Exposition this year that have ever been erected at any international exposition, and much larger than will probably be shown again in some years. At the Pan-American Exposition at Buffalo next year large high-power engines and direct-connected generators will be conspicuous by their absence. Niagara power will be the great attraction, and large-engine builders will not go to the expense that foreign manufacturers have at Paris. The 3,000-horsepower, horizontal engine operating the Helios three-phase generator (Fig. 1) is a good example of the high-power engines in use in Europe in many central stations. At Cologne the central station is equipped with six such units, and several are used for lighting the Kiel or Kaiser Wilhelm Canal and the city of Rosenheim, in Bavaria. The illustration (Fig. 2) gives a view between the cylinders of the Helios engine and shows the columns and levers for the valves and switches. This unit was illustrated and briefly mentioned in the Western Electrician, May 19th last, and a more detailed account will be of interest now.

This engine and dynamo are the most powerful of all that are doing active work in the exhibition. The relative size may be judged from the accompanying pictures. The distance from the lowest point in the foundation to the highest point is 13 meters, or nearly 44 feet, a height equal to that of a two-story house. The dimensions are greater than those of any former execution, as the largest machines of this type that have been furnished so far are those for the electric station of Cologne, which have a flywheel diameter of eight meters, or 26 feet. As in former constructions, the dynamo has been coupled directly to the shaft of the steam engine in such a way that the magnet wheel of the alternator forms the flywheel of the steam engine. The latter has been furnished by the Vereinigte Maschinenfabriken of Nuremberg and Augsburg. The steam used to drive these and other Helios units is taken from a battery of five boilers furnished by German makers. The total water-covered heating surface of these boilers is about 1,000 square meters, or 10,760 square feet.

About 800 cubic meters, or more than 28,000 cubic feet, of masonry and cement was required for the foundations of this large dynamo. To enable the erection of the machine, a special traveling crane was required, as even the largest crane of the exhibition was unable to handle the masses of the machine.

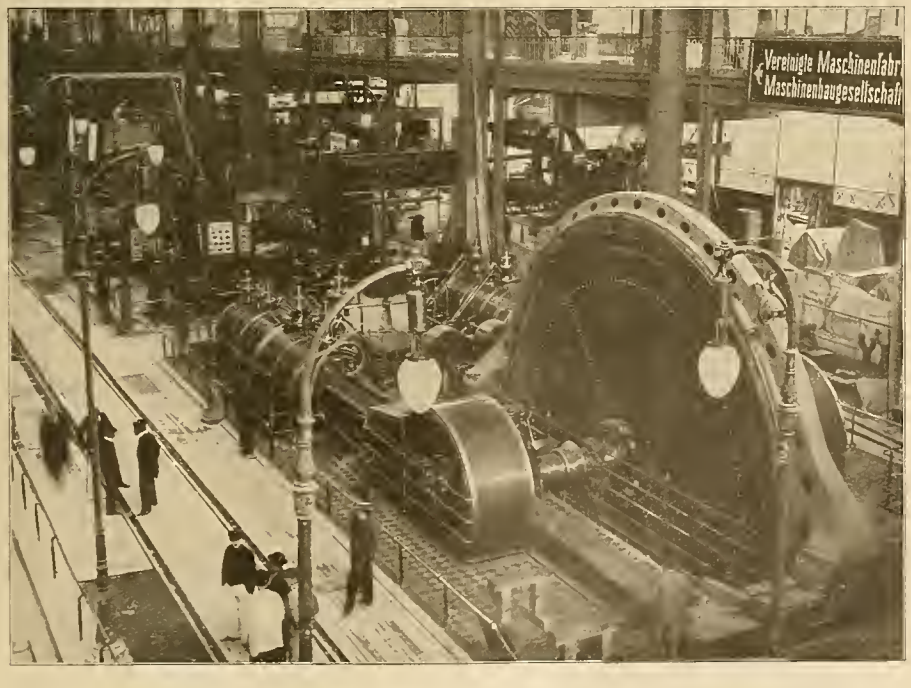


FIG. 1. LARGE HELIOS UNIT AT PARIS EXPOSITION.

In this dynamo only a revolving magnet wheel and a stationary ring are to be seen, the latter bearing the armature coils on its interior circumference. The magnet wheel produces during its revolution single-phase and three-phase currents simultaneously in the windings of the static ring. This arrangement has been chosen, as it is necessary for many practical cases to employ these two kinds of current simultaneously, or side by side. The number of revolutions is 70 a minute, the weight of the dynamo is 50 tons, the pressure is 2,200 volts and the output is either 2,000 kilowatts, single-phase current, or 3,000 kilowatts, three-phase current, or 1,200 kilowatts, single-phase current, and 1,500 kilowatts, three-phase current, simultaneously. This dynamo represents a new type of the Helios company, which, by simply increasing the width and without any increase in the diameter of the rotor or stator, allows an increased output. The total weight of the dynamo is 350,000 kilogrammes or 772,000 pounds. It contains, in spite of its great dimensions, only two bearings.

Another striking feature of the unit is the absence of any switchboards or marble slabs with switching devices in the neighborhood of the dynamo. Of course, such switching devices are necessary to provide for the switching, but a special arrangement was made by the Helios company. The intention was to make the mechanisms to be handled by workmen as simple as possible, so as to give the work-people confidence in the work they have to do. Instead of a complicated switchboard, there is only a column between the two large cylinders of the steam engine. This column is arranged near the steam valves, and contains a gear wheel and two hand levers. Two other columns have been placed near it, one containing the electrical, the other the mechanical, instruments which serve for the regulation of the whole engine, the electrician and the engineer standing side by side in controlling their machines.

The whole arrangement is constructed in such a way that any fault in the levers or the dynamo does not allow the connection to be made, but causes the levers to spring off the contacts automatically. In this way safety is secured and risk of fire is reduced to the minimum. P.

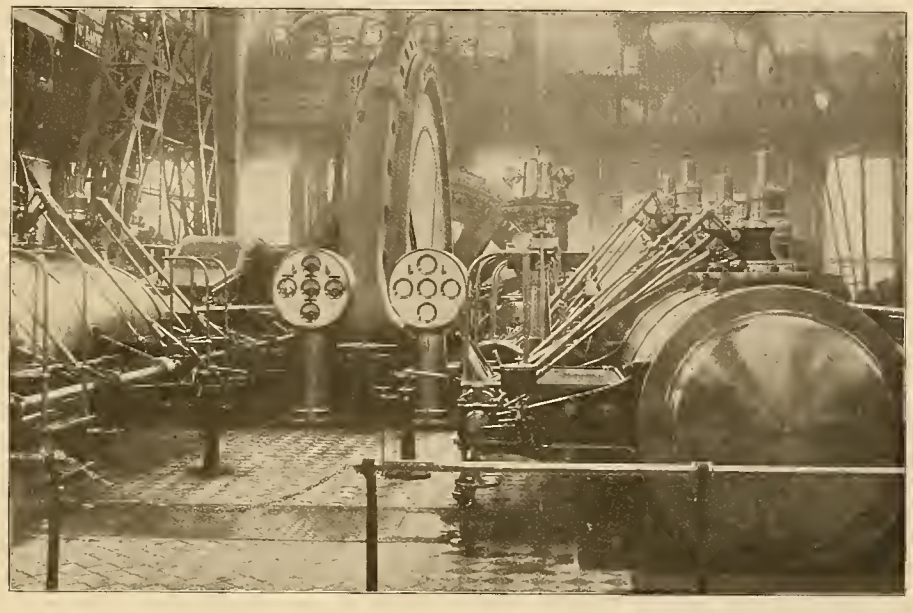


FIG. 2. LARGE HELIOS UNIT AT PARIS EXPOSITION.—VIEW BETWEEN ENGINE CYLINDERS SHOWING VALVE MECHANISM.

A Cadmium Accumulator.

A cadmium accumulator has been brought out in France by Commelin and Viau. The positive electrode has been constructed with the view of reducing the weight to a minimum, but is essentially like that of ordinary accumulators, its active material being lead peroxide.

The negative electrode is composed of a sheet of insulating material, generally celluloid, completely covered with a sheet of lead 0.25 millimeter thick. On both faces of the plate thus given a series of parallel shelves or cleats are fastened, one centimeter wide and eight millimeters apart. These strips are to prevent particles of cadmium, loosened from the face of the electrode, from falling to the bottom of the cell. The negative plate thus prepared is placed in a bath of sulphate of cadmium and a layer of finely divided metallic cadmium, deposited upon the lead electrolytically. Negative electrodes have also been made of carbon, in place of lead, with good results.

During the discharge the positive electrode behaves as in an ordinary lead accumulator; the peroxide of lead is reduced, but the cadmium on the negative electrode is transformed into sulphate of cadmium, which is soluble in the electrolyte. In charging, these actions are reversed. It seems that the deposit of cadmium is absolutely insoluble in the liquid. The two positive plates are placed close to the edges of the shelves on the two faces of the negative plate, with a sheet of perforated celluloid separating them.

The maximum electromotive force of the cell is stated to be 2.30 volts. This voltage is held during the discharge to a remarkable degree. A cell charged for 100 ampere-hours showed two volts after 93 ampere-hours' discharge; the potential then fell to 1.2 volts at the end of 96 ampere-hours.

A great feature of the cadmium cell is its ability to be discharged completely without sulphation of the positive plate; the negative plate will be completely dissolved first. Moreover, the potential drop is gradual, and, unlike that with lead accumulators, gives ample warning of the battery's exhaustion. This property will appeal especially to automobilists.

Tests have shown the efficiency of the battery, unfortunately, to be poor, but this fault seems due to imperfection of the present construction merely, since the reaction is the same on the positive plate as in the lead accumulator, and that on the negative plate has an efficiency of almost 100 per cent.

The total weight of an 80-ampere-hour cell is given as 5.645 kilogrammes (12.41 pounds).

American Equipment Needed in Paris.

Already the Metropolitan Underground Railway company of Paris has begun to discard French equipment for American apparatus. M. de Griegge, the engineer who built the line and who passed six years in the United States investigating American methods of electric traction, has reached the conclusion that the equipment should actually be made in America, instead of having the appliances built in France after American ideas. To start the reconstruction Milwaukee air brakes are supplanting Soulerin's French air brakes, which have been found noisy and cumbersome, and of insufficient power. Owing to the restrictions in the French law which prohibits the installation of mechanical devices of foreign patent, unless they have been manufactured in France, the Metropolitan company has had to secure a special dispensation from the government before the American brake could be bought. The next move that the road is likely to make in the way of Americanizing its plant will be the adoption of the multiple-unit system for motor cars.

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CONVENTIONS AND EXPOSITIONS.

Automobile Shows, New York, N. Y., November 3d to 10th and November 10th to 24th.

Illinois State Electric association, Peoria November 27th.

National Automobile and Sportsman's Exhibition, Washington, D. C., December 10th to 15th.

Roentgen Society of the United States, New York, N. Y., December 13th and 14th.

Electrical power transmission is comparatively new in India, but two or three projects of considerable magnitude now under way show that the capitalists and engineers interested in the development of England's great Asiatic colony are awakening to the possibilities of utilizing the power of rivers and watercourses at a distance. One installation of large size, in which power is to be electrically transmitted 93 miles for use in gold-mining operations, is described in this issue. This will rank with the longest of the electrical power-transmitting lines of the world, and the engineering details seem to have been carefully worked out. It is gratifying, also, to note that all the electrical apparatus will be furnished by an American manufacturer.

Mr. Cochrane's paper on high-speed electric elevators, which is begun in this issue of the Western Electrician, is a valuable contribution to the literature of the subject. The topic is a timely one, owing to the increasing use of high-speed electric elevators for passenger service in the newer high office buildings. The body of the paper is taken up with a comprehensive description of the reversing, starting and commutating mechanisms used with a compound motor, and also, in connection therewith, of an electrical method of control. Of the three types of elevators described—the winding-drum, traveling-nut and multiple sheave, and double-motor continuously running cable machines—the author places the general economy of operation of the first-named far in advance of the others. He thinks that the winding-drum mechanism, with proper care given to details of construction, ought to fulfil all reasonable requirements for high-speed service and at a decided economy over any other known form of elevator mechanism.

But little has been heard of Professor Elisha Gray's telautograph in this country of late, but in England, under the auspices of the British Telautograph company, Foster Ritchie has made some improvements which are said to simplify the machine greatly and to add to its effectiveness. The great objections to the original telautograph, as exhibited at the World's Fair in Chicago, were the complication of the delicate parts and the number of wires required as conductors. By the recent improvements but two line wires are needed, if a grounded return be employed. The writing is done on a roll of paper five inches wide, with an ordinary pencil, the movements of which cause variations in the strength of current that is sent through the line wires. These varying forces cause the receiving pen to take up motions as imparted to the pencil, but the arrangement is such that corrections, drawings, shorthand and all kinds of messages are within the power of the machine. The received message is written in ink upon a similar roll of paper, which can be readily cut off. The telautograph was always a most ingenious and interesting machine, and if it has been improved so as to be commercially useful over considerable distances it will no doubt make a place for itself, for by its means facsimile written messages and even outline pictures may be electrically transmitted.

One result of Professor Carhart's year abroad is an interesting paper, read before the American Institute of Electrical Engineers, descriptive of the famous Reichsanstalt, or Physico-technical Institution, of Berlin. This paper is printed in this issue of the Western Electrician and deserves the attention of all interested in electrical measurements and standards. It is particularly apropos at a time when an effort is making by the Treasury Department to secure the establishment by Congress of a National Standardizing Bureau.

Dr. Carhart tells of the work already accomplished and now in way of accomplishment by the Reichsanstalt and truly says that it is the pinnacle of Germany's scientific edifice. He remarks that one of the most potent factors in the notable industrial advance in Germany is the alliance between science and commerce existing in that country. Therefore, it needs no great acumen to perceive that the Reichsanstalt has "paid" in the most materialistic sense. In addition it has contributed in a marked degree to pure scientific research and consequently to the prestige of Germany among the scientific men of all the earth. Many nations, the United States among the number, are indebted to the Charlottenburg institution for standards and comparisons, and the obligation is gratefully acknowledged; but it is time that this country should verify its units of measurement at home, and this end can be attained by the establishment of the National Standardizing Bureau—a project which the Western Electrician has already warmly commended.

While many enlightened electric-light men advocate uniform accounts, open to the public, as an antidote for the municipal-ownership agitation, some of the gas men—what proportion of the whole number of managers we do not know, but probably a small one—go a step farther and urge governmental control of the price of gas. Mr. Alfred E. Forstall of Montclair, N. J., read a paper on this subject at the meeting of the American Gas Light association at Denver last month, and he stated his reasons for grappling with the question fearlessly in the following terms:

The right of public control of the price of gas exists and inaction on our part will not prevent either its application or the discussion of the form in which it shall be applied. Would it not be well for us, therefore, to recognize the trend of events and, instead of obstinately resisting that which we cannot prevent, endeavor so to guide legislative action as to secure a system of control that shall be to our advantage as well as that of the public? Otherwise it is practically certain that we shall have forced upon us, sooner or later, either municipal ownership or a system of control worked out without our aid by men who, though sincere, have no special knowledge of the various conditions affecting the industry which they propose to regulate. It is certainly to the interest of all that gas engineers and managers should take a part in the formation of the laws made to control the business with which they are familiar, and their aid would doubtless be welcomed by those who are sincere in their desire to work out the best possible solution of the problem of public control of gas companies. Imperfect though it may be, any system carefully thought out by a representative body of gas men would be preferable to the present liability to control applied with an entire absence of system, under which regulation is limited to action reducing the price of gas, taken by Legislatures or City Councils, as the case may be, without any examination of the cost of production or of any of the other conditions which must be considered to enable the fixing of a fair price, with the result that the price so fixed is unreasonably low and the courts must be appealed to to save the company affected from having to carry on its business at a loss.

Mr. Forstall recites the systems of governmental supervision in vogue in France, Great Britain and Massachusetts, and thinks the English legislation worthy of consideration for adoption by the states of this country. In Great Britain the control of the supply of gas rests in the hands of the general government. By a sliding-scale system a standard price and a standard dividend are specified. For each increase of one penny in the price of gas above the standard the rate of dividend must be decreased one-fourth of one per cent., while for each decrease of one penny below the standard price the rate of dividend may be increased by one-fourth of one per cent. Practically exclusive rights of supply are given in the territory of each company, and the scheme is worked out with all necessary details, which cannot be given here.

The Western Electrician believes that the salvation of all quasi-public corporations lies in the utmost candor and fairness in dealing with the people, who, in the last analysis, are the masters of the situation and who are gradually giving more attention to the great economic problems which affect the daily life of every citizen. The attitude of the National Electric Light association to this question at last year's meeting in Chicago was commendable. Mere denunciation of municipal ownership will not do; thoughtful men demand proof that the case made out by the municipal-ownership advocates is based on faulty premises and incorrect conclusions. Honest central-station men only ask what their investment of brain and money entitles them to receive and are willing to submit the facts to the public. At first blush the idea of governmental control of the price of electric current is distasteful to American ideas—a seeming interference with the freedom of individual initiative. But it might be possible to devise a system which would safeguard the interests of both the public and the companies, as Mr. Forstall suggests. At any rate, it is wise to consider the matter fairly and temperately, for the whole problem is gradually pressing for a settlement, and central-station men want to see it settled right.

The Imperial Physico-technical Institution in Charlottenburg.

[*Continued from page 286.*]

Determination of the capacity of an air condenser.
Comparison of the standard cells of Divisions I. and II.
Determination of the conductance of water solutions with a higher degree of accuracy than has been attained hitherto, especially with very dilute solutions.
III. Work in Light: Investigation with electrically heated black bodies.
Proof of Stefan's law between 90° and 1,700° absolute temperature.
Determination of the relation between the intensity of light and the temperature.
Measurement of radiation in absolute measure.
Determination of the distribution of energy in the spectrum of black bodies.
Determination of the distribution of energy in the spectrum of polished platinum and other substances; also their reflective power.

SECOND (TECHNICAL) DIVISION.

I. Work of Mechanical Precision: Investigation of the errors of length and of the division of 300 scales, tubes, etc.
Coefficient of expansion of 18 bars, tubes and wires.
Verification of 86 tuning forks for international pitch.
Construction of a new transverse comparator.
Study of the variations of angular velocity of rotating bodies.
II. Electrical Work: Calibration of direct-current apparatus, 183 pieces.
Calibration of alternating-current apparatus, 58 pieces.
Examination of other electrical apparatus, 76 articles.
Examination of accumulators, primary elements and switches, 37 articles.
Examination of insulating and conducting materials and carbons, 23 articles.
Installation of storage cells for a current of 10,000 amperes.
Installation of small storage cells for an electric pressure of 20,000 volts.
Installation of alternating-current instruments for measuring potential difference up to 500 volts and current up to 100 amperes.
Examination of 29 samples of alloys for specific resistance and temperature coefficient.
Examination of 126 samples of insulating materials with an electric pressure up to 800 volts.
Verification of single resistances, 123 samples.
Calibration of 33 resistance boxes, compensation apparatus, etc., containing 1,153 single resistances.
Comparison and verification of 133 standard cells—111 Clark and 22 Weston elements.
Determination of the ratio Clark 15° C. to cadmium 20° C., and Clark 0° C. to cadmium 20° C. with a large number of standard cells.
Examination of 21 samples of dry and storage cells.
Calibration of 15 galvanometers to measure high and low temperatures with thermal elements.
Magnetic examination of 25 samples of iron and steel.
Investigation of the difference between the continuous and the discontinuous magnetization of steel.
Investigation of the influence of repeated heating on the magnetic hardness of iron.
III. Work Relating to Heat and Measurement of Pressure: Calibration of 18,777 thermometers.
Examination of four safety appliances and benzine lamps.
Calibration of 317 thermal elements.
Verification of nine manometers and 22 barometers.
Testing of 190 samples of apparatus for petroleum investigations.
Testing of 3,210 samples of safety rings and plugs.
Testing of 22 samples of indicator springs.
IV. Work in Light: Testing of 149 Hefner lamps for photometric purposes.
Testing of 189 incandescent lamps.
Testing of 143 gas and other lamps and adjunct appliances.
Investigation of the relation between the temperature of sugar solutions and their rotatory power on polarized light.
Investigation of quartz plates for the examination of sugars.
Determination of 100 points in the normal Ventzke scale for sodium light.
Especially careful collection of sugars from Germany, Austria, France, Russia and North America for the investigation of specific rotatory power.
V. Work in Chemistry: Continuation of the study of the soluhility of important salts.
Electrolysis of platinic chloride and the migration of the ions.
The quantitative determination of metallic platinum.
Investigation of liquids for use in thermometers to measure low temperatures.

In addition to the above work, attention is drawn to the fact that there are two institutions for calibration and certification of thermometers under the control of the Reichsanstalt, one at Ilmenau and the other at Gehlberg. During the last 10 years the institution at Ilmenau has tested, in round numbers, 350,000 thermometers.

The number of persons employed in the Reichsanstalt last year was 87.

V. A LESSON FOR US.

If Germany has found it to her scientific and industrial advantage to maintain the Reichsanstalt, and is proud of what it accomplishes; and if Great Britain is so impressed with the success of the institution that she has decided to imitate it, it is surely the part of wisdom for the United States to move in the same direction. It is therefore very gratifying that, at the suggestion of Secretary Gage, a bill was introduced in the last Congress to establish a national standardizing bureau, and that the committee on coinage, weights and measures reported unanimously and strongly in favor of its passage. So great is the importance of this movement, from the point of view of science, of national pride and of the higher interests of industrial pursuits, that the effort so happily begun, to secure suitable legislation, should be repeated with redoubled force and enthusiasm. Some of the reasons for making this effort one does not need to go far to seek.

In the first place, the scientific interests to be served are certainly as great as in any other country in the world. Science is cultivated here with increasing assiduity and success. We are no longer content to follow in the footsteps of European savants and modestly repeat their investigations. Original work of a high order is now done in many American universities; but the difficulties under which university instructors prosecute research are even greater here than in Germany, and we are still compelled to go to Europe for most of our standards. As a result, inventions of an almost purely scientific character originating here have been carried to perfection in the Reichsanstalt, and Germany gets the larger part of the credit. I need only instance the Weston standard cell, which has been so fully investigated at the Reichsanstalt, and the alloy "manganin," which the same institution employs for its standard resistances, after a searching inquiry into its properties. Both of these are the invention of Mr. Edward Weston, one of the past-presidents of this Institute. So long as there is no authoritative bureau in the United States under federal control, and presided over by men commanding respect and confidence, we must continue "to utilize the far-superior standardizing facilities of other governments." It is true that science knows no nationality, but the scientific workers of any nation can serve their own country better if they are not compelled to obtain their standards and their best instruments from distant parts of the globe. America has the cultivation in physical science, the ability on the part of her investigators and the inventive faculty to do work in a national institution that we shall not be ashamed to place by the side of Germany's best products. The establishment of a national institution for physical and technical purposes cannot fail to foster a vigorous and healthy growth in science, to which we already owe so much of our national prosperity and renown.

In the second place, Congress should be stimulated to take action because of national pride. It is not creditable for a capable and self-reliant nation to continue to depend on foreign countries for its standards of measurement, for the certification of its instruments, and for the calibration of its normal apparatus for precise work. Different departments of our government and offices under their control must at present appeal to foreign bureaus for the certification of their standards and instruments of precision. The first day the writer spent at the Reichsanstalt he was consulted with reference to an extended correspondence between the director of the technical division and the officials of the Brooklyn navy yard relative to the calibration of a large number of incandescent electric lamps for use in our Navy Department. The spectacle of a government bureau going to a foreign imperial institution for standards in an industry whose home is in the United States is a humiliating one. Yet the proceeding was entirely proper and justifiable because there is in this country no standardizing bureau for the purpose desired. Are the representatives of the American people willing to have this state of affairs continue?

Again, the higher interests of the industrial utilization of scientific knowledge require the establishment in Washington of an institution similar to the Reichsanstalt, and in no degree inferior to it. We are an inventive people, and may justly claim renown in the prompt and efficient utilization of the discoveries in physical science. It is highly improbable that a practical limit has already been reached in the field of applied physics. We are not estopped from making further discoveries. Still it may be affirmed with confidence that the most important and promising work to be done, except in the rare instances in which genius makes a brilliant discovery, will consist in the more perfect adaptation of known physical laws to the production of useful results. It is precisely this field which has not been extensively cultivated as yet in the United States. We have explored the surface, and, presumably, gathered the largest nuggets and the most brilliant gems. To increase the output we must now delve deeper and scrutinize more closely. To drop the metaphor, what will be required for future pre-eminence is the more intensive and exhaustive study of the scientific conditions in the industrial utilization of physical laws. This study will require the best talent of our technical schools, aided and supported by an authoritative national institution, itself far removed from patents and commercial gains, but jealous of our national renown and eager to co-operate with manufacturers for the sake of national prosperity.

Germany is rapidly moving toward industrial supremacy in Europe. One of the most potent factors in this notable advance is the perfected alliance between science and commerce existing in Germany. Science has come to be regarded there as a commercial factor. If England is losing her supremacy in manufactures and in commerce, as many claim, it is because of English conservatism and the failure to utilize to the fullest extent the lessons taught by science, while Germany, once the country of dreamers and theorists, has now become eminently practical. Science there no longer seeks court and cloister, but is in open alliance with commerce and industry. This is substantially the view taken by Sir Charles Oppenheimer, British consul-general at Frankfurt, in a recent review of the status and prospects of the German empire.

The Reichsanstalt is the top stone of Germany's scientific edifice. It has also contributed much to her industrial renown. It is necessary to cite only her manufactures involving high temperatures, such as the porcelain industry, to appreciate the help afforded by the Reichsanstalt. The methods and instruments elaborated there for the exact measurement of high temperatures constitute a splendid contribution toward industrial supremacy in those lines. The German government sees with great clearness that the Reichsanstalt justifies the expenditure made for its maintenance, not by the fees received for certifications and calibrations, but by the support it gives to the higher industries requiring the application of the greatest intelligence. In this connection, it should be thankfully acknowledged that the services of this imperial establishment are placed at the disposal of foreign institutions of learning with the most generous liberality. The charges for calibration are only about one-fourth the expense incurred in making them, but the support thus given to German makers of instruments of precision, by increasing their foreign orders, is deemed a sufficient return for the services rendered.

Electrical Men in Sound-money Parade.

Although the time for preparation was very limited, the electrical industries of Chicago made a fairly creditable showing in the sound-money or prosperity parade of October 27th, turning out about 1,400 men. The total number of marchers was about 36,000. The electrical men were in the first division of the procession, under the general direction of Marshal H. E. Niesz of the Chicago Edison company. First came the 650 men of the Chicago Edison and Commonwealth Electric companies, headed by Marshal John F. Gilchrist. They paraded to the music of a brass band of 30 pieces. They were formed in seven companies and marched eight abreast, each company having a captain and two lieutenants. The uniforms consisted of "rough-rider" hats, leggins, gold sashes, white badges with gold lettering and campaign canes. The Edison "boys" were well equipped and well drilled, and their appearance excited much favorable comment.

Following the Edison "regiment" came a "mixed battalion," made up of men from the General Electric, Central Electric, Electric Appliance, Illinois Electric, Guarantee Electric, Reliable Electrical Supply and Dearborn Electric companies and from Kohler Bros.' establishment. This command was divided into companies of 24 men each, and music was furnished by a bugle corps of 16 men. There were several banners, and each marcher carried a cane with one yard of two-inch gold ribbon tied to it. Many well-known electrical men were in this battalion, and at several points in the line of march they received the enthusiastic applause of admiring spectators. The marshal of the "mixed" contingent was James Wolff of the New York Insulated Wire company, and his aides were Colonel Charles A. Munson of the Fort Wayne Electric Works and George P. Townsend of the General Electric company. All marshals and aides in the electrical brigade were mounted.

The Western Electric company turned out 500 men, headed by a band, and completed the electrical contingent. The men were in charge of J. C. Warner, president of the Western Electric Sound Money Club, and J. B. Edwards. They marched in a solid body, without company formation, wore crimson badges and carried canes and American flags. Both shop and office men were in the ranks.

The New York sound-money parade is planned for November 3d, and with much more time at their disposal, the electrical men of that city are planning to make a large turnout.

Alaskan Telegraph Lines.

The United States military telegraph line, now building in Alaska, is under charge of five parties. Four parties are building in the Yukon Valley at different points between Kaltag, on the Lower Yukon, and the boundary line between Alaska and the Yukon Territory. The fifth party is building from Valdez northeasterly toward Eagle City or Fort Egbert. The last report from this party indicates that about 100 miles of that section of the line will be completed this fall. Fort Egbert is the only Alaskan post which will be connected telegraphically with the United States this fall. The line connecting Fort Egbert with Dawson is about completed. During the present year the Canadian field parties have built 570 miles north of Quesnelle.

A cable extends from St. Michael to Safety Harbor, about 115 miles, and thence by land line for 25 miles between that point and Nome, and is now being operated by the Signal Corps. A second cable is intended to be laid between St. Michael and Unalaklik, where it connects with a land line of 90 miles across the portage to Kaltag, on the Yukon. From there a line has been constructed for a considerable distance up the river toward Fort Gibbon, which is at the mouth of the Tanana.

General Randall is desirous that this system should connect with the United States by a cable running from Valdez to Skagway, thence south through Juneau to Seattle or some other point on the Pacific coast. Such an extension would give an all-American telegraphic route in and out of Alaska. There is now no telegraphic communication whatever with Juneau, the capital of Alaska.

A company of eastern capitalists has been organized to take control of the Pontiac-Flint (Mich.) Electric railway. The plan is to build a double-track line from Detroit to Bay City, Mich.

DEVELOPMENT OF THE TELEPHONE FIELD.

Stroud Telephone Meter.

Even among the largest telephone companies giving measured service, the calls are still, to a great extent, recorded by pencil in the hand of an already overburdened operator. Although there have been numerous forms of service meters devised, each seems to have its objectionable features. These meters may be divided into three classes: In the first the meter is located at the subscriber's station only,

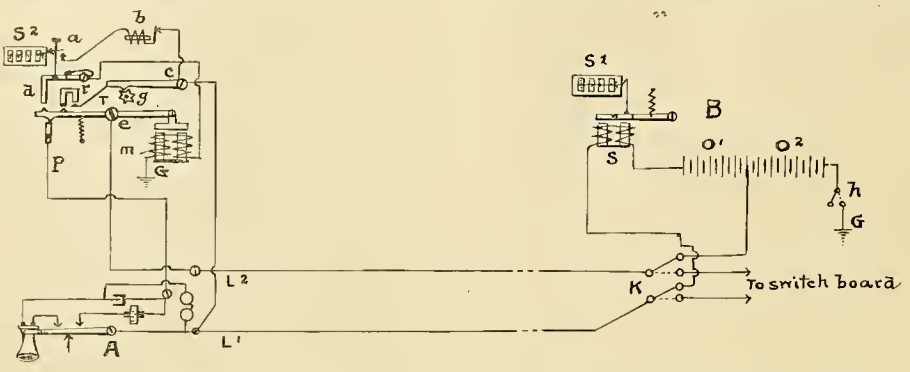


FIG. 1 STROUD TELEPHONE METER.—DIAGRAM OF CONNECTIONS.

and must be controlled or supervised by the central-office operator, either by the ringing of a bell in proximity to the subscriber's transmitter, or by the more applicable means of operating a vibrator in the talking circuit. The registration is accomplished just before the making of the sound which announces to the operator the fact that the user has registered. In class two the meter is located at the central office, operated manually by the switchboard operator, or automatically by the differentiating conditions of relays or auxiliary magnets, so as to respond when the person called removes his receiver. In the third class there are duplicate registers at the subscriber's station, actuated simultaneously by either the subscriber or operator.

The first class involves the expense and inconvenience of a visiting meter man, to read the subscriber's meter. The second is unsatisfactory to the subscriber, who has no means of verifying his bill, while the cost of installing and maintaining numerous relays and other devices intermingled with those already required in a common-battery exchange makes this form costly for the company. With the third class, also, this latter disadvantage holds.

The Stroud meter is designed to overcome all these objections. In this system a permanent meter is not required at the switchboard for each line. One portable recorder does the work for a whole exchange. It can be used as well with local as with common-battery systems. Each outgoing call is "stored," so to speak, at the instrument from which it is made; the operator need not be concerned as to who the caller may be. At the end of a month, or given time, the registered number of these calls can be transmitted electrically to the central office at the will of the reading operator there.

Fig. 1 is a diagrammatical view of the electrical connections, (A) representing the register at the subscriber's station and (B) the counter, with its battery, etc., at the central station. Fig. 2 illustrates the counter or reading instrument. This is disconnected from the line, except when in use. Fig. 3 is a view of the meter at the subscriber's station, permanently in the circuit.

The operation is as follows: The subscriber at (A) removes his receiver and gives the number desired to the operator. As soon as the person called

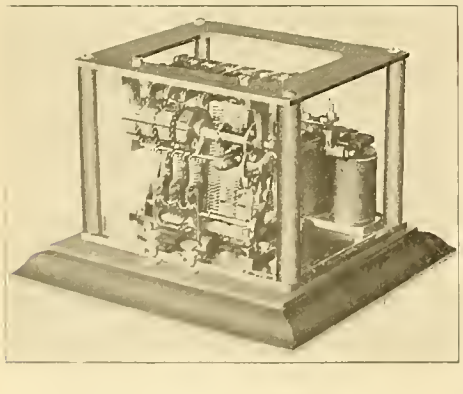


FIG. 2. STROUD TELEPHONE METER.—INSTRUMENT AT EXCHANGE.

responds the operator asks the one calling to press the button (a), which must be done before conversation begins. The operation of pressing the button sounds the buzzer (b) by closing the circuit from (L 1) through (d) by being brought in contact with (c) and thence to (L 2). The same motion of button (a) simultaneously moves the counter (f) one number forward and rotates the cam-wheel (g), to which is connected a spring, thus winding the spring and "storing" the call. When it is desired to take the reading the person having this duty disconnects the line to be read at a convenient point in the central office and attaches the cords of the reading instrument to the outgoing line, rings the subscriber and requests him to press the button (a), which closes the controlling circuit at (a), through coil (m), through (d), (e) and to (L 2), thence to (K), and through limb (O 2) of battery and switch (h) to ground, completing the controlling circuit and energizing magnet (m), which draws down its armature and closes together the contacts (c) and (r), also maintaining the connection made at (e) and (d) by the act of pressing the button.. The energizing of magnet (m) also releases falls which check the spring connected with (g), and the latter rotates backward, giving motion to arm (c), which intermittently closes the circuit through (r). The number of strokes of arm (e) represents the number of calls stored on the spring, thus the closing of the circuit at (c) and (r) gives an impulse over the line, which

FIG. 3. STROUD TELEPHONE METER —METER ATTACHED AT SUBSCRIBER'S STATION.

actuates the magnet (S) at (B), thus transferring the registered calls to the reading instrument at the central office. After each reading the counter (S 1) is restored to zero by turning a button. The counter (S 2) at the sub-station does not reset, but continues to count to 9,999, and then reverts to zero, thus making it possible for the subscriber to see how many calls he has used from time to time, and gives the company a positive record should any trouble arise in the transmission. The number on the receiving instrument (S 1), after reading, added to the previous total, should equal the number at the sub-station indicator.

New Company Proposed for Detroit.

There is a movement on foot to establish an Independent telephone system in Detroit, Mich., in opposition to the Michigan Telephone company. William J. Kurtz, general manager of the Kurtz National Telephone company of St. Louis, backed by Detroit capitalists, is said to be promoting the enterprise. It is stated that Mr. Kurtz will ask for a franchise for 99 years, agreeing to put wires underground with one year's notice and agreeing also to sell out to the municipality at any time or forfeit franchise on refusal to do so. If the franchise is granted, the company agrees to commence construction within two months. The franchise proposed fixes rates at a maximum of $5 a quarter ($20 a year) for residence telephones and $7.50 a quarter ($30 a year) for business telephones. Mr. Kurtz says further that he has signed a contract with the National Telephone Equipment company of Detroit to furnish all the instruments and apparatus needed in the new system. The Kurtz company is incorporated under the laws of Illinois, with a capitalization of $200,000. It is said to operate exchanges at Peoria, Ill., Portland, Ore., Muncie and Martinsville, Ind., and St. Joseph, Mo.

Lorimer Automatic Telephone System.

It is announced that the Lorimer system of automatic telephony has been completed and that the plant which was constructed for experimental purposes at Piqua, Ohio, has proven the correctness of the new ideas developed by J. Hoyt Lorimer and G. W. Lorimer of that city. Although no details of this system have been made public, the result of the work of these two young men has been given to the public to some extent, not in detail, however. The system is different from the ordinary exchange from the fact that subscribers may connect with lines by means of a device in the central office, and thus do away with the mediation of an operator.

A few days ago a meeting of the interested parties was held in Brantford, Canada, and reports of experts who examined it were heard. They were so satisfactory that it has been decided to go on with the manufacture of the apparatus. The Lorimers are the leading stockholders in the American Machine Telephone company of Piqua, and at the meeting in Canada, the following-named officers were chosen: President, J. Hoyt Lorimer; vice-president, N. D. Neill; secretary and treasurer, G. W. Lorimer.

A few days ago a meeting of those interested ronto, Ont., has strongly recommended the adoption of an automatic telephone system, and the operation of the system as a municipal institution. The Lorimer company is negotiating to install a system in Toronto, which will accommodate 10,000 subscribers. A plant of this size will certainly demonstrate the capacity of the new system to perform the work that its inventors claim for it.

Duplex Telephone Line in Japan.

Some time ago the Japanese government caused to be installed two metallic-circuit telephone toll lines between Yokohama and Tokio, a distance of about 15 miles. The traffic soon exceeded the capacity of these lines, and in default of a government appropriation for a third line, it was decided to duplex the two existing ones To do this the repeating coil at each end of either circuit (four in all) was split at the middle point of its primary winding, and a wire placed connecting these two points in the two coils at Yokohama, and a similar connection between the two coils at Tokio. In each of these cross-connecting circuits was placed the ordinary microphone and telephone apparatus. Thus a third circuit was obtained, the two legs of which were double, each leg embracing the two parallel wires of one existing metallic circuit. Interference and cross-talk between the new instruments and the others was thus neutralized in each circuit. The duplex arrangement has been working satisfactorily since its installation. An engineer of the Erie Telephone company worked out the details of the arrangement.

President Hudson's Successor.

As yet there has been no announcement by the directors of the American Telephone and Telegraph company in the matter of selecting a permanent successor to the late President Hudson. However, it is rumored in Boston that the selection has been made of a gentleman prominent in telephone circles, who will receive a salary of $50,000. A more authoritative statement says that the directors have under consideration the four following-named gentlemen, who have been long experienced in the telephone business: C. F. Cutler, president of the New York Telephone company; John J. Sabin, president of the Pacific Coast Telephone company; Charles J. Glidden, president of the Erie Telegraph and Telephone company, and J. J. Hall, vice-president and general manager of the American Telephone and Telegraph company. Of these gentlemen, Mr. Cutler, it is said by many, is likely to be chosen for the place.

Bell Business in Canada.

At a recent meeting of the municipal telephone committee of the City Council of Toronto, Ont., the chairman presented a report which gave the following statement of the Bell Telephone company's business in Canada: Net revenue in the Dominion of Canada, $353,307; number of telephones, 34,923; average profit per telephone, $10.11; miles of long-distance lines, 18,920; miles of poles, 6,229.

The Indian Territory and Kansas long-distance telephone systems have been connected, and there is now through connection from Denison through the Territory to Kansas points. All the Indian Territory lines not having copper-wire circuits are to be so equipped shortly.

Telephone News from the Northwest.

Thomas P. Lyons of Lansing, Mich., has been appointed to succeed Dana Bennett as manager of the office at Menominee, Mich., of the Michigan Telephone company.

A count was kept of the telephone calls on the People's Telephone company's system in Superior, Wis., for 24 hours, ending at 7 a. m., October 16th. There was a total of 8,206 calls, of which 5,980 were local, 625 from Duluth and 886 to Duluth.

The rehearing of the case of the Northwestern Telephone Exchange company against the city of Minneapolis before the Supreme Court of Minnesota has been set forward from October 27th to November 29th. The counsel for the telephone company asked for more time.

W. H. Mathews of Beltrami, Minn., is constructing a line to Ada, Fertile, Gary and Twin Valley. Connections will be made at Fertile with the long-distance system.

An automatic telephone exchange is being installed for Manning, Iowa. It is the invention of W. B. Swaney of Audubon, Iowa, and is said to be very successful.

The Iowa Telephone company is said to have about completed arrangements for the purchase of the Central Telephone company of Des Moines. The Central owns a toll line from Des Moines to Oskaloosa, connecting there with several Independent lines covering Southeastern Iowa; also a line to Baxter, one to Newton, and an exchange at Colfax, a line to Story City and to several other points. The Central was formed by H. McFarlin and H. E. Teachout, who were prime movers in the anti-Bell enterprises in the state. The officials of the Iowa company at Davenport deny the report.

Kauffman Bros. have sold their interest in the telephone line from Salina, Iowa, to Four Corners, to Dr. A. M. Morrow, who becomes the sole owner.

The Pacific States Telephone company has 3,375 telephones in use in Spokane, Wash., which is an average of one instrument to every 11 of population —a greater number, in proportion to population, than any other city in the United States or in the world, it is said.

The Osseo (Wis.) Telephone company has extended its line from Osseo to Augusta, and will build a line to Eleva yet this fall. The latter will be continued to Mondovi in the spring.

The Blue Earth Valley Telephone company has installed a 200-drop self-restoring switchboard in its office at Blue Earth, Minn.

The Wisconsin Telephone company has about completed the work of rebuilding its exchange at Bayfield, Wis.

It is alleged that the object of the resolution investigating the work done by the Mississippi Valley Telephone company in St. Paul is to assist local investors to secure an interest in the plant. Should the matter be pushed to the point of revoking the franchise, then the local men would be given one and the company would have to make the best of the case and sell its system. R.

Notes from Ohio.

The Lancaster Telephone company, Lancaster, Ohio, was incorporated a few days ago, with a capital stock of $100,000, the incorporators being F. F. Pomeroy, A. R. Warner, A. E. Akins, M. J. Mendelbaum and J. O. Wilson. Mr. Pomeroy is general manager of the Cleveland and Western Electric Railway company, and several of the other gentlemen are residents of Cleveland. The articles of incorporation will allow the company to build and operate exchanges and short and long-distance lines in Lancaster and Fairfield County and also to construct and operate a line from there to Cleveland.

The Citizens' Telephone company of Columbus has added 1,040 drops to the exchange, which gives it a capacity of 5,200 subscribers. Several miles of new cable are now being put in to accommodate the growing business. Manager Beam is well satisfied with the progress made.

The case of George E. Case of Granville against the United States Telephone company has been settled privately. Mr. Case alleged that the construction gang had damaged his shade trees by putting in poles lower than was agreed between the residents and the company. O. M. C.

In Colorado.

The City Council of Greeley, Colo., has granted a franchise to the Independent Telephone company, which has just been incorporated, to build a telephone system in that city.

The Extension Telephone company of Conejos, Colo., has just been incorporated, with a capital stock of $5,000, to build telephone lines in Conejos County. The incorporators are Jose A. Garcia, N. N. Russell and Frederick Warshauer.

The Colorado Telephone company has reduced the hours of the young-lady operators from nine to eight hours, but no reduction is made in the pay. Under the new plan the operators go to work at 7 a. m. and are off duty from 11 a. m. until 1 p. m., being then at work until 5 p. m. A similar schedule applies to the other two units. D.

Virginia and the Carolinas.

A report is current to the effect that the Independent telephone lines of the Carolinas, to a large extent, will form a union for the purpose of gaining mutual advantages and better and more-comprehensive connections. The plan will likely be to select four central towns as central offices from which connection with the exchanges of the neighboring towns can be easily gained.

The Gordon Telephone company, Charleston, S. C., is making preparations to extend its lines to all of the sea islands in that vicinity, and it is also proposed to strike inland and connect with Independent lines in other parts of the state. Four submarine cables will be used in connecting the sea islands with Charleston.

T. J. McAdoo has purchased the telephone system of Burlington, N. C., and is reconstructing it.

The Newport News and Richmond Telephone and Telegraph company is extending its line from Williamsburg, Va., to Newport News and Richmond.

E. L. Moore, of Dillon, S. C., is endeavoring to organize a new telephone company at Fayetteville, N. C. D. H. L.

Telephone Burglar Arrested.

The "telephone burglar" has again been heard from, this time in Buffalo, where the authorities succeeded in arresting him. His method of entering houses under pretext of repairing telephones was the same as at other cities. He was captured while ransacking rooms. It is believed that he is from New York city. This telephone burglar has given the telephone companies no end of trouble. After his appearance they sent out notices to their subscribers, warning them to admit no one to their homes who did not wear a badge with the name of the company on it or carry other credentials. Many people who had read of the numerous robberies, without waiting to examine the credentials of the telephone-repair men, slammed their doors in the faces of the company's legitimate agents. The biggest hauls made by the burglar were in New Rochelle, Pelham Manor, Yonkers and White Plains.

NEW COMPANIES.

The Andover Electric Telephone company has been incorporated at Andover, Ohio, with a capital stock of $6,000.

The Georgetown and North Island Telephone company has been chartered in South Carolina, with a capital stock of $1,000, by J. B. Steele and A. E. Springs.

The Paris and Minter Telephone company has been incorporated in Texas, to operate a telephone line from Pattonville to Paris, Minter and other points. The capital stock is $2,500.

The Queen City Telephone company has been chartered at St. Louis, Mo., with a capital stock of $50,000, by Charles G. C. Haddock, Fred A. Churchill, H. M. Dix and others.

The Hamlet (N. C.) Telephone company has been chartered, with a capital stock of $50,000. W. H. Lilly of Fayetteville, T. M. Rose of Hamlet and W. F. Leal of Fayetteville, N. C., are the incorporators.

The Gainesboro Telephone company of Georgia has been incorporated with a capital stock of $4,000, with the privilege of increasing this to $40,000. The incorporators are J. N. Cox and Lewis K. Smith of Carrolton, Ga.

Articles of incorporation have been filed by the Buchanan County Telephone and Telegraph company at Independence, Iowa. The system will be run underground, and the city will not be generally connected until spring.

The Monmouth Telephone company has been incorporated at Monmouth, Ill., with a capital stock of $25,000, to operate a telephone system. The incorporators are Howard M. Carter, Sidney W. Worthy and Arthur Dyrenforth.

The West Canada Telephone company has been incorporated at Albany, N. Y., with a capital stock of $3,000, to operate a telephone system connecting Trenton Falls, Grant, Wilmurt and other villages. The directors are Jonah W. Jenkins, James E. Jenkins, S. E. Harvey, Byron E. Turnbull, Charles H. Clark, Walter W. Martin and John Frinkle.

The Queen City Telephone company of Sedalia, Mo., has been incorporated with a capital stock of $50,000. The stockholders are G. C. Haddock, Fred A. Churchill, H. M. Dix and others. The company some time ago secured a franchise to do business in Sedalia, one of the conditions of which was that the system should be in operation with 400 telephones by January 1, 1901.

Franchises have been granted at Williamsburg, Va., to the Chesapeake Telephone and Telegraph company and the Newport News and Richmond Telephone and Telegraph company. The companies will not be allowed to charge per annum more than $38 an instrument for business telephones and $30 on five-year contracts. For private telephones the price will be not more than $28 per annum, or $25 per annum on five-year contracts.

GENERAL TELEPHONE NEWS.

The Michigan Telephone company will entirely rebuild its system at Marquette, Mich., and will also install a very complete conduit system for the center of the city.

A syndicate headed by Lewis W. Parker of Greer Depot, S. C., has purchased the Citizens' Telephone Exchange of Spartanburg, S. C., for $22,500, and will operate it.

The Central District and Printing Telegraph company of Warren, Ohio, has received a 200-drop switchboard for its local exchange, which will be placed in commission as soon as connections can be made.

The name of the Peoria and Eastern Automatic Telephone company of Chatsworth, Ill., has been changed to the Peoria and Eastern Telephone company, and its capital stock has been increased from $12,000 to $25,000.

The Allegheny County Telephone company of Pennsylvania, which has been bought out recently by a syndicate headed by George R. Webb, of Baltimore, operates 850 telephones in the Carnegie works and at Braddock, a few miles outside of Pittsburg.

President Miller, of the South Carolina Telephone company, denies the report that his company has not been able to make outside connections. He says that his plant will soon give one of the best interstate connections to be found. The company is an Independent one.

In Paris recently, it is said, a Spaniard, who had been given telephone connection from his hotel to a stranger instead of to a friend, lost his temper and fired four shots into the instrument, entirely wrecking it. Naturally, he had to pay heavily for the repairs, and also to leave the hotel.

The Austrian government is about to install a telephone exchange at Budapest, Hungary. The equipment is to be for 10,000 subscribers at first, though the exchange will be so designed as to enable it to accommodate 20,000 subscribers when necessary. Bids will be accepted from firms of any nation.

Telephonic communication between England and Belgium will be opened to the public about February 1, 1901. The Belgian line will start from La Panne, near the French frontier, and will be about 45 miles long. The tariff is fixed at 10 francs ($1.93) per three minutes. Experiments with this line in view have been carried on for some months.

An important decision has been rendered at Durham, N. C., in the case of W. K. Debnam against the Southern Bell Telephone company, in which the plaintiff was awarded $2,025 damages. Mr. Debnam was struck on the head by a pair of pliers which fell from the top of a pole where an employe of the Southern Bell company was at work, and on this accident the action for damages was based.

F. H. Taylor, manager of the Cripple Creek exchange of the Colorado Telephone company, has been promoted to a place in the main office of the company in Denver, probably in the auditing department. His place will be taken by Louis P. O'Brien, who has been in the company's employ since the first days. The company is doing a remarkably large toll business in the Cripple Creek District.

At the beginning of 1900 the National Telephone company of England had in operation 169,925 telephones in the United Kingdom, 35,700 of which were in London. The company had at that time 960 different exchanges working, of which 45 were in London. There were also 575 public call offices for public use, open in the metropolis. Over these exchange lines the company is transmitting annually upward of 617,000,000 messages.

On November 1, 1901, the telephone systems in St. Petersburg, Moscow, Warsaw, Odessa and Riga are to pass from the hands of the Bell company into that of the Russian state, whence they will be retransferred to private persons or companies. Applications for the working of any of these should at once be made to the Chief Administration of Russian Post and Telegraphs, St. Petersburg. All foreigners may compete and obtain the concessions.

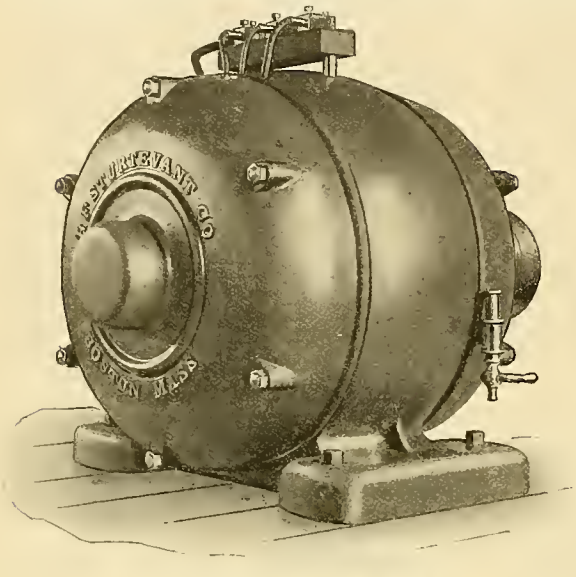
At the meeting of the Consolidated Telephone Construction and Manufacturing company of Great Britain, on October 24th, a minority of American shareholders defied the British shareholders, when Col. D. E. Gourand, formerly of New York, attempted to elect himself a director of the company. The Colonel commanded 23,000 shares, but was forced to yield to the 114,000 shares voted by the administration. Considerable bitter feeling was developed at the meeting, Colonel Gourand being called a "Texas colonel" and a guerilla fighter. Colonel Gourand intends to persevere in his effort.

A telephone is soon to be placed in every police station in Chicago, for use as police and fire alarm. Heretofore the police department has had to content itself with about 16 telephones, and those who have had occasion to talk to the nearest police station have often found it impossible to do so. It is thought that the new instruments will greatly aid rapid communication with the fire department and engine houses. These telephones will not be open to the public, but the public telephones throughout the city may be connected with the police stations.

New Sturtevant Enclosed Motor.

The new type of enclosed motor built by the B. F. Sturtevant company, Boston, Mass., and shown in the accompanying illustration, being enclosed and readily portable, in the small and medium sizes, is especially adapted for driving small machines, such as machine tools, blowers, etc. For certain classes of work, where the conditions are favorable, the motor may be direct connected to the machine which is to be driven. Encased fans of the centrifugal type may be thus equipped, and, if desired, the fan casing itself may be supported by the motor frame and made adjustable about it, so that any direction of air discharged may be provided. In order to avoid the excessive temperature which is incident to the operation of most enclosed motors, this type has been very carefully designed, so that a low temperature rise can be maintained without greatly increasing the size and weight above that of the ordinary open type.

This machine is capable of continuous operation for 10 hours, with a maximum temperature rise not exceeding 60 degrees Fahrenheit. Yokes extending out from the field ring support the armature shaft. The end casings are entirely independent, and can be instantly removed to give access to the entire interior. The bearings and brushes can be reached by simply removing the caps in the center of the casings. The brushes are of hard carbon, in holders of a modified reaction type, which allows of easy adjustment when it becomes necessary to reverse the direction of rotation of the motor. The bearings are self-oiling and self-aligning, and fitted with composition sleeves, which are removable from the outer ends of the boxes. These motors are built in this type in seven sizes, ranging from one-sixth to five horsepower.



NEW STURTEVANT ENCLOSED MOTOR.

Vintage Fete in Paris.

[Special correspondence of the Western Electrician.]

Paris, October 16.—During the exposition, several evenings have been given up to special fetes, but the "Vintage Fete" of last evening was the most elaborate and best-carried-out illumination of the season. Every light, both electric and gas, in the Champ de Mars and the Trocadero Gardens as well as on the Eiffel Tower, Trocadero Museum and Electricity Palace, was lighted. To these were added thousands of Japanese lanterns suspended from the branches of the numerous trees on the grounds and the special arrangement of incandescent lamps, bordering the main avenues.

From the Eiffel Tower to the Chateau d'Eau, both sides of the avenue were illuminated with lines of artificial grapes, suspended in an artistic manner from lamp post to lamp post. The bunches of grapes, representing the various varieties grown in France, were made of translucent paper and of large size so as to compare favorably with the surroundings. On the inside of each bunch was suspended a 16-candlepower incandescent lamp. The light from the imitation grapes shone on the green leaves of the entwining vines and produced an effect very difficult to describe, but one of great beauty. The arc lamps suspended from the ornamental iron posts on the bridge between the Trocadero Garden and Champs de Mars were replaced by large clusters of incandescent lamps of low candlepower, so arranged as to give the appearance of immense bunches of grapes hanging in the sunshine.

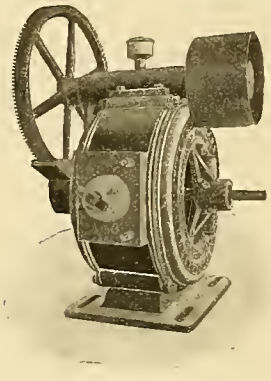
To add to the scene there were two parades symbolic of the season. The girls and boys, women and men, were dressed in fantastic costumes and carried Japanese lanterns suspended either from long branches of the grape vines or from an arbor made by entwining the vines over a light framework of wood. There were many beautiful floats on which pretty girls portrayed the various scenes of the harvest. They were on automobiles and wound their way through the crowd without any visible motive power.

In the midst of the procession red lights were ignited on various stages of the Eiffel Tower from the base to the very top, giving a glow to the whole scene which caused the immense throng to stand spellbound. To the uninitiated, the tower might well have been mistaken for an unexpected conflagration extending from the earth to the sky. The whole spectacle was magnificent and far surpassed anything shown at the World's Fair in 1893.

J. M. H.

Emerson Back-geared Motor.

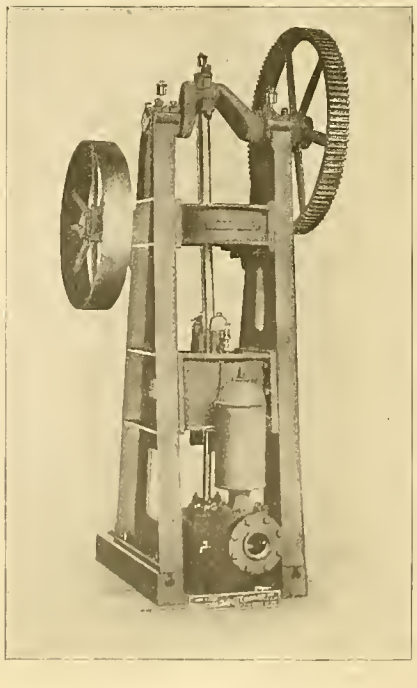
The accompanying cut illustrates a new type of alternating-current motor made by the Emerson Electric Manufacturing company of St. Louis. This back-geared motor is particularly suitable for operating slow-speed machinery and can be direct-belted to linotype machines. The pulley countershaft shown revolves at one-fifth the speed of the motor shaft. The pulley regularly furnished is five inches in diameter, with a three-inch face. A pulley may also be placed on the high-speed shaft, which projects for that purpose, if it be desired to operate two differently speeded machines directly from the same motor. The pinion and lower part of the gear on this motor are inclosed in a suitable gear case, so as to obviate danger of accident. This motor may be also equipped with a Stow flexible shaft, attached directly to the slow-speed shaft, making the motor available for operating tapping and reaming machines or emery wheels.



EMERSON BACK-GEARED MOTOR.

Smith-Vaile Deep-well Power Pump.

The accompanying illustration shows a Smith-Vaile deep-well, working head of the differential type. This head is suitable for both open and drilled wells. The stroke is 24 inches in length and the machine is adapted to almost any size of working barrel, depending somewhat, however, upon the maximum lift. This pump has been installed in some of the larger office buildings, elevating water 375 feet in the new Montgomery Ward building in Chicago. It is made especially strong and heavy. The crank is of steel, the crank bearings being of liberal area. Charcoal-iron, machine-cut gears are used. The pinion shaft operates in ring-oiling bearings. The connecting rod is of steel, provided with bronze boxes at the crank-shaft connection, and also with an adjustment device at the cross-head connection. The cross-head operates in an adjustable shoe. A combination water-box base is also provided, and a check valve is located beneath the air chamber. This pump is manufactured by the Stilwell-Bierce & Smith-Vaile company of Dayton, Ohio.



SMITH-VAILE DEEP-WELL POWER PUMP.

American Electric Company of St. Paul.

The American Electric company of St. Paul, Minn., although only a year old, is already commanding a large trade, particularly in the Northwest. In that territory the company is exclusive selling agent for the Western Electric company's goods, the Simplex Electrical company's wires and cables and the Sunbeam incandescent lamps. The company has an attractive store at 56 East Sixth street, St. Paul, and carries an exceptionally complete stock of all staple supplies for inside work and line construction. Ernest S. Harrison of Winnipeg has been recently appointed as the company's sales agent in the province of Manitoba. Mr. Harrison is engaged in the supply and construction business at Winnipeg, and is favored with a large trade. The American company is incorporated under Minnesota state laws, with an authorized capital stock of $25,000. The officers are the following-named gentlemen: President, Chester D. Crandall; vice-president and general manager, George S. Ellicott; secretary and treasurer, A. McNab Little.

American Enterprise in India.

The project for the utilization of the power available in the Falls of the Cauvery, in India, for the generation and transmission of electric energy to the gold fields of the Kolar district of Mysore, has attracted considerable attention in the engineering world.

The Cauvery River rises in the Western Ghauts, flows in a southeastern direction through Mysore state and Madras, discharging in the Bay of Bengal, after a course of some 475 miles. The Falls of the Cauvery, at which the generating station will be situated, are of famous memory, at a distance of about 93 miles from Kolar, the center of the Mysore gold-mining industry, where the power is to be applied.

The following details will give some idea of the scope of the undertaking: The discharge required to generate sufficient power at the falls to transmit and deliver 4,000 horsepower at the Kolar gold fields has been found to be 181 cubic feet per second, and observations have shown that even in the dryest months of the dryest seasons on record the quantity required is easily available. The actual horsepower generated at the falls' power station will be 5,970, and an allowance of 33 per cent. has been made for loss during transit. The generators will consist of six complete units of 1,000 horsepower each, each unit comprising a waterwheel and generator on a horizontal shaft. The generators will work at 2,200 volts.

In order to save wire on the line, step-up transformers will be employed to raise the voltage from 2,200 to 30,000. At the receiving end of the line step-down transformers will reduce this voltage to 4,000 for distribution purposes. At each mine secondary transformers will be employed to reduce still further the voltage to between 150 and 200. The transmission line will be in duplicate—two sets of poles, each carrying three wires. As a rule, both lines will be used, each line taking half the current, but in the event of one failing, the remaining line will be sufficient to carry the whole current.

In order to reduce the line loss to the minimum, change-over stations will be provided at 30-mile intervals. These stations will enable sections of the line to be thrown out of operation for repair at any time, without interfering with the remaining parts of the same line.

A number of leading electrical manufacturing firms sent in their proposals for the scheme, and that of the General Electric company of Schenectady, N. Y., has been accepted. In the scheme of this company the generator proposed is of the stationary-armature type. The plant to be supplied by the General Electric company will include six generators of 720 kilowatts' capacity each, two exciters of 75 kilowatts' capacity each, 12 step-up, air-blast transformers, 400 kilowatts each, 12 step-down, air-blast transformers of 350 kilowatts each, four blower sets for carrying step-up and step-down transformers, one electrically driven air compressor and reservoir for blowing dust from generators, two air compressors for blowing dust from switchboards in the two transformer stations, one switchboard for step-up transformer station, one switchboard for step-down transformer station, eight switchboard panels for section house, three hand-power cranes, lightning arresters, six tachometers for indicating

the speed of the generators, and all the necessary material and supplies, including wire and cables, poles for the transmission line, insulators, pins, cross-arms, etc.

The General Electric company's contract price amounts to $704,520. The scheme is at present at the following stage: The sanction of the government of India has been obtained and arrangements have been entered into by the government of Mysore with the government of Madras for the supply of water in the Cauvery River. Tenders for the execution of the necessary works in India have been accepted, and the collection of materials and the excavation of the channels begun.

The foregoing notes give in brief outlines the project and general position of one of the most enterprising and interesting engineering schemes in the annals of British rule in India. The Indian and Eastern Engineer of Calcutta, from which the above is an abstract, concludes its exhaustive article on the subject with the words that the only point for regret is that practically the whole of the plant will be of foreign manufacture; "but with many American engines on our railway lines," that journal continues, "American rails to run them on, and the general enterprise of America in engineering and its allied trades, we must be content to acknowledge that the British manufacturer is quite unable to retain his old monopoly in the wide marches of the empire."

CORRESPONDENCE.

London Letter.

London, October 16.—The Great Eastern Railway company is credited with an intention to apply to Parliament next session for powers for the construction of an underground electric line, to run under its present railway from Ilford to Liverpool street. The new line would be about seven miles long.

The Chester Town Council has resolved to apply to Parliament for an act empowering it to take over the Chester Tramways undertaking, and to adapt it for mechanical traction and to extend the system beyond the city boundaries. The price to be paid by the council to the tramway company is $91,500 plus the rolling stock, at a valuation.

A company has been formed for the purpose of acquiring and developing the business of the General Electric company, which was originally started as a private concern in 1880 and registered as an incorporated company in 1889. The share capital is placed at $4,000,000, divided into 40,000 five per cent. cumulative preference shares of $50 each and ordinary shares of the same value, while the company will also have an authorized issue of $1,000,000 of four per cent. first-mortgage debenture stock. The net profits for the last three years is stated to have averaged $308,975 per annum.

An unprecedented episode occurred at the last meeting of the Liverpool City Council. The business was to pass resolutions for an electric-tramway extension, and it was necessary that two-thirds of the council should vote in the affirmative. The Irish members, resenting what was described as the "closure" applied to them at the previous meeting, announced that they would now decline to vote. They carried out their threat, with the result that the necessary number of votes—78—was not given. In this attitude they persisted, despite an appeal, and the council had to adjourn, the whole of the afternoon's proceedings being futile.

The Dudley Town Council has decided to borrow $50,000 for the purpose of defraying the cost of the free wiring of houses and business premises for electric lighting. A government inspector was on Saturday informed at an inquiry held by him that the municipal authorities intended to charge 12 cents per unit for the first two hours' consumption per day, and three cents per unit—the lowest charge on record—for the remaining 22 hours, being equivalent to 18 cents per 1,000 feet for gas.

Last week I referred to the fact that the Leicester Town Council was making a substantial profit from its electric-light undertaking. Manchester, too, I understand, makes an annual profit of some $50,000. On the other hand, municipal trading in a number of other cities and towns has resulted in a big loss. One of the earliest to launch out for itself was Godalming, in Surrey, which nearly went bankrupt. Bedford did almost equally badly, and drops to this day something like $5,000 a year on its venture. Bath shows a nominal profit of $7,390 a year, but pays in interest and sinking fund, without making any provision for depreciation, $11,245. Liverpool at first scouted the whole idea, contenting itself with encouraging a company to handle the new venture. The company was a success, and the Town Council thereupon bid humbly for permission to take back again the powers it had parted with so lightly. In the result it had to pay the Liverpool Electric Supply company a sum of $2,000,000 for plant which had admittedly cost but about half of that amount. Chesterfield, with a population of 22,000, is so determined to have its own electric light that, after rejecting a private tender to supply electricity at four cents per Board of Trade unit, it is engaged in laying down plant to supply itself at a cost to the borough of exactly 12 cents per unit.

The new works for the supply of electricity to Poplar, a populous district in the East End of London, were opened last week. The terrors of by-streets and alleys situated in "darkest London" have too often been enlarged upon, but with the enterprise of modern days, which gives to the poorest parts the blessing of electricity, the old reproach is in a fair way of being removed altogether. The local board, it appears, is alone responsible for the carrying out of the project, having some five years since pressed into its service for the purpose Mr. Alfred Blackman, electrical engineer of the Aberdeen corporation. At a total cost of nearly $500,000 the work has been brought to a successful issue, some of the chief items of expenditure being as follows: site, $16,000; buildings, $68,000; boiler-house equipment, $74,000; engine-house and battery-room plant, $87,500; arc lamps and posts, $40,000; mains, $255,000. The full installation is not yet completed. Included in the works are two 330-horsepower and two 167-horsepower engines, triple expansion, with two 200-kilowatt dynamos. The system adopted is the three-wire, and is available for both power and light. The supply will be that of maximum demand, both for lighting and power at the rate of 10 cents, eight cents and six cents a unit for the former, and six cents and three cents for the latter. There are 67 miles of streets in the district and 30 miles of mains have been laid down. For street lighting 195 arc lamps have been placed in position, the standards carrying at the height of the ordinary street lamps two incandescent lights which are turned on after midnight, and the arcs switched off. Nearly 700 other street lamps will be fitted with the incandescent bulbs as the works develop. Arrangements have been made for the supply of fittings in the houses of consumers free of initial cost, and meters with slots for money will be furnished, so that customers can pay as they go along. W. H. B.

New York Notes.

New York, October 27.—In the sound-money parade, to be held on November 3d, the electrical interests will be well represented. An association has been organized with these officers: President, E. S. Keeler; vice-president, Allan S. Bakewell; secretary, H. B. Kirkland; treasurer, G. L. Patterson; marshal, H. L. Shippy. These gentlemen form the executive committee, with Dr. S. S. Wheeler, John H. Dale and T. C. Martin. A finance committee has been appointed, composed of the treasurer, Dr. Wheeler and J. W. Godfrey. A committee on badges, flags, canes and general equipment was formed, comprising H. F. Albright, C. S. Pease and J. W. Dale. Secretary Kirkland was appointed a committee of one on music, and Mr. Martin a committee of one on press. From the reports already filed it is evident that not less than 3,000 marchers may be counted on from the electrical industries. The Western Electric company will make the largest showing, with the Crocker-Wheeler and the Sprague men next in numbers.

Important changes in the affairs of the Brooklyn Rapid Transit company are looked for in a few weeks. It is expected that the Metropolitan street-railway interests will acquire control of that system, with a unifying of the surface transit routes of the boroughs of Manhattan and Brooklyn.

Members of the State Railroad commission met in the Fifth Avenue Hotel last week to consider, among other matters, the proposition of the New York, Brooklyn and Jersey City Rapid Transit company and the New York and Brooklyn Union Transit company to build a tunnel connecting Brooklyn and Jersey City. Commissioner Dunn, of Binghamton, presided. Mr. A. E. Orr, president of the Rapid Transit commission, said that the board had always had the question of rapid transit to Brooklyn in mind, and had finally decided on a route. This was from the terminus of the existing rapid-transit system, at City Hall, down Broadway to South Ferry, including a loop at the Battery. It would then cross under the East River to the foot of Joralemon street, Brooklyn, under Fulton street to the junction of Flatbush avenue, under Flatbush avenue to its junction with Atlantic avenue, and then come out of the ground at some point near there. No contracts for the work have yet been made. Mr. Orr estimated the cost of the board's plan for Brooklyn at $8,000,000.

It is impossible to predict the extent of saving in the substitution of electric for steam power on the Manhattan Elevated road, but from the reports of the elevated roads in Chicago, where the operating expenses have been thus reduced on an average of 20 per cent., one can estimate that there should be an increase in its net revenue of about $1,750,000 (based on last year's gross earnings from traffic of $8,719,000), or 3½ per cent. on the $50,000,000 stock. In addition to this, a large increase of traffic may naturally be expected as a result of the greater speed, comfort and convenience of electric traction. Manhattan earned for several years in succession over $10,000,000, and in 1893 over $11,000,000. If we take $10,000,000 as a basis, this will show an increase of $1,300,000 over last year, or $700,000 net, estimating operating expenses at 45 per cent., which is about the average on the Chicago roads. To this should be added the 20 per cent. saving as above, making a total of $2,450,000 additional for the stock.

The bronze tablet, which for years marked the home of Samuel F. B. Morse, at No. 5 West Twenty-second street, has been replaced in the wall of the new Spinning Wheel building, on the same site. These additional words have been added to the original inscription: "This tablet removed from building formerly on this site and replaced A. D. 1900." Mr. Morse lived in the Twenty-second street house for eight years and died there. M. L. G.

New England News.

Boston, October 26.—The Massachusetts railroad commissioners have been asked by the management of the Lowell and Suburban Street Railway company to rescind a decree of the board issued some time ago, limiting dividends of the company to seven per cent. annually. It appears that in 1896 the board issued an order that the Lowell and Suburban dividend be limited to six per cent., owing to an impairment of capital. In 1897 this impairment was partially made up and the board issued another order limiting the dividend to seven per cent. The company has entirely wiped out this impairment and now asks that the order limiting amount of dividends be rescinded. The Lowell and Suburban property is appraised at $2,340,000. Consolidation with the Lowell, Lawrence and Haverhill railway under the control of the Massachusetts Electric Companies is also asked for.

The railroad commissioners have been taking testimony in connection with a petition to compel the Boston Elevated Railway company to run vestibule cars for the protection of motormen in winter.

Disagreement by the jury was the result in the trial of Chief Train Dispatcher Hugh J. Hill of the Taunton Division of the New York, New Haven and Hartford railroad, who was accused of violating Section 10 of Chapter 370 of the Acts of 1898, United States Statutes, for alleged discrimination against Peter J. Galligan, an operator employed at his office, and causing the latter's discharge last April because he was a member of the Order of Railroad Telegraphers. The case has been on trial before Judge Lowell in the United States District Court here. As it was a test case, the first of its kind to be brought under this comparatively new law, it was watched with interest by labor organizations, corporations and the public at large. The jury came in twice for instructions. After having deliberated eight hours, the foreman reported that they were unable to agree, and Judge Lowell dismissed them. It is believed that Mr. Hill will be tried again.

The Massachusetts Supreme Court has rendered an important decision which relieves the various electrical companies that were involved in litigation for some time after the famous subway explosion in this city, four years ago, from all responsibility for damages in connection therewith. The suit which has thus terminated is known as the Koplan case. There are upward of 100 other suits for damages pending, and the decision in this case having fixed the blame upon the Boston Gaslight company, the others will doubtless be pressed to trial or settlement in some form. About $500,000 is involved. Wolfe Koplan was a bootblack who was thrown against a nearby building by the force of the explosion. His suit, one of many, was the first one entered, and was given the importance of being made a test case. The subway was in process of construction at the time and the action, therefore, was brought against all who might be concerned, the original defendants being the Boston Gaslight company, the Metropolitan Construction company, which was at work on a portion of the subway, the Edison Electric Illuminating company, the Boston Electric Light company, the Bay State Gas company and the West End Street Railway company. The trial lasted six weeks. Before its completion the Boston Electric Light company and the Bay State Gas company were dropped from the case, it being agreed that they were in no way responsible. After the plaintiff had put in all his evidence, Judge Lilley, who presided at the trial, instructed the jury that there was no evidence against the Edison Electric Illuminating company, and directed them to return a verdict favorable to that company, which was done. The case was submitted to the jury as against the Boston Gas Light company, the West End Street Railway company and the Metropolitan Construction company. Verdicts favorable to the two latter corporations were returned by the jury, and a verdict of $3,000 was awarded to the boy against the Gas Light company. An appeal was taken, the Gas Light people contending that probably a spark from an electric car had ignited the gas, but the Supreme Court finally decided otherwise. B.

Southern Developments.

Charlotte, N. C., October 26.—A seven-mile electric railway will be built at Greenville, S. C. D. H. Whitner will survey the route. The contract calls for the completion of the work by December 15th.

Gaffney, S. C., has voted an additional issue of $15,000 bonds to increase the electric-light and water facilities.

The Virginia Electrical Railway and Development company of Richmond, Va., expects to be ready to generate and supply electric power to consumers within about five weeks.

The Indianola Power company will develop a 10,000-horsepower site near Lancaster, S. C. The power will be transmitted electrically to a number of towns. The contract was given to Ladshaw & Ladshaw of Spartanburg, S. C.

The Atlanta (Ga.) Rapid Transit company, which has gained control of the Lakewood street railway in Atlanta, proposes to connect its system with the newly acquired line at an early date.

The Hampton Roads Railway and Electric company has secured a franchise to construct a proposed electric line at Newport News, Va. The new company, it is stated, proposes to operate a peninsula system in opposition to the Newport News

and Old Point Railway and Electric company, which is said to have Baltimore capital back of it.

D. H. L.

Gleanings from Colorado.

Denver, October 25.—The City Council of Colorado City has adopted the franchise giving to the Citizens' Light, Heat and Power company the right to do business in that city. The special election to vote on the franchise is fixed for November 6th.

The American Gaslight association has been in session in Denver this week. A considerable number of electrical men were present, coming from cities in which gas and electrical interests are controlled by a single company. Among them were H. F. Coggshall, Fitchburg Gas and Electric Light company, Fitchburg, Mass.; C. L. Gerauld, Galesburg Gas and Electric company, Galesburg, Ill.; E. C. Jones, San Francisco Gas and Electric company, San Francisco, Cal.; L. L. Kellogg, Sioux City Gas and Electric company, Sioux City, Iowa; Ira A. Miller, Colorado Springs Electric company, Colorado Springs, Colo.; F. D. Moses, Trenton Gas and Electric company, Trenton, N. J.; C. F. Pritchard, Lynn Gas and Electric company, Lynn, Mass.; F. L. Terry, New London Gas and Electric company, New London, Conn., and E. E. Witherby, Union Gas and Electric company, New York, N. Y.

A fine of $25 has been imposed by the city magistrate of Denver for the failure of an electrical contractor to notify the city electrician to inspect the wiring in a block of houses. The defense was that a notice had been sent, but it had not been delivered to the city officer, being lost in the mail or otherwise miscarried.

The directors of the Denver Consolidated Gas and Electric company, at a recent meeting, adopted resolutions on the death of the president, George Treadway Thompson. The question of the competition in the electrical field of the Lacombe Electric company was considered. Mr. W. F. Donthirt, the general counsel of the company, is quoted as saying on this subject: "In a city like Denver competition is impossible. We shall be obliged to protect our investment in case a new company enters the field, even to the extent of a rate war and the consequent loss."

The Lacombe Electric company is proceeding rapidly with its work on its line construction. Its new poles in the business section overtop all those now in place, so that no fear will be experienced of wires from other circuits dropping on their wires in bad weather. The plans for the new power station will soon be completed.

A Denver paper announces the appointment of Simeon W. Cantril as superintendent of the Denver Tramway company, to take the place of Mr. C. K. Durbin. Officers of the company say that the announcement is premature.

W. G. Evans, secretary of the Denver Consolidated Tramway company, recently returned from a trip to Europe. He reports that there is no immediate prospect that the company's plant will be sold, as the option given to Englishmen has expired; the necessary money was not raised.

The Denver Consolidated Tramway company has increased the wages of its trainmen from 1½ to one cent an hour. The men at present earn from 18½ to 24 cents hourly. The amount varies in accordance with the length of service with the company. The increase of wages is a great satisfaction to the men. A raise was asked by the men, and when the matter was not acted upon immediately the papers started some agitation. It was even suggested that a strike might be declared, although there is no organization among the men. The men are now well satisfied, as there are few cities in which higher wages are paid for similar labor.

J. W. D.

PERSONAL.

Harry A. Brinkerhoff of Upper Sandusky, Ohio, has accepted a position as manager of the Home Telephone company at Greenville, S. C.

A. P. Munning, manager of the New York office of the Cutler-Hammer Manufacturing company, is in Chicago enjoying a well-earned vacation.

Dr. Karl E. Guthe of the department of physics of the University of Michigan is spending the present year in Leipsic, Germany, conducting investigations in the general subject of physical chemistry.

Henry Tyrrel, formerly with the Bell company at Jefferson City, Mo., has been appointed manager of the new Independent exchange at that city, recently installed by the Capitol Telephone company. W. A. Magee was engineer and superintendent of construction for the Capitol company.

Storm Emans of Poughkeepsie, N. Y., died at his home in that city on October 24th. In his early life he was a telegraph operator, and at one time was manager of the Atlantic and Pacific Telegraph company at Newburg, N. Y. At the time of his death he was cashier of the Poughkeepsie City and Wappinger's Falls Electric Railway company.

The formal inauguration of Dr. Henry S. Pritchett, former chief of the United States Coast and Geodetic Survey, as president of the Massachusetts Institute of Technology, took place on October 24th in the new Symphony Hall in Boston. A distinguished company was present, consisting of representatives of colleges and universities from all parts of the country and of representatives of the alumni organizations. The entire main body of the hall was filled by the students, 1,250 or more in number. Brief addresses were made by Senator Henry Cabot Lodge, by Col. Thomas L. Livermore on behalf of the corporation, and by ex-President Crafts. Dr. Pritchett, in his inaugural address, dwelt upon "The Relation of Educated Men to the State."

ELECTRIC LIGHTING.

The city of Orlando, Fla., is advertising for bids for an electric-light plant.

Ilion, N. Y., has issued $30,000 in bonds for the purpose of building an electric-light plant.

The Durant (I. T.) electric-light plant has been purchased by Bonham and Durant capitalists.

The Edison Electric Illuminating company of Cumberland, Md., has decided to spend $35,000 for improving its plant.

Plans are being prepared for a $5,000 electric-light plant at Kasson, Minn., to replace the one destroyed by fire some weeks ago.

City water and electric light will be furnished Vineland, N. J., by the Buchanan company of Philadelphia. The power house will cost $7,000.

The council of Lewiston, Pa., will receive bids until November 5th for lighting the streets with 30 or more arc lights of 2,000 candlepower.

Bonds to the amount of $25,000 have been sold for the purpose of erecting an electric-light plant and waterworks in Ruston, La. R. M. Adams is the engineer.

The City Council of Hawkinsville, Ga., (T. H. Grace, mayor), wants prices on a complete outfit of electrical machinery for operating 40 arc and 1,500 16-candlepower lights.

The Southern Light and Power company has been organized at Vicksburg, Miss., with a capital stock of $100,000, to build, own and control electric-light and power plants throughout the South. J. C. Schaefer of Chicago will probably be president, and F. S. Mordaunt, manager.

Big Rapids, Mich., is advertising for bids for the furnishing of not less than 50 1,200 or 2,000-candlepower arc lights. The bids will be received until December 3d, and are to be made upon the midnight, moonlight and all-night schedules for one, three or five-year contracts. Correspondence may be addressed to the City Clerk, Big Rapids, Mich.

The New York Trust company has purchased the plant of the Shenango Valley Electric Light company in Pennsylvania for $73,000. The company has also bought the Youngstown, Sharon and Sharpsville electric-light plants, the Valley Street Railway and the Sharon and Wheatland and Youngstown Electric Railroad franchises. Over $2,000,000 will be expended in the three towns in improving the lighting and railroad facilities.

The plans proposed for the lighting of St. Cecilia's Church of Boston will give it one of the finest designs of illumination of any such edifice in the country. The designs include a large Byzantine cross, 12 feet high, to be suspended above the main arch of the marble altar. Projecting from the columns supporting this main arch will be a set of pendants, while along the sides of the nave electric lanterns will be hung from the medallions. Above the side alcoves of the altar will be clusters of lights, and depending from each column along the bays of the church will be oval-shaped lanterns. The whole scheme of lighting calls for nearly 4,000 electric lights, which will be hung within or behind the various designs, the body of these shapes being formed of opalescent glass and colored cathedral-glass jewels.

ELECTRIC RAILWAYS.

The International Rapid Transit company of Buffalo has been incorporated at Dover, Del., with $1,100,000 capital stock.

The Galion-Bucyrus electric line in Ohio will be extended from the latter place to Sandusky, and $125,000 has been appropriated for the purpose. The distance is 17 miles.

General F. F. Myles of New Orleans is making arrangements for building a trolley line from St. Martinville, La., via New Iberia, and all the Teeche towns, to Berwick, La.

The Albany (N. Y.) County Railroad company has been incorporated with $20,000 capital stock, to build an electric railway three-fourths of a mile long on Central avenue, in Albany. J. K. Kennedy of that city is interested.

An electric street railway is to be built from New Iberia, La., to Berwick City. The new line will be 45 miles long. A stock company has been organized in New Orleans for the building of the new road, with General F. F. Myles at the head of the project.

Experimental excavations were begun on October 29th at various points along the route of the Charing Cross, Euston and Hampstead railway of London, the franchise of which was recently acquired by Charles T. Yerkes. It is stated that the work will be continued without interruption.

It is announced that the tracks of the Cincinnati, Saginaw and Mackinaw Railroad company, between Bay City and Saginaw, Mich., will be converted to a third-rail electric system. The Murphy Safety Third Rail Electric company, it is said, will install the new system.

A company has been formed to build a trolley line from Parkersburg, W. Va., to Marietta, Ohio. H. C. Henderson is president of the company. The line will be constructed within a year and will make tributary to Parkersburg all the towns about the city for 12 miles.

The Tennis Construction company of Philadelphia has been awarded the contract for building the new electric road of the Uniontown and Monongahela Valley Railroad company. The tracks will extend through the new Masontown coke fields, making about 20 miles of track.

Representatives of the New York Trust company have purchased the Shenango Valley Electric Light plant at Sharon, Pa., and also the Sharpsville Electric Light works. The company expects to build electric railroads connecting Sharon, Newcastle and Youngstown, and will invest over $2,000,000.

The stockholders of the Fairmont (W. Va.) and Clarksburg Electric Railway have elected the following-named directors: J. N. Camden, S. D. Camden, I. Davis, of Parkersburg, W. Va., and others. The purpose of the company is to build an electric passenger railroad from Clarksburg to Fairmont, through the Camden coal fields.

Articles of incorporation have been filed in Wisconsin by the Milwaukee, Berlin and Northern Railway company. The road is to be built from Berlin to Stevens Point, and is capitalized at $100,000. The directors are L. Groff, H. Rommerdall, J. S. Carter, C. C. Bartlett and others of Chicago, and W. W. Cooper of Kenosha, Wis.

J. I. Beggs of Milwaukee, on behalf of the Fox River Valley Electric Railway company, has arranged for work to begin at once on a temporary power house to operate the street-railway and city-lighting system of Appleton, Wis. Next spring a permanent power house will be erected to furnish the needed power and to sell power to manufacturing plants.

It is expected that the new roadbed of the Detroit, Lake Orion and Flint railway, between Detroit and Flint, Mich., will be in use before the end of the year. The time occupied for the trip will be two hours and 40 minutes, or only five minutes more than the present railroad time. The cars on this line will be 50 feet in length, full vestibuled, with three compartments—parlor, smoking and buffet sections. Each car is to be equipped with two 100-horsepower motors.

AUTOMOBILES.

It is stated that Chicago is shortly to have a school of instruction for automobile operators, conducted on an extensive scale. Mrs. E. S. Blye, the originator of the idea, will be one of the instructors of the school and will devote her attention mostly to women who may desire to master the mechanical construction of their machines. The Chicago Motor Vehicle company is interested in the project.

Charles N. Wheeler, formerly of Peoria, Ill., who left New York city several weeks ago on an automobile trip to El Paso, Texas, has been compelled to abandon his trip on account of the illness of his wife. Over good roads he was able to cover from 70 to 85 miles a day. He reports the roads of New York, Ohio and Indiana to be first-class turnpikes, but the Illinois roads the poorest of dirt thoroughfares.

Two automobile shows are to be held in New York this month. The first, given under the auspices of the Automobile Club of America, will be held at Madison Square Garden from November 3d to November 10th. A number of interesting contests, races etc., to determine the superior abilities of different machines, will take place during this exhibition. From November 14th to November 24th another show will be given at the Grand Central Palace.

At the annual meeting of the Automobile Club of America, held recently in New York, the following-named officers were elected: President, Albert R. Shattuck; vice-president, A. C. Bostwick; treasurer, Jefferson Seligman; secretary, M. W. Ford. Former Secretary Hedge said that reciprocal relations had been established with the automobile clubs of Great Britain and Ireland, France, Belgium, Switzerland, Berlin, Turin and Vienna, and that the club had affiliated with those of the principal cities of the United States. It was recommended by the law committee that an effort be made to have all parkways and drives opened to motor vehicles.

PUBLICATIONS.

A folder sent out by the Joseph Dixon Crucible company of Jersey City, N. J., dwells upon the covering capacity and great durability of Dixon's silica-graphite paint, which is claimed to be the cheapest protective coating for ironwork on the market. A picture is shown of the Park street railroad bridge at Cincinnati, coated with this paint, which success-

fully resisted the action of engine fumes for over five years.

"Alternating-current Induction Motors" is the theme of Bulletin No. 3021, issued by the Emerson Electric Manufacturing company of St. Louis, Mo. While the motors here described are of the same general appearance as those described in Bulletin No. 3003, a great improvement in electrical efficiency is claimed, and a number of sizes have been added. The pamphlet gives considerable information on this type of machine.

A fine specimen of the picture-maker's art is the large photogravure that is being distributed to its friends by the American Electrical Works of Providence, R. I. The picture, which is 17 by 33 inches in size, shows in a group the electrical men who foregathered at the recent twenty-second annual clambake given by the American Electrical Works at the Pomham Club. There were 359 gentlemen in attendance and a key gives the names and addresses.

W. R. C. Smith and C. S. McMahan, formerly western managers of the American Electrician and Street Railway Journal, respectively, have resigned their positions with those journals and have purchased a controlling interest in The Engineer, a monthly publication devoted to the interests of steam users and printed in Cleveland. Messrs. Smith and McMahan are experienced in the advertising end of technical journalism, and they have many friends and acquaintances who will extend best wishes for their success in the new venture.

The suggestive title of a 56-page production of the advertising department of the B. F. Sturtevant company, Boston, Mass., is "2,500 Witnesses." As announced in the sub-title, the book is "A List of Buildings and Sundry Steamships Wherein the Sturtevant System or Apparatus has been installed for the Purposes of Ventilation and Heating." The names presented in the list are the most emphatic, and, in fact, the only witnesses that this company desires to present as evidence of the successful operation of the Sturtevant system and apparatus.

A paper on the "Metric System," read by Rufus P. Williams before the American Chemical Society, is published by the Decimal Association, of London, England. It is hoped that the distribution of this paper may lead to further interest in the question among those engaged in commerce and legislation in the United States, especially in view of the fact that the metric system is already in use in some of the new island possessions of the United States. The paper treats of the present extent of the system in this country and in Europe, of its advantages, and the best methods of introducing it in commerce and in schools.

A catalogue recently published for the Westinghouse Electric and Manufacturing company is entitled "Westinghouse Railway Motors." The publication contains illustrations and brief descriptions of the standard Westinghouse railway motors and at the conclusion of the book is given a number of illustrations showing typical railway power-house installations equipped with both direct-current and polyphase systems. The catalogue, which displays the careful preparation and excellent mechanical execution characteristic of the Westinghouse publications, will be mailed to officers of electric-railway companies, consulting and contracting engineers and others interested, upon application.

SOCIETIES AND SCHOOLS.

The announcement of the meeting of the Chicago Electrical association for November 2d contained a notice of a paper by A. M. Blumenthal on "Roentgen Rays."

E. B. Ellicott, city electrician of the city of Chicago, will read a paper on "The Robert A. Waller City Electric Lighting Plant" before the meeting of the Western Society of Engineers in Chicago on November 7th. At the same meeting a paper on "The River and Harbor of Chicago" will be presented by R. B. Wilcox, of the city engineer's office.

The board of directors of the Electrical Contractors' association of New York state held a special meeting at the Builders' Exchange at Buffalo, on October 22d. New York city was represented by Charles L. Eidlitz, president of the association in that city; Utica, by W. H. Morton, of Johnson & Morton; Syracuse, by James Hilton and E. F. Lester; Rochester, by Rudolph Schmidt, and Buffalo, by J. C. Sterns.

ELECTRICAL SECURITIES.

The National Carbon company of Cleveland, Ohio, has declared the regular quarterly dividend of 1¾ per cent. on its preferred stock, payable November 15th.

The Chicago Edison company has declared the regular quarterly dividend of $2 a share, payable November 1st, to stockholders of record at the close of business on October 23d.

MISCELLANEOUS.

The tomb of Sir Humphry Davy, at Geneva, has been restored recently and put in good condition. It had been in a neglected condition for some time.

The Gas and Electric Fitters' Association of America has been incorporated at Chicago. The organization is not one for profit. Its incorporators are Thomas Mulqueen, Edward Hobbs and John A. Long.

The Monongahela River Consolidated Coal and Coke company is introducing a number of electric mining machines in three of its mines in Pennsylvania. A number of similar machines are in use in the mines of the Pittsburg Coal company. It is said that in a reasonable time every mine of the latter company will be supplied with electrical machines. Two men are employed at a machine, and it is said that one machine can do as much work as three men with picks.

At Middleton, Ohio, recently, occurred a peculiar accident. The iron safe of the Middleton shoe factory refused to open, and the bookkeeper, Louis Jaquith, and the engineer, W. H. Rice, attempted to burn out the combination by use of a carbon and electric current. The task took several hours, during which time each was subjected to the glare of the light. Soon after both men complained of a dizziness and pain in the head, and after some hours both went suddenly blind at about the same time. All efforts to restore their sight have been unavailing, and it is feared that the men are hopelessly blind.

TRADE NEWS.

The Holophane Glass company announces that it has removed to its new offices at 15 East Thirty-second street, New York.

It is stated that C. E. Carpenter has severed his connection with the Ward Leonard Electric company to embark in the rheostat business for himself.

The Chicago Motor Vehicle company has been incorporated at Harvey, Ill., with a capital stock of $1,000,000 to manufacture vehicles, motors, etc. The incorporators are William O. Worth, Henry W. Kellogg and William R. Donaldson.

The Chicago Mica company of Valparaiso, Ind., is sending to the trade samples of its mica washers with requests that they be given a trial. A circular shows the company's new factory which has grown to the extent of 34,000 square feet in floor space since the company started in 1898.

The H. T. Paiste company of Philadelphia announces that F. M. Clark, who for the last 18 months has solicited orders in the southern states for that company, has severed all connection with it. C. I. Hills, general sales agent for the H. T. Paiste company, will, in the future, look after the business in that section.

The Electrical Construction company of London, Ont., is asking for bids for the erection of a new factory. It is the intention to have a three-story building, 40 by 100 feet. This company, from a small concern, has risen to large proportions, and forms an important addition to the manufacturing interests of the city of London.

The Carleton window lock, which the Western Electric company is now handling, is said to be a positive burglar alarm and window lock combined. By means of this device a window can be left open for ventilation, but cannot be moved from this position by any person outside of the building. Any attempt to move it rings a bell in the house.

The Emerson Electric Manufacturing company of St. Louis has filed suit against the Van Nort Bros. Electric company of St. Louis. The complainant alleges that the Van Nort Bros. company sold alternating-current ceiling fans made by the Dayton Fan and Motor company of Dayton, Ohio, which, it is alleged, infringe the patents of the Emerson company.

Sealed proposals will be received at the office of the supervising architect, at Washington, until November 17, 1900, for the installation of a wiring system for the old United States courthouse and temporary court building adjacent thereto at Baltimore, Md. Copies of the drawing and specification may be obtained at the Washington office, or at the office of the custodian at Baltimore, Md.

The Bullock Electric Manufacturing company is receiving bids for two one-story additions to its plant in Norwood, Cincinnati. One will be an addition to the machine shop, 100 by 160 feet in dimensions, while the other will be an independent building in the rear of the office, 50 by 100 feet, to be used as a boxing factory. Large shipments of goods to Paris and Alexandria, Egypt, are almost completed and will be made in a short time.

Sealed proposals will be received at the office of the supervising architect, at Washington, until November 22d, for the installation of a wiring system for the United States courthouse and postoffice building at Topeka, Kan., in accordance with the drawings and specification, copies of which may be obtained at the Washington office, or at the office of the superintendent of construction at Topeka, Kan.

About four years ago the Warren Electric and Specialty company of Warren, Ohio, established the custom of giving its employes an annual banquet. In 1899 the banquet was made coincident with the opening of the firm's new office building. This year it was held in the new building of the Economy Electric company immediately adjoining. About 250 guests sat down at the banquet table on the first floor on the evening of the banquet a few days ago. Toasts were responded to by officers of the Warren company and others. After the banquet the party adjourned to the second floor, where an enjoyable dancing party was given. The affair was pronounced an unqualified success.

The Sprague Electric company of New York describes in a recent bulletin some new electric hoists recently developed by the company. A trolley hoist, illustrated by side and end views, travels on a single track and is provided with two one-horsepower Lundell motors, one for hoisting and one for traveling. The machine may have a hoisting capacity of 500 or 800 pounds as desired, and the traversing speed is six miles an hour. This apparatus is particularly adapted for shipyards, docks, warehouses and similar locations requiring handling over considerable distances. The electric traveling hoist consists of a small truck mounted on flanged wheels which travel on a double track. The hoisting motor, provided with a specially designed controller, will lift a load of 4,000 pounds at a maximum speed of six feet a minute. The traversing of the hoist is done by hand. This hoist is especially adaptable for assembly rooms and packing or shipping rooms.

BUSINESS.

The Electric Appliance company, Chicago, has catalogues descriptive of Packard lamps and Packard transformers, which it is mailing upon application.

The Western Electric company has just shipped a large number of its Petite direct-current arc lamps to Australia and a number of the series enclosed-arc lamps to South America.

Hoopes & Townsend of Philadelphia, Pa., have contracted with the American Bridge company to build a bar-mill building 70 feet by 500 feet in size on the line of the Trenton cut-off of the Pennsylvania railroad.

The Sprague Electric company has secured the contract for ventilating the new Grand Central Depot, New York city. The ventilating fans, ranging in size from 18 to 60 inches, will be operated by the well-known Lundell electric motors.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 23, 1900.

660,119. Alarm Appliance for Refrigerator Pans. James H. McGurty, Jersey City, N. J. Application filed June 14, 1900.

This invention is an alarm appliance for refrigerator pans. With the pan of the refrigerator are combined a detachable clamp composed of two members hinged together and having an intervening spring, a float arm hinged to the clamp, two metallic plates on the clamp, and an electric alarm arranged to be sounded upon the rise of the float arm which carries one of the plates into contact with the other.

660,124. Telephone System. Lambert Schmidt, Weehawken, N. J. Application filed March 8, 1900.

With a supporting frame for an automatic switch are shown a shaft or drum, having a series of circuit-closers arranged thereon, journaled in the ends of the frame, and a series of pairs of contacts carried by the sides of the frame, one of the contacts of each of the pairs extending into the path of the circuit-closers, alternate pairs of contacts being carried by opposite sides of the frame. Means are provided for rotating the shaft or drum in one direction, a detent engaging the shaft or drum to hold it with one of the circuit-closers in position to press together one of the pairs of contacts. Means are also shown for releasing the detent.

660,134. Automatic Circuit-breaker and Closer. William B. Watzel and Forrest L. Shekell. Washington, D. C. Application filed January 4, 1900.

In an electric circuit-breaker and closer of the character described is a double bulb having an intermediate contracted neck, and an armature upon the lower part of the bulb. Loosely coiled wires enter the bulb upon opposite sides: the bulb incloses a suitable charge of electrical conveying fluid, and is adapted to be suspended within a yoke pivoted to the spark coil of an electric circuit.

660,138. Thermo-electric Cell. Ernest F. Yost and William H. Smith, New York, N. Y. Application filed June 28, 1900.

A thermo-electric cell has one element of the thermo-electric couple inclosed within the other element of the couple, while a tube is electrically connected with the inclosing element and insulated from the element inclosed, and another tube is electrically connected with the inclosed element and insulated from the inclosing element; the tubes are insulated from one another and mechanically connected to convey the fluid through the cell.

660,139. Thermo-electric Cell. Ernest F. Yost and William H. Smith, New York, N. Y. Application filed June 28, 1900.

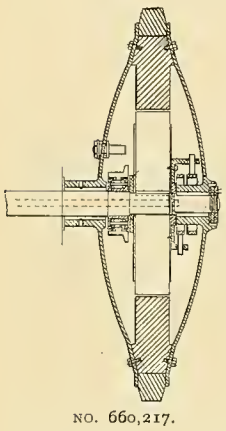
In this thermo-electric cell are shown a body of electro-negative metal, an outer covering of electro-positive metal, and a contact piece of electro-positive metal embedded in the negative metal, and electrically connected at its ends to the electro-positive metal.

660,152. Electric Welding Tongs. John R. Duncan, Indianapolis, Ind., assignor of five-eighths to Calvin F. Darnell and C. Augustus Schmidt, Indianapolis, Ind. Application filed May 17, 1900.

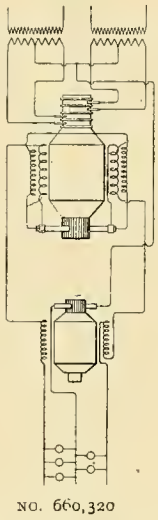
This electric welder comprises a pair of tongs having a pair of jaws and a pair of handles connected to the same, a washer insulating the jaws at their joint, a sleeve insulating the handles at the points of connection, and an electrical connection with the jaws whereby the current will pass from one to the other transversely through the articles to be welded.

660,154. Receptacle for Incandescent Lamps. Philip H. Fielding, New York, N. Y. Application filed April 2, 1900.

A receptacle for incandescent lamps is described consisting of an elongated block carrying at its middle a lamp socket, and binding screws exposed on each side of the socket, the extremities of the block being perforated for fastening screws in combination with a cap or cover of insulating material. This cover has a cylindrical portion surrounding the lamp socket. Binding screws are shown and extensions or ears covering the ends of the block, the ears being perforated in line with the perforations in the ends of the block.



NO. 660,217.



NO. 660,320

660,155. Apparatus for Controlling Mechanism of Moving Vessels or Vehicles. Bradley A. Fiske, U. S. Navy, assignor to the Western Electric company, Chicago, Ill. Application filed September 7, 1898.

In combination with a source of electrical waves or disturbances are claimed a moving vessel or vehicle, mechanism thereon for steering or operating the same, a circuit and means therein for controlling the mechanism, and means for rendering the circuit active or inactive through the influence of the waves or disturbances exerted at a distance from the source.

660,156. Method of Controlling Moving Vessels or Vehicles. Bradley A. Fiske, U. S. Navy, assignor to the Western Electric company, Chicago, Ill. Original application filed September 7, 1898. Divided and this application filed April 2, 1900.

An improvement in the art of controlling the movements or operation of a vessel or vehicle is described, which consists in providing in the vessel an electric circuit controlling electromagnetic motor devices for operating the mechanism of the vessel, adjusting or rendering such circuit sensitive to etheric waves or disturbances, establishing a region of such waves or disturbances, and rendering by their influence the controlling circuit active or inactive.

660,199. Telautograph or Facsimile Telegraph. Anton Pollak, Szentes, Austria-Hungary, assignor of one-half to Friedrich Silberstein, Vienna, Austria-Hungary. Application filed May 25, 1898.

In the facsimile telegraph described, a transmitting apparatus comprises a moving dispatch carrier, a plurality of selenium cells, and a commutator having contact pieces in connection with the respective cells, in combination with a receiving apparatus. This receiver comprises a sensitized film moving in synchronism with the dispatch carrier, a mirror moving in synchronism with the commutator, an electromagnet energized by the current from the transmitting apparatus, and a reflector vibrated by the magnet, adapted to reflect a ray of light on the mirror which in turn reflects the ray upon and off the strip, as the mirror is vibrated.

660,217. Electric-motor Wheel. Charles E. Isbills, Passaic, N. J. Application filed December 13, 1899.

An electric-motor wheel is mentioned consisting of the combination of a field-magnet ring having internally radiating cores and a circular contour, a tire mounted at the circumference upon the ring. Webs are shown having central bearings respectively formed thereon, secured to the ring and projecting beyond the same for the purpose of holding the tire upon the ring. An axle has the armature and commutator of the motor fixed thereon. Brush-holders for the commutator are carried upon one of the webs, collector rings are mounted upon the bearing of the other web, and a brush-holder for the collector rings is screwed upon the axle against the armature. (See cut.)

660,263. Electric Linotype Machine. Alfred W. Storm, Ramsey, N. J. Application filed September 22, 1897.

The invention relates to a linotype machine having a series of matrices assembled and adjusted by the operation of keys and electric circuits controlled by the keys. A keyboard is composed of conductive plates each insulated from the other and in connection with one of the terminals of a source of electricity. A series of elastic, metallic keys are mounted on the keyboard in electrical connection with one of its plates, the keyboard being pierced beneath the keys, and each key having a key hook projected downward through the keyboard and adapted to engage one of a series of detachable hooks arranged below. Means are provided for disengaging the hook when the matrix corresponding to a given key is adjusted.

660,268. Indicator. Charles L. Clarke, Mount Vernon, N. Y. Application filed January 17, 1900.

An electrical indicating apparatus is described relating to a stroboscopic system having independent elements and means actuated by alternating currents for independently operating them. An object is rotated by an alternating-current motor and means for causing the object to be periodically visible are similarly actuated. (See cut.)

660,271. Insulating Knob for Electric-light Wiring. Robert H. Henderson and John G. Henderson, Chicago, Ill. Application filed December 10, 1897.

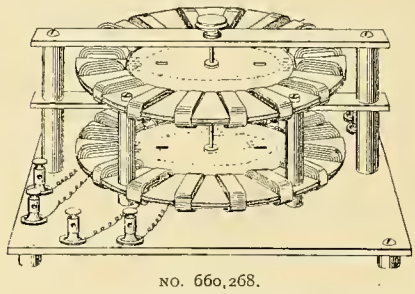
An insulating knob is shown with a groove for a wire like an ordinary knob, with a hook curved over from its outer end, forming a cavity underneath large enough to receive the required wire, in such proximity to the groove that, when the end of a wire is placed underneath this hook and the wire wrapped around the knob in the groove, it effectually shuts in the end of the wire, so that it cannot be pulled out.

660,305. Thermo-electric Battery. Jesse Oliver, Memphis, Tenn., assignor to Thomas B. Turley and West J. Crawford, trustees, Memphis, Tenn. Application filed February 8, 1900.

This thermo-electric battery has the elements extending substantially radially and with the positive elements located in one plane and the negative elements in a different but substantially parallel plane.

660,313. Lightning Arrester. Charles J. Reed, Philadelphia, Pa. Application filed February 17, 1899.

In a lightning arrester, a spark gap is arranged comprising a coiled or bent portion of an electric conductor and a conducting tube surrounding this portion and having internal ribs or projections between the turns of the coil, but not in contact therewith.



NO. 660,268.

660,320. System of Electrical Distribution. Charles I. Young, Philadelphia, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed March 6, 1900.

In the three-wire system described are combined, with a dynamo-electric machine having direct-current connections to the positive and negative wires of the system and alternating-current connections to a transformer winding, a regulating generator having its armature connected in circuit between the middle point of the transformer winding and the neutral or balancing conductor of the system, and having field-magnet coils which have no magnetizing effect when the two sides of the circuit are equally loaded, but which produce a field that corresponds in direction and amount to an extra load on either side of the circuit. (See cut.)

660,340. Safety Cut-out for Electric Circuits. Joseph Sachs, Hartford, Conn. Application filed July 10, 1899.

A safety fuse for electric devices is described combining, with the fuse wire, a tubular casing entirely surrounding and inclosing it, and having an opening through the side of the casing. Means are connected with the opening for effecting a discoloration of the walls of the opening for visually indicating the disrupted condition of the fuse wire.

660,341. Safety Fuse. Joseph Sachs, Hartford, Conn. Application filed November 24, 1899.

In a safety fuse with a tubular case and a non-conducting filling material, are end terminals within the case, of relatively ample conductivity, and a fuse strip of thin flat metal of extended area connected to and between the terminals.

660,375. Electric Battery. Frank K. Irving, Newark, N. J., assignor of one-half to Andrew G. Vogt, Newark, N. J. Application filed March 19, 1900.

This invention relates to a battery electrode consisting of metallic strips or bands arranged upon each other "log-cabin" fashion, and forming a central open space, the strips having contacting portions forming solid conductors, and intermediate spaces between their non-contacting portions.

660,385. Self-winding Electric Clock. Augustine J. Madden, Prahran, Victoria. Application filed December 23, 1899.

With a master-clock pendulum are shown a wheel, pawl, a lever to which the pawl is pivoted and a link movement. A tilting mercury holder is connected with the link. Wires of a clock circuit lead to a magnet whose armature is connected in the circuit and extends into the path of an arm so as to move it and be in contact therewith, before the clock circuit is closed. Attraction of the armature moves the arms, pawl and link and the mercury holder, and a cut-out for the magnet is closed by movement of the armature. Means for retracting the armature are shown.

660,393. Electric Arc Lamp. John J. Rathbone, London, England, assignor of two-thirds to Eric Rivers Smith and Charles Bean King, Jr., London, England. Application filed February 24, 1900.

The patent describes an electric-arc lamp having a guide tube surrounded by a shunt coil and carrying a suitable liquid. A lower carbon holder is in the form of a central core, while a solenoid is arranged in the tube and partly supported by the liquid. An air-tight globe is carried by the guide, and an air-tight capping fitted with a screw-socket is connected to the globe, and the lower carbon holder carried by the capping.

660,396. Electric Regulator. Charles W. Richards, Needham, Mass., assignor of one-half to Winthrop M. Chapman, Needham, Mass. Application filed August 21, 1899.

In a regulator for electric currents, a solenoid is placed in the circuit of the current to be regulated. Two circuit controllers are shown, a spring whereby the solenoid core is normally balanced between the circuit controllers and adapted to operate one of them, when the tension of the spring is overcome by the attractive force of the current flowing through the solenoid. A motor is controlled by the circuit controllers, and a rheostat operated by the motor. A device for increasing the tension of the spring is described, this device being connected with and operated by the rheostat.

660,459. Slot Wedge for Dynamo-electric Machines. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 21, 1900.

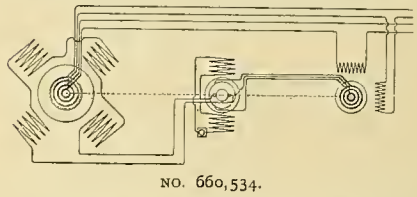
The invention relates to the combination, with a dynamo-electric machine having coil-retaining slots, of slot-closing devices of laminated magnetic material.

660,470. System of Signaling. Edward J. Silkman, Baltimore, Md., assignor of one-third to Charles Selden and Edgar Wesley Day, Baltimore, Md. Application filed March 13, 1899. Renewed August 6, 1900.

An apparatus for signaling is described comprising two disks with symbols similarly arranged thereon, and means for rotating the disks approximately in synchronism. Means are also shown for making a visual or audible signal when the proper symbol on one disk passes a given index, each disk and its operating mechanism being wholly unconnected from the other disk.

660,475. Manufacture of Incandescing Electric Lamps. William H. Voelker, London, England, assignor to Theron Clark Crawford, New York, N. Y. Application filed November 20, 1899.

This method of manufacturing incandescing electric lamps consists in forming a bulbous body with two extensions having an air space between them, then introducing a loop-shaped filament so that the legs thereof respectively occupy these extensions and are sealed therein, and then closing the bulbous part of the chamber and exhausting it.



NO. 660,534.

660,483. Transmission of Power. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 16, 1899.

The inventor claims the combination of a source of alternating current for power distribution; a plurality of rotary converters fed through separate transmission lines running back to the source, and conductors connecting together the direct-current terminals of the converters. Conductors also connect together the alternating-current terminals of the converters.

660,502. System of Motor Control. Alexander S. Garfield, Paris, France, assignor to the General Electric company of New York. Application filed March 11, 1899.

In this system of motor control a number of motors or sets of motors are described, and indicators near each motor or set of motors, one of the indicators being responsive only to current flowing in its adjacent motor or sets of motors, and another of the indicators responsive to current flowing in a non-adjacent motor or set of motors. As applied to an electric-railway system, the invention involves the combination of a number of electrically propelled cars, an indicator on one of the cars arranged to indicate only current flowing in circuits of the car, and an indicator on another car arranged to respond to the flow of current in circuits of a car other than that on which it is placed.

660,534. Regulating Dynamo-electric Machines. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 18, 1899.

With an alternating-current dynamo-electric machine are combined an exciter therefor, and means for controlling the voltage of the exciter by current derived from circuits of the machine, but of a frequency different from that of current flowing in the circuits. With a multiphase alternating-current dynamo-electric machine, and an exciter therefor, a frequency changer is described for producing current of a different frequency and a different number of phases from that flowing in the machine. Means controlled by the current are furnished for varying the voltage of the exciter. (See cut.)

660,539. Coin-controlled Electric-shock Machine. Bethuel M. Davis, Chicago, Ill., assignor to the Advance Machine company, Chicago, Ill. Application filed February 12, 1900.

An apparatus is described which comprises a handle, means for closing a circuit through the handle when the latter is moved, a coin slot, a plunger working through the slot and connected with the handle, and a locking dog for the plunger, having a portion adapted to be engaged by the coin for releasing the dog from the plunger.

Reissue.

11,865. Method of Insulating Electric Conductors. Nikola Tesla, New York, N. Y. Application filed September 21, 1900. Original No. 655,838, dated August 14, 1900.

The method of insulating electric conductors described consists in reducing to and maintaining in a frozen or solidified condition the material surrounding or contiguous to the conductor by the action of a gaseous cooling agent maintained in circulation through one or more channels.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, NOVEMBER 10, 1900. No. 19

Power Plant of the Chicago and Northwestern Shops.

About two years ago the management of the Chicago and Northwestern Railway company became convinced that it would be desirable to install a central power station for its Chicago car and locomotive shops, doing away with a number of independent engine and boiler plants, and concentrating the power in large units so as to secure a greater economy. The yards where these shops are located extend along the Northwestern tracks from West Fortieth street westward for a distance of about three-fourths of a mile. The shops provide repairs to the cars and locomotives of the Galena and Wisconsin divisions, where the heaviest work of the road is done. Owing to the extensive character of boiler-making machinery, the boiler repairs are made here for a much larger section of the road, including upward of 1,100 engines. General repairs are provided at this point for about 500 engines. Included in these shops is a large building used for repairing the tanks used on locomotive tenders.

In considering the improvement the idea of a central power station was favored by Robert Quayle, superintendent of motive power of the railroad company, who has introduced many improvements within the last few years. The problem of power transmission was somewhat complicated on account of the various factors entering into it. The conditions were as follows:

It was necessary to erect several new buildings and enlarge others, while at the same time the machinery in the main portion of the shops was already installed and in working order, and this machinery was already grouped to a large extent in accordance with the requirements of the shops. Accordingly, it was not thought best to interfere to any considerable extent with the existing arrangement. At the west end of the shops there is a wood machine shop and blacksmith shop. Inasmuch as the power for these shops was supplied by fuel from the waste product of the wood shop, it was not thought best, for the time being, to disturb the existing arrangement for power in these two shops.

However, the power for the remaining shops, which is supplied by boilers burning coal, was centered in a large power plant, which is located about 150 feet west from the main machine shop, at what is expected in the future to be the point for the most economical distribution of power to the various shops. There are several additional shops planned for the future, but which have not yet been erected.

The power house, shown in Fig. 2 on the next page, is well designed and substantially built. It is of brick construction, with steel-frame roof. In dimensions it is 100 by 112 feet and 30 feet in the clear under the roof trusses. A basement nine feet eight inches deep extends under the engine room. A brick wall divides the building longitudinally into a boiler room 46 feet wide and an engine room 54 feet in width.

In the boiler room (Fig. 3) are six 250-horsepower Babcock & Wilcox water-tube boilers arranged in series of two in each setting, with space for two additional boilers. The boilers are equipped with Roney stokers, furnished by Westinghouse, Church, Kerr & Co., and "smokeless" furnaces. They carry a pressure of 150 pounds. Coal is unloaded from a track on the north side of the building into a hopper below the track, from which it is raised by a coal conveyor and deposited into the coal bins by means of a horizontal conveyor. The bins are located in front of and above the boilers and have a storage capacity of 180 tons. They feed into the hoppers of the furnaces by 12-inch pendulum chutes. The coal-conveying machinery is driven by a 15-horsepower General Electric motor. The ashes are removed by cars on a depressed track running along the boiler fronts. Fig. 2 shows a car raised by a pneumatic crane ready for dumping into a flat car.

The chimney, which was designed by G. R. Henderson, assistant superintendent of motive power, is of light-colored brick, 180 feet high. It is lined with firebrick to a height of 75 feet, the core being 8½ feet in diameter. The stack is large enough to provide for 2,000-horsepower boiler capacity. The question of building three steel stacks and using mechanical draft was considered at first, but the brick chimney was finally determined upon, as it represented but little additional outlay in first cost and besides other advantages would require no operating expense.

In the engine room, a general view of which is shown in Fig. 1, are two 250-horsepower, vertical compound, non-condensing engines, each driving two 75-kilowatt, six-pole, 125-volt generators by direct connection, and also a 60-horsepower, simple, vertical engine directly connected to a pair of 20-kilowatt, 125-volt generators. This latter unit is used for the night load. The generators were furnished by the General Electric company and the en-

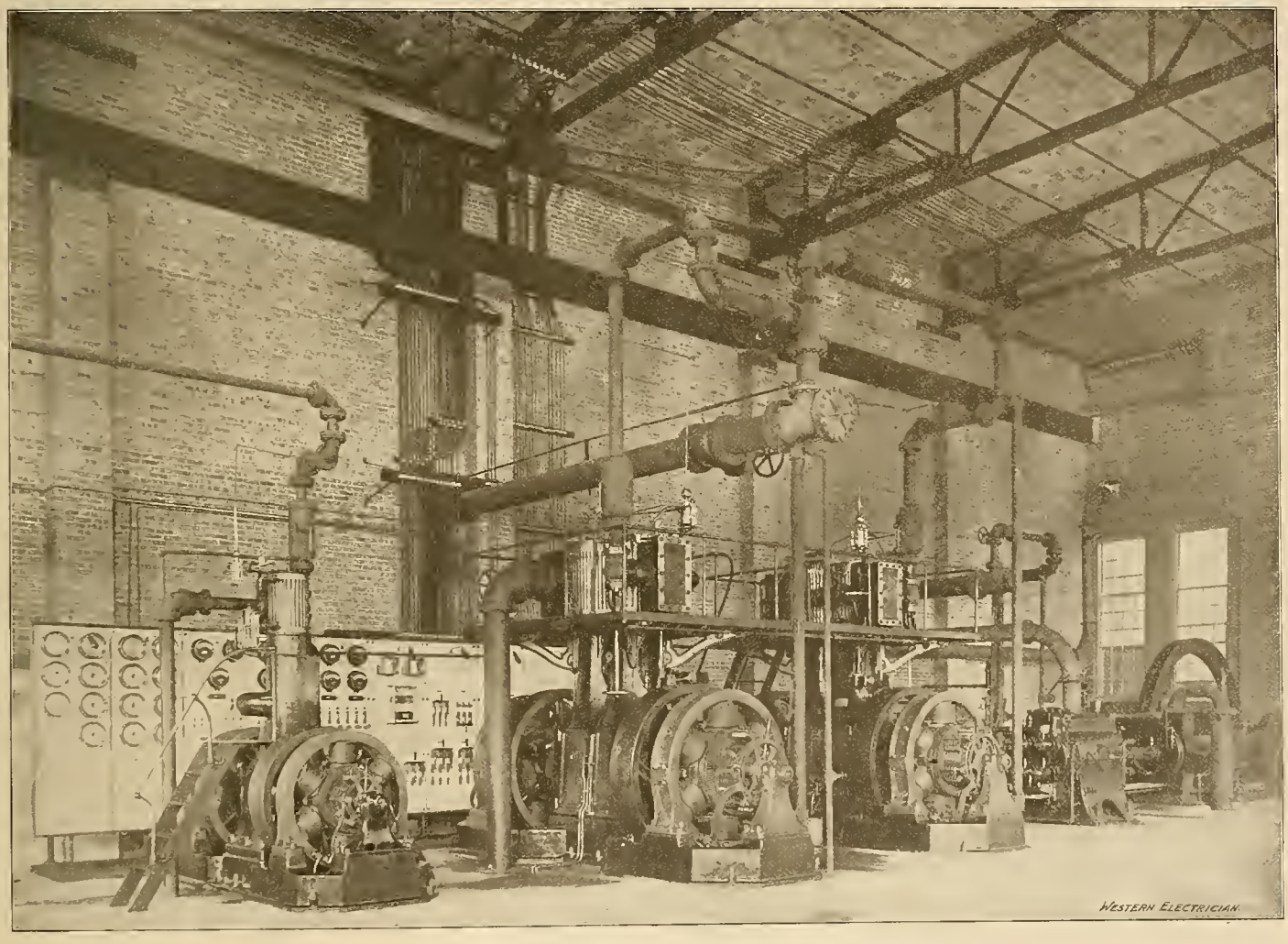


FIG. 1 POWER PLANT OF THE CHICAGO AND NORTHWESTERN SHOPS.—ENGINE ROOM.

gines by the Ball Engine company. The larger engines have cylinders 12 and 22 by 14 inches, and run at a speed of 270 revolutions a minute. The small engine has a 9½ by 10-inch cylinder and runs at 360 revolutions.

At the right in Fig. 1 is seen a large air compressor of the Riedler type, built by Fraser & Chalmers of Chicago. Its capacity is 1,500 cubic feet of free air a minute compressed to 90 pounds per square inch. At the opposite end of the engine room is a hydraulic pump, supplying water at a pressure of 1,500 pounds per square inch, for use chiefly for the boiler-shop riveters, punches and shears. The water service on the grounds is supplied by two fire pumps, having 1,000 gallons a minute capacity. In addition, the engine room contains a 1,500-horsepower Cookson feed-water heater, boiler-feed pumps and a pump for washing out locomotive boilers. A seven-ton handpower crane, with a span of 49 feet three inches, traverses the room.

In taking up the question of power transmission, it was decided to adopt electricity on account of its flexibility and economy in transmission. The next question presented was the type of electrical apparatus to be used, and the decision was partly influenced by the fact that there was already installed on the ground a lighting plant using the Edison three-wire system. Furthermore, the three-wire, direct-current system seemed particularly advantageous, owing to the desirability of handling motors at variable speeds. The main shops were to be provided with traveling cranes, the transfer tables and turntables were also to be operated by electricity, and in all of these 220-volt, direct-current motors would be highly advantageous on account of the easy control of their speeds. Accordingly, the plant was installed on the Edison three-wire system, securing at the same time both the advantage of the 230-volt pressure for the power-transmission lines and the 115-volt pressure for the lamps.

There were four Edison dynamos in the old plant and one General Electric multipolar machine, all of which are utilized as motors in the new arrangement. The Edison three-wire system is used throughout, and contracts were closed with the Chicago Edison company providing for the entire electrical equipment, including dynamos, switchboard, wiring, motors, arc and incandescent lamps. The engineering department of the Edison company also designed the plant, in collaboration with Mr. Quayle, and installed it.

The wiring is divided in the first place into two distinct systems—one supplying the power for the motors, and the other supplying the current for the lights. In addition to this division there is a further subdivision, which provides an independent set of feeders for the shops belonging to the principal divisions or departments. There is one set of feeders which provides for lighting the car-shop department, another set of feeders for lighting the roundhouses, a third set for lighting the main erecting shop, while a fourth provides for lighting the new boiler shop, paint shop, tank shop and blacksmith shop. There is a separate feeder provided for the traveling cranes, and the power feeders for the different shops are divided up in a similar manner to that described above for the lighting feeders. There are also individual feeders for some of the smaller shops.

On the switchboard (Fig. 4) in the central power house are provided switches corresponding to these divisions. By this arrangement the operator at the switchboard can control, to a large extent, the service of light to the different departments, or, in case of any trouble in the power house, he can cut off the current from such shops as can spare it the most easily. The dynamos are connected to the main power and lighting switchboard by cables run in the basement, so proportioned that a fluctuating load will divide itself proportionately between the different dynamos. The switchboard is provided with two main buses, a power bus and a lighting bus, corresponding to the two main divisions of the lighting system. For each dynamo there is a triple-pole, double-throw switch, so that any dynamo can be thrown either on the power or the lighting bus. There is also a main switch for throwing the two sets of bus-bars together, so that at any time, if it is desired, all the light and power can be connected to one pair of dynamos, and even at times of heavy load, if desired, the bus-bars can be thrown together so as to operate the plant with practically one set of bus-bars. The switchboard consists of eight panels of white marble, and besides the electrical instruments and switches, contains the steam, air and water gauges. There are two Thomson wattmeters with ornamental glass case, which measure the lighting current used on the two sides of the three-wire system. There is also a similar 220-volt Thomson wattmeter which measures the power.

The power wiring provides for over 700 horsepower in motors varying in size from one to 95 horsepower. The electric-light wiring is calculated for over 100 2,000-candlepower arc lamps and upward of 2,000 16-candlepower incandescent lights, or a total equivalent in capacity of over 3,000 16-candlepower lights.

The feeders, both for light and power, consist of weatherproof cables strung on poles between the different buildings and rubber-covered wire where they run inside the buildings. The size of these feeders is figured for a drop of 10 per cent. under maximum load, but as the maximum load occurs only for a short period of the day during a comparatively short period in the year, the average loss on the feeders will probably be less than two per cent. The wiring within the shops is of the best quality of braided, rubber-covered wire, run on porcelain insulators, except in certain portions where it is necessary to protect wires from fumes, or where it is necessary that wires be run beneath the floor. In such places they are carried in the loricated iron-armored conduit manufactured by the Safety Conduit company. In the car shops running boards are used for stringing the wires, in order to protect the wires from injury and also to keep them firmly in position.

As has been stated above, there were a number of dynamos which were transformed into motors. The traveling cranes also were provided with their own motors. The balance of the motors, amounting to about 400 horsepower, are of the latest type of multipolar motors manufactured by the General Electric company. An exception to this is a 25-horsepower motor used for the heavy transfer table (Fig. 5) near the locomotive shop which carries the locomotives from one point to another. The transfer-table pit extends along the sides of the machine and boiler shops for a distance of about 900 feet. The motor driving the table is the standard series-wound General Electric street-car motor, with street-car controller and resistance, and the transfer table is operated in a manner similar to the operation of an ordinary street car. The motor is wound for 220 volts and is operated from a double trolley line.

FIG 2 POWER PLANT OF THE CHICAGO AND NORTHWESTERN SHOPS.

As above stated, it was desired not to disturb any more than necessary the existing arrangement of machinery, both because the machines were largely grouped in accordance with the requirements, and also because it was necessary to keep the entire shops running without a shutdown of any department during the change from steam to electric power. Accordingly, the motors for the most part have been distributed so as to provide one motor for each shop or section of shop, this motor being belted direct to the line shaft.

In the main machine or erecting shop there was a single line shaft running the entire length of the building. This line shaft was divided into four sections, each of which is now driven by a 35-horsepower motor. If it is desired, however, these sections can be connected so that the entire line shaft will run, even if one or more motors are shut down. In this shop a 10-horsepower motor operates a walking crane which travels the entire length of the building. The largest motor installed was one of 95 horsepower, which is located 1,000 feet from the power switchboard, and drives the machinery used in making paint in the paint mill. The turntables in the two roundhouses are to be operated by 10-horsepower motors.

While the plant has been in operation for only a few weeks, it has already shown itself to be an unqualified success. Both the motors and the dynamos have been thoroughly tested and have been found to operate successfully, even when loaded far beyond their rated capacity.

The arc lamps are the latest-type long-life lamps manufactured by the General Incandescent Arc

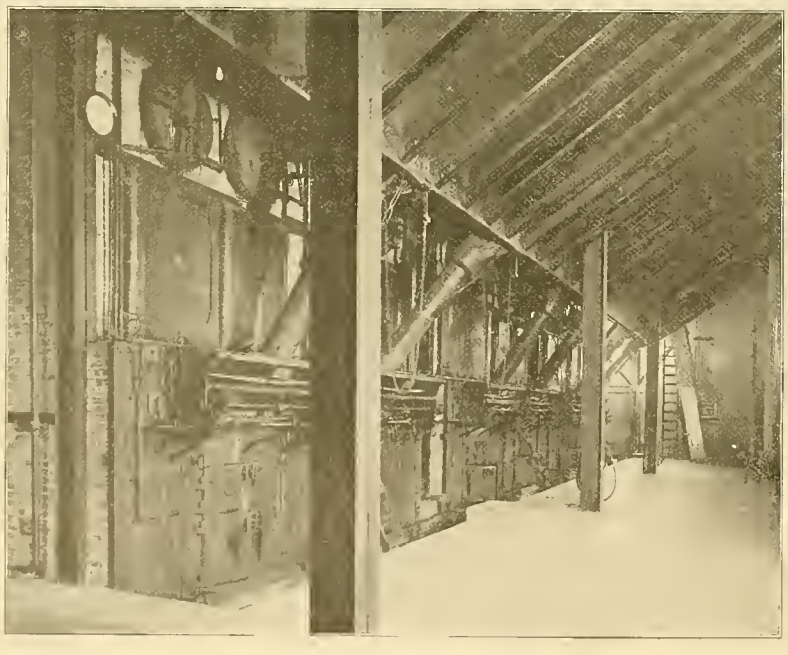


Fig. 3. Boiler Room.

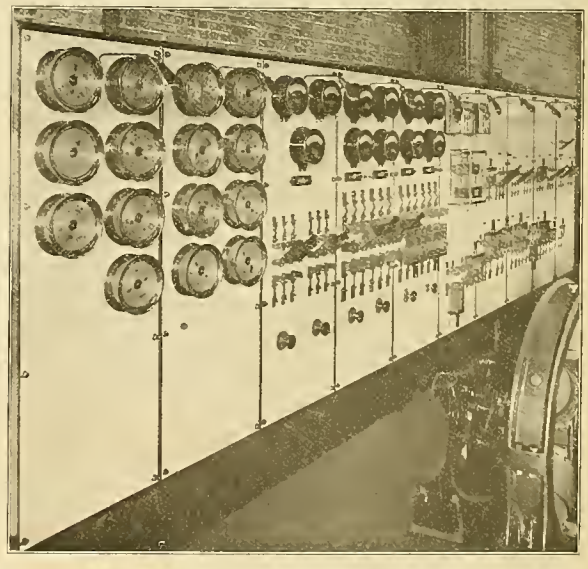


Fig. 4 Switchboard.

POWER PLANT OF THE CHICAGO AND NORTHWESTERN SHOPS.

Light company, and have worked with satisfaction. One of the features of the lighting system has been the lighting not only of the shops, but the yards, thereby facilitating the handling of cars and locomotives along the various tracks. An idea of the magnitude of these shops can be gathered from the fact that the buildings themselves cover a space of nearly 100 acres, while the entire space devoted to the buildings is 640 acres. The number of men employed at these shops averages about 2,000. This

FIG. 5. POWER PLANT OF THE CHICAGO AND NORTHWESTERN SHOPS.—ELECTRIC TRANSFER TABLE.

plant has been watched with considerable interest by railroad men throughout the country, and it is expected that it will lead to a similar modification in the shops of a good many of the principal roads.

Electric Elevators for Safe and Economical Operation at High Speed.

By Hayward Cochrane.

Part II.

Fig. 4 represents a type of high-speed electric elevator known as the traveling-nut and multiple-sheave machine. The motor is coupled direct to the screw which moves the cross-head (H), carrying the sheaves (S) either toward or away from the fixed sheaves (S'). The lifting cables are fastened at one end to the shackle (P), and the other ends are attached to the car. By employing a sufficient number of multiplying sheaves at (S) and (S'), almost any desired car speed may be attained, with a single-threaded worm, while the motor may be of the same speed as that used to operate a winding-drum outfit. This type of elevator is electrically controlled, a small pilot motor being used to operate the reversing switch and controller, and the brake being released magnetically. This form of elevator gives practically the same speeds and kind of service as that obtained with a hydraulic machine. The motor required for this type of machine, however, to give the same speed and load capacity, must be much larger than that for a winding-drum machine, which makes the first cost and

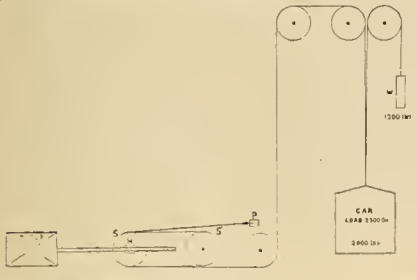


FIG. 4. HIGH-SPEED ELECTRIC ELEVATORS.—TRAVELING-NUT MULTIPLE-SHEAVE MACHINE.

interest on investment high. Referring to Fig. 1 (page 283, Western Electrician, November 3d), which represents a winding-drum outfit, assume that the car weighs 2,000 pounds, that the full load to be lifted is 3,000 pounds and the speed 400 feet a minute. Let the counterweights equal half the load to be raised plus the weight of the car, or 3,500 pounds. In raising 3,000 pounds on the car, therefore, the net load raised is 1,500 pounds. This, at 400 feet per minute, is 600,000 foot-pounds. When the car is descending empty the net load will be the overcounterbalance of 3,500 minus 2,000, or 1,500 pounds. This, at 400 feet, is also 600,000 foot-pounds.

With the type of the machine shown in Fig. 4 the counterweight must weigh less than the car by several hundred pounds, say, 700, to insure its descent without slackening the lifting cables. In raising a load of 3,000 pounds on the car, therefore, the net load raised is 700 plus 3,000, or 3,700 pounds. This, at 400 feet per minute, is 1,480,000 foot-pounds, or more than 2.46 times as much as that taken with a winding-drum machine of same capacity, which is more than borne out in practical car-mile tests. Assuming that the net load efficiency of the two types of machines is practically on a par, the traveling-sheave machine requires a motor capacity greatly in excess of that for a drum machine. This means a heavier demand for current when starting the load, and practically prohibits the use of the traveling-sheave machine on incandescent-lighting circuits. In descending with reasonably large loads the motor acts as a generator, this dynamic action being used as a brake to control the speed of the car. While with the winding-drum mechanism, as explained above, when the motor acts as a generator, it furnishes current to the line and runs the meter backward, if one is used, and reduces the power bill.

The traveling-sheave machine, having both an electrically released brake and a pilot motor for operating the controller, uses a large amount of power in these devices, or practically double that

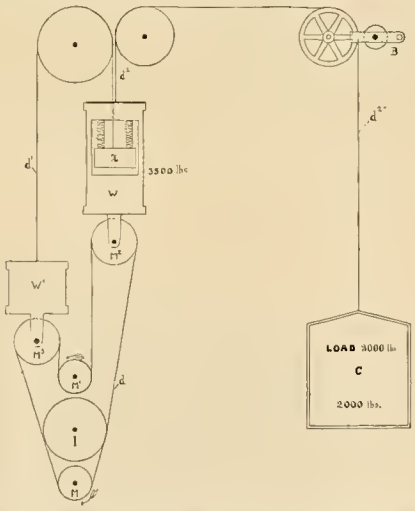


FIG. 5. HIGH-SPEED ELECTRIC ELEVATORS.—DOUBLE-MOTOR CONTINUOUSLY RUNNING CABLE MACHINE.

used with the method of electrical control indicated in Fig. 3 (page 284).

A somewhat novel and interesting type of electric-elevator mechanism[1] is outlined in Fig. 5. (M) and (M') represent sheaves of equal diameter, keyed upon the shafts of two independent motors of equal normal speeds. (I) is an idler wheel, to prevent the cables (d) from chafing upon themselves when either weight (W) or (W') is at the top of the elevator shaft. (M^2) and (M^3) are sheaves attached to the bottom of weights (W) and (W'), respectively. (C) represents the car and (B) the brake, which is applied to the sides of the sheave at top of hatchway, over which the car cables (d^2) run. The weight (W') is simply a guide block for carrying the sheave (M^3) and one end of cables (d'). (W) answers the purpose of guide for sheave (M^2) and attaching the other end of cables (d'), besides forming the counterbalance for the car (C). Within the weight (W) is a take-up block (X), to which the ends of cables (d'), after passing freely through the top of (W), are fastened. Two springs are placed between (X) and the top of (W), to maintain as nearly as possible a constant tension upon cables (d) and (d'). The brake (B) is held out of action magnetically at all times, except when the motors (M) and (M') are cut out of circuit. The weight (W) may be made as heavy as desired, up to an amount equal to the car plus half the load to be lifted, so that this type of machine allows the car to be overcounterbalanced as much as a winding-drum outfit. While in continuous service both motors are kept running, but are stopped entirely if the elevator is out of service for any appreciable length of time.

If motor (M) runs faster than motor (M'), it will draw in the endless cables (d) from sheave (M^2) faster than the motor (M') pays them out to (M^2), provided there is no slipping of the cables on sheaves. This action draws the weight (W) down and thus causes the car (C) to go up. On the other hand, if motor (M') runs faster than motor (M), it will draw in the cables (d) from sheave (M^3) faster than the motor (M) pays them out to (M^2). This causes the weight (W') to be drawn down, letting the weight (W) go up and the car (C) go down. To stop the car, therefore, the motors have to be brought to the same speed. When the car is to be stopped long, both motors are shut down, and the electric brake (B) is released, which prevents the car from starting in case it should be either empty or heavily enough loaded to overbalance the weight (W).

Assume for this outfit a load of 3,000 pounds, and a speed of 400 feet per minute, with a car of 2,000 pounds, and let the effective weight of (W) to overbalance the car (C) be 3,500 pounds. Then the net load to raise 3,000 pounds will be 1,500 pounds, which, at 400 feet per minute, is 600,000 foot-pounds. If car is descending empty, the net load will be 3,500 minus 2,000, or 1,500 pounds, which, at 400 feet per minute, is also 600,000 foot-pounds. So far as the actual work done in moving the loads is concerned, therefore, this type of elevator mechanism is as economical as the winding-drum type. It has the advantage also of easy electrical control,

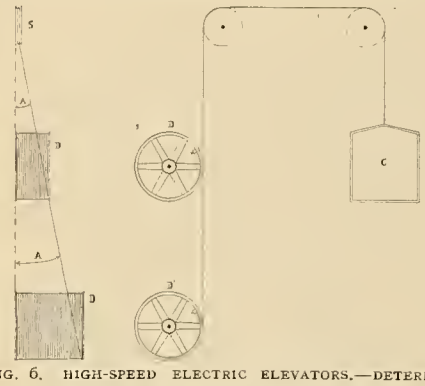


FIG. 6. HIGH-SPEED ELECTRIC ELEVATORS.—DETERMINATION OF DIAMETER AND LENGTH OF DRUM.

smoothness of operation and accurate speed regulation.

Some of its objectionable features may be mentioned: One of these machines, which is in practical operation, has sheaves (M) and (M^4) about 16 inches in diameter, or 4.182 feet in circumference, while the endless cables (d) are of about five-eighths-inch-diameter rope, with about three-sixteenths-inch-diameter steel cable, as a center or core. About six such cables are used for a machine of the above-named capacity. The difficulty of splicing six such cables, so as to make them exactly of the same length, is apparent. While, if they are not of equal length, the shorter cables have to stand a greater strain and give out sooner. In actual practice they do not last over two or three months' time, and it is found difficult to make splices that will be serviceable and safe. Moreover, the bending of ropes or cables around sheaves of small diameters wears them out rapidly, and is to be avoided, if possible. If the sheave or motor (M) of 4.182 feet circumference revolves at a speed of 200 revolutions per minute at slowest speed, it will pay out cables (d) at the rate of 836.42 feet per minute. If the car (C) is to have a speed of 400 feet per minute, the cables (d) must be drawn in by the motor or sheave (M') at the rate of 1,646.42 feet per minute, or 800 feet faster than sheave (M) pays them out. This means that the motor or sheave (M') runs at a speed of 391 revolutions per minute. It is plain, therefore, that very slow-running motors must be used, or the sheaves (M) and (M') must be exceedingly small diameter.

The elevator mechanism referred to here has two 30-horsepower motors, while a winding-drum outfit, to give same capacity, requires one motor of about 27.5 horsepower, with a normal speed of about 800 revolutions per minute. The cost of motors, therefore, for the above type of machine is double, or more, that of a winding-drum outfit. Except when the car is shut down, the electric brake (B) is taking current; in other words, it is not released and applied each time the car starts and stops. The size of this brake solenoid is greater than that generally used for a brake that is released and applied for each start and stop of the car, one reason being that the current is kept on the solenoid nearly continuously, instead of intermittently, as with the ordinary brake; a greater amount of energy is consumed, therefore, in a brake of this kind. Moreover, a large amount of energy is consumed in keeping the large motors (M) and (M') running at even a slow rate of speed while the car is not

1. Elevators of this type were illustrated and briefly described in the Western Electrician, July 21, 1900.

moving. To say nothing about the per cent. of efficiency of motors of such design as (M) and (M') must be, it is apparent that the energy consumed in operating an elevator mechanism of this type must be greatly in excess of that consumed by a winding-drum outfit.

Another novel method of operating an elevator, which has been figured out, but not tried practically, so far as known, is to have the motor direct-coupled to the drum shaft. This method, if it could be used, would doubtless give the highest efficiency obtainable from any form of elevator mechanism. Assuming the same load and speed as for the other types, viz., 3,000 at 400 feet per minute, it would be necessary to use at least two seven-eighths-inch-diameter steel cables. And it is not best to run such cables over a drum of diameter less than 40 times the diameter of cable. This would require a drum diameter of about 36 inches, or circumference of about 9.6 feet. For a building 224 feet high, a drum of at least 28 inches' length would be needed. To give a car speed of 400 feet per minute, the drum and motor would have to revolve at the rate of 41.6 revolutions per minute. This would require a motor of abnormal design, of large size and low efficiency, but the total machine efficiency might, nevertheless, be high. One of the principal objections to such an arrangement would be the difficulty of operating the brake positively and safely, and there might be a lack of flexibility also in the general operation. It would be necessary to have an electrically released brake in connection with the overhead car-supporting sheave, which could be applied at any time when desired, or would automatically apply in case of current failure.

It may be thought by most persons that the amount of energy consumed by an ordinary brake solenoid amounts to very little. Experience has shown, however, that there is a difference amounting to from $5 to $15 a month in the cost of running an elevator between the use of a mechanically or an electrically released brake, depending on the capacity of any given machines, as shown by meter rates.

The general economy of operation, therefore, of a winding-drum machine, especially if equipped with a mechanically released brake, is far greater than that which can be obtained from either a multiple traveling-sheave machine, or from a double motor, continuously running, cable mechanism. One of the difficulties in connection with the use of winding-drum elevator machines for very high speeds, and very high buildings, has been in determining the diameter and length of drum to be used. Referring to Fig. 6, let (D) represent the drum of a machine for a building of eight floors, or, approximately, 112 feet lift.

Assuming a drum diameter of 48 inches, or circumference of 12.75 feet, and using two seven-eighths-inch-diameter steel cables, the face of drum will need to be about 22 inches. For a building of 16 floors, or, approximately, 224 feet lift, using an elevator of same capacity and speed, with a drum diameter of 48 inches, the face of drum will be about twice 22 inches, or 44 inches. Referring again to Fig. 6, (D') represents such a drum.

In the case of either drum (D) or (D'), the cables should be fastened into the drum at the right-hand side, as shown, so that when the car is down and cables are unwound, they will have an angle (A) with the vertical, which angle will be the same for the high as for the low building. By fastening the cables at the right-hand side of the drums they lead on to the drums so as not to chafe on themselves. While, if fastened at the left-hand side of drums, they would chafe and wear out rapidly. The angle at which the cables lead on to the overhead sheave (S) is not great enough to wear them seriously in ordinary cases. The angle of lead of cables, therefore, for high buildings and high speed, is not of any serious consequence.

The speed of car may be increased to 500 or more feet per minute, by increasing the number of threads on the worm of the machine and also increasing the pitch of teeth, without using an abnormally large diameter of drum. The safety of operation in descending with full load may be obtained by the automatic speed-controlling device. The economy of operation of such a winding-drum elevator outfit is greatly ahead of any other type of electric elevator, especially if it is controlled mechanically. The speed of car herein assumed, viz., 400 feet per minute, may be considered by some as too low, but we find the actual speed and load as used by the double-motor outfit, or the multiple-sheave traveling-machine mechanism, to be about what is here assumed. The comparison has been made on that basis, therefore, and it is questionable if much higher speeds are of practical use in the ordinary office building, unless it be for express service in the higher buildings. Even for express service, speeds of 500 feet per minute are rarely exceeded by the hydraulic elevators, which are capable of giving yet higher speeds. The winding-drum elevator mechanism, therefore, when properly constructed, ought to fulfill all reasonable requirements for high-speed service, and at a decided economy over any other known form of elevator mechanism.

[*The end.*]

The report of Naval Constructor W. L. Capps, on the new battleship Alabama, states that the ventilation there employed, by steam-driven fans, is notably inferior to that of the Kearsarge and Kentucky, where electrically driven fans are employed. Mr. Capps recommends strongly the use of electric ventilators in all future construction.

Electric Fire-fighting Apparatus.

The Fire Department of Paris has recently added to its apparatus three types of fire automobiles driven by electricity, which are said to have increased considerably the efficiency of the department's service. One of these vehicles is a hose wagon, and has been in operation for some time. It is essentially an electric wagon, capable of seating six men and provided with a supply of hose, nozzles, ladders and life-saving apparatus.

The electric fire pump, shown in Fig. 1, is of an entirely new type. It consists in principle of a metallic tank of 100 gallons' capacity, mounted upon an automobile carriage, and a pump, provided with a hose and nozzle. The same electric motor which propels the carriage drives the pump as soon as the vehicle comes to a standstill at a fire. This end is accomplished by a very ingenious system of gearing, which transmits the power of the motor to

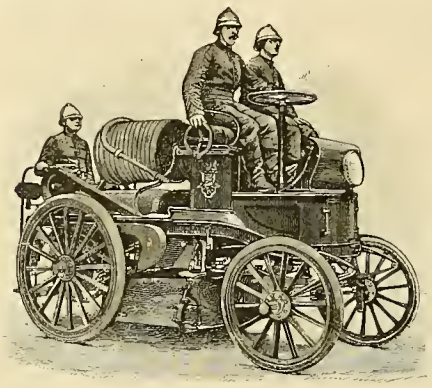


FIG. 1. ELECTRIC FIRE-FIGHTING APPARATUS —FIRE PUMP.

the propelling mechanism of the pump. This system, therefore, constitutes a complete combination for immediate operation. It offers the advantage of permitting the vehicle to start without any delay as soon as an alarm is given, and of allowing the engine to be set immediately in operation as soon as the vehicle reaches the fire. Again, it is with the same object of rapidity of action in view that the hose of the engine reel consists of a rubber tube provided internally with a spiral of metal, which preserves its cylindrical form and permits it to be kept full of water, even when it is wound up.

The engine starts off at the first alarm, and, as soon as it reaches the fire, commences to act in utilizing the 100 gallons of water in its tank, which, under ordinary circumstances, suffices for an operation of five or six minutes. During this period, the electric hose wagon, which immediately follows it, has had time to arrive in its turn and allow the hose that it carries to be coupled to a hydrant in order to supply the engine. Then, if the extent of the fire requires it, the attack is pursued as usual with steam and hand engines; but, in all cases, valuable time has been gained by the preliminary and immediate action of the electric fire-engine. The fire-engine, in running order, weighs, inclusive of the crew and 100 gallons of water, 6,380 pounds.

The engine, as well as the hose wagon, is arranged in such a way as to permit the utilization of a part of the energy of the accumulators for the illumination, through arc or incandescent lamps, of fires that occur at night. This latter system will prove particularly valuable in cases where it is necessary to throw light into places in which the existence of explosive mixture may be suspected.

Fig. 2 shows an electrically operated ladder wagon, consisting of a low truck, upon which the large ladder in use in the department is hoisted almost horizontally by means of an inclined plane and a windlass. The total weight of this apparatus, inclusive of its crew, is 9,150 pounds. It is the heaviest of the pieces of fire material to which mechanical propulsion has been applied. So, by reason of the peculiar difficulties presented by the maneuvering of it, it became necessary to assure the perfect stability of the vehicle, especially in turning corners, while running at considerable speed. This has been done so successfully that the electric ladder truck is more stable than horse-drawn ones.

The storage batteries of the three types of apparatus were furnished by the Société Bouquet-Garcin-Schrive of Neuilly, France. They are enclosed in a case suspended beneath the vehicle and are so calculated as to permit of the vehicles making 36 miles at an average speed of 12 miles an hour on one charge. A French journal furnishes the data (translated by the Scientific American) on which this brief description is based.

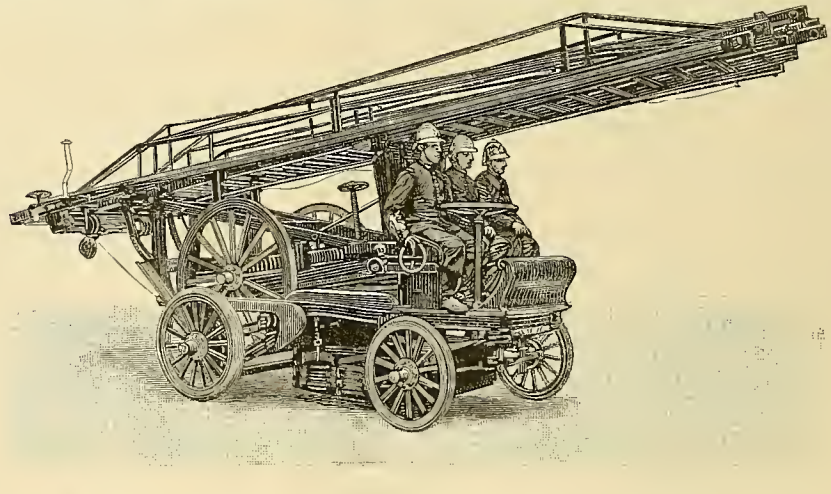


FIG. 2. ELECTRIC FIRE-FIGHTING APPARATUS.—HOOK AND LADDER.

Chicago Elevated Railroads.

The elevated-railroad companies of Chicago made comparatively poor showings for the month of October. The South Side line carried nearly 5,000 passengers a day less than during October, 1899; the Metropolitan's falling off was over 7,600 in its daily average; the Northwestern elevated, which was not in operation a year ago, cannot suffer from a comparison, but reports a daily average traffic of 50,807. The reason for the decrease in the business of the other roads for the month is that this year the fall festival and other attractions, which drew heavy crowds last year, were lacking. However, October was the only month of the first 10 this year to show a decrease in business for any of the roads.

The Lake Street Elevated Railroad company is making preparations for laying a third track, to permit an express service similar to that on the Northwestern line. Express trains will be run downtown in the morning from the outlying stations and from the city to the western terminus during the rush hours of the evening. It is announced that bonds will be issued to meet the cost of this improvement, and that a plan for the readjustment of the capitalization of the road will be brought out shortly. Mr. Yerkes will take personal charge of the finances. Blair & Co. of New York, who have large holdings in the Northwestern elevated, have had the proposition in hand for several months. It is not unlikely that these developments will lead to the consolidation of the Lake street road with the Northwestern Elevated road, a project which Mr. Yerkes and other stockholders of these roads are believed to favor.

Secrets of the Starry Universe Revealed.

"The Secrets of the Sun and the Starry Universe" is the title of a remarkable pamphlet by H. R. Rogers, M. D., belonging to that borderland of conjecture which may be styled imaginary science. "That the sun and all the starry worlds are constituted alike is now the belief of some of the highest authorities," and to expose to ridicule this "stigma" on science is the object of the book. "The temperature of universal space is variously estimated at from hundreds to millions of degrees below zero," says the author, and "this fact of the universal darkness of space is fatal to every theory of the sun yet advanced." Obviously, "no light can come through the 93,000,000 miles of utter darkness." The reader will be pleased to learn "that the sun may be dark, cool and habitable, and filled with life, intelligence and beauty, like unto the earth, as shown in facts already well known, and which stand unquestioned." Twenty-five years of study in this field has furnished to Dr. Rogers the "key to the new philosophy," "that the sun and all stars are maguets polarized in immensity and filled to repletion with the electrical principle." "Thus the 'fire-ball' theory of the sun comes to its merited end."

Work will be commenced soon on an electric railway 21 miles in length, from Lake View, near Columbus, to Lima, Ohio.

A Frontier Electric-light Plant.

By George D. Shepardson.

The village of Gardiner, Park County, Mont., contains about 50 log houses and a population of about 100 inhabitants, the large ratio between inhabitants and houses being accounted for by the scarcity of women and the large number of single men keeping bachelor homes. Gardiner is in the southwestern part of Montana, on the northern boundary of the Yellowstone National Park. As its principal street is on the park line, the hotels and business houses command an uninterrupted view of Electric Peak and other less prominent mountains toward the south in the park. The town is 53 miles from Livingstone, the county seat and nearest banking point, and is three miles from Cinnebar, the terminus of the National Park branch of the Northern Pacific railroad. It is the only settlement between Cinnebar and Mammoth Hot Springs, with each of which places there is daily stage connection. Gardiner has waterworks, electric lights and tele-

FIG. 1. A FRONTIER ELECTRIC LIGHT PLANT.—POWER HOUSE AT GARDINER, MONT.

phone connection. The business houses include the postoffice, general store, candy and patent-medicine store, two hotels, four saloons, two blacksmith shops, tailoring and millinery shops, livery, harness shop, justice's office, several boarding houses and the first station of the Wylie Camping company for tourists through the National Park. The principal business of the town is "freighting," that is, teaming supplies for Bear Gulch and other mining camps farther in the mountains by means of horses and wagons or by pack animals.

The Gardiner electric-light and waterworks system furnishes an excellent example of how Yankee

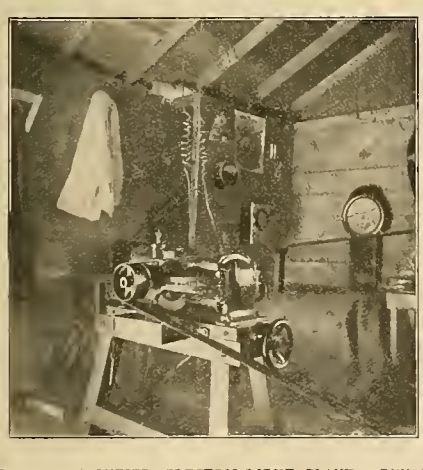


FIG. 2. A FRONTIER ELECTRIC-LIGHT PLANT — DYNAMO AND SWITCHBOARD.

ingenuity and skill can adapt means to ends and compel success where many would hesitate. By combining the resources of two citizens—capital furnished by John Spiger and ingenuity and skilled labor supplied by Charles Huntley—a waterworks plant was constructed in 1892 and an electric-light plant was added in 1895.

The town is built on the bank of the Yellowstone River, a distance of perhaps 1,000 feet below the confluence of the Gardiner. From the latter point a flume extends to the power house on the river bank, just below the town, as shown in Fig. 1. The power house, which is constructed of pine, consists of three parts. The water pump and its wheel are in the basement, the electrical equipment is in the main part, occupying the upper story, while an annex houses the penstock, the waterwheel for the dynamo and the gates for both wheels.

In the basement, with its log walls, are the two single-acting pumps, with plungers of two-inch diameter and six inches throw. Both pumps are driven by cranks from a common shaft, which is belted to a breast-wheel, eight feet in diameter and four feet long. The whole was built on the spot by Mr. Huntley. The water is pumped to an elevated tank near the center of the town.

In the main part of the building, which is about 20 feet square, is the dynamo room, with its dynamo, shafting, switchboard, circular saw and work

FIG. 3. A FRONTIER ELECTRIC-LIGHT PLANT.—SHAFTING AND WATERWHEEL GOVERNOR.

benches. The dynamo is a second-hand "Indianapolis Jenney" machine, capable of carrying 50 110-volt, 16-candlepower incandescent lamps. The switchboard, as seen in Fig. 2, includes a Whitney voltmeter, a field rheostat and a fuse block and switch for controlling the station lights. The outside main distributing line comes directly to the dynamo terminals without encumbering the switchboard, and is innocent of switch, fuse or lightning arrester.

The dynamo is driven at a speed of 1,800 revolutions a minute by a four-inch belt running from the six-inch dynamo pulley to a 48-inch pulley on an intermediate shaft. This shaft carries a 12-inch pulley, from which a second belt runs to a 30-inch pulley on a second shaft, carrying also a 12-inch pulley, driven by a belt running from a 50-inch pulley on the extended shaft of the waterwheel. The electric-plant waterwheel is of the overshot type, being eight feet in diameter and 6½ feet long. Like its mate, it was made on the spot. The shafting, boxes and pulleys were adapted from the wheels and trucks of abandoned mowing machines, while parts of a bicycle were used in governing the water-gate opening, as shown in Fig. 3.

The water flume is excavated from the gravel bank of the river to a point near the power house, whence it is continued in a wooden trough or penstock four feet wide by one foot deep, provided with a spillway and the gates for the two wheels. The gates are of the simplest character, that for the waterworks wheel being simply a board sliding be-

FIG. 4. A FRONTIER ELECTRIC-LIGHT PLANT.—ENCLOSED WATERWHEEL AND FLUME.

tween vertical guides at the end of the penstock. The overshot wheel that drives the electrical machinery is encased directly beneath the flume, as shown in Fig. 4, its gate consisting of a trapdoor, the upstream side of which is raised or lowered to suit the varying load. Figs. 4 and 5 illustrate some structural details of the power house and present the accomplished engineer and constructor.

The lighting plant is operated during nine months of the year, and the water tank is kept in constant service throughout the year, the pumps being operated as required. Incandescent lights are furnished at the flat rate of $1 a month. The company has about 40 customers for light and water. The townspeople seem well satisfied, and the engineer is justly proud of his plant and its successful operation.

Large Gas Engine in Electric Power Plant.

Probably the largest gas engine yet installed in this country is that at the Howard Axle Works, one of the Carnegie interests at Homestead, Pa. It was designed by Westinghouse, Church, Kerr & Co. It is a 650-horsepower machine, direct-connected to an engine-type Westinghouse generator, giving direct current at 250 volts. Natural gas is supplied from the Carnegie Steel company's six-inch mains. The engine runs smoothly, with little noise, and is odorless. The cylinders are water-jacketed and are not perceptibly hotter than those of a similar high-pressure steam engine. The speed is only 150 revolutions per minute, yet the regulation is said to be very satisfactory, with only a small flywheel on each end of the shaft. There are three cylinders, in each of which ignition occurs once in every two revolutions, and the cranks are set at such an angle that the shaft receives an impulse once in every two-thirds of a revolution.

The direct-connected generator is of 400 kilowatts' capacity, giving 1,600 amperes, at 250 volts. The voltage regulation is said to be as good as that from the best steam-driven generator.

The engine occupies 29 by 11 feet of floor space, aside from a small area occupied by the gas-driven, air-compressing set for starting the big gas engine. The water required for the water jackets is approximately four to five gallons per horsepower-hour;

FIG. 5 A FRONTIER ELECTRIC-LIGHT PLANT.—THE MAN WHO BUILT IT.

this is discharged at a temperature between 100 and 200 degrees Fahrenheit, and is sometimes used to warm feed-water heaters of a boiler plant. Yet even with this heat going to waste in the drain, the engine shows such efficiency, say the manufacturers, that a brake horsepower is obtained with less than half the amount of coal required in a high-grade steam-engine plant, or an efficiency of 25 to 30 per cent. The longest continuous run of this engine was of 260 hours' duration, which is nearly as severe as that to which engines of an Atlantic liner are subjected. In exterior appearance this gas engine closely resembles the steam engines of the Westinghouse make.

Twenty-eight Westinghouse electric motors are at present used in the Howard Axle Works, ranging in size from 50 horsepower down. The largest of these motors are used to drive furnace blowers at 900 revolutions per minute. Overhead cranes and conveyors, straightening machines, and axle lathes are electrically operated. Motors are also used for a wide variety of minor purposes, including the operation of a carpenter shop, a machine shop, and a boiler-house crane with coal and ash-handling machinery. In addition to the motors, the generator will supply 75 arc and about 150 incandescent lamps.

Electricity and the New Haven Elms.

The assertion has been made in New Haven that currents from the trolley wires, which are sometimes supported from the trees along the streets, have been the cause of the death of many of the fine elms there. The street-railway companies have sought to prevent damage suits by an offer to test the scientific correctness of these assertions. Permission has been obtained from the Department of Public Works and police supervision assured for the interesting experiment of charging the big tree in front of City Hall with the full voltage of the trolley system. If the tree dies a score of suits will be filed by property owners who have been compelled to cut down trees, some of them 150 years old, since the trolley ran through the avenues.

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CONVENTIONS AND EXPOSITIONS.

Automobile Shows, New York, N. Y., November 3d to 10th and November 10th to 24th.

Illinois State Electric association, Peoria, November 27th.

National Automobile and Sportsman's Exhibition, Washington, D. C., December 10th to 15th.

Roentgen Society of the United States, New York, N. Y., December 13th and 14th.

Mr. McKinley has been re-elected president, and there is no doubt that the greater portion of the constituency of this journal is well pleased with the result. Now let us all bend our energies toward such an expansion of the electrical industries in these United States as has been witnessed never before.

Twelve cents a thousand volts is certainly an unusual price for electricity. A newspaper correspondent in Freeport, N. Y., says that that price prevails there and that the people of the village think that they enjoy the cheapest rate for electricity in the United States. The village owns the plant and is running it at a loss, it is said. Hence, there is some dissatisfaction among mean-spirited taxpayers, who fail to recognize Freeport's fame in not only corralling the elusive volts, but actually selling them by measure.

Deaths among the electrical fraternity often seem to come in groups or cycles. Four are recorded in this issue of the Western Electrician. Mr. Bliss, the oldest man on the melancholy list, was at one time one of the most prominent electrical men in the Middle West. Mr. Tailleur was an expert in underground construction and had given his name to several practical and well-known devices used in work of this class. Mr. Gundaker had a large circle of acquaintances among the electrical people of New York and vicinity, and Mr. Hooper, less generally known than any of the others, perhaps, was equally esteemed by those who had the privilege of his acquaintance. The Western Electrician extends its sincerest sympathy to all those to whom the deaths of the gentlemen named come with the severe wrench of personal bereavement.

The admirable review of the present aspect of wireless telegraphy by Hertzian waves written by Blondel and Ferrié for presentation at the Paris Electrical Congress has been translated for the Western Electrician and is presented, in abstract, in this issue. It is worthy of the careful attention of all interested in this fascinating subject, for the present state of the art (with the exception of Marconi's latest experiments, to which reference is made in an editorial footnote) is clearly and carefully stated by competent authority. The limitations of wireless telegraphy are plainly indicated, although the advances made in the last four or five years have been little short of marvelous. Marconi is accorded full credit for his work, and, looking to the future, the authors indicate the lines along which still greater improvements must be made.

Experiments having for their object the artificial cultivation of rubber have hitherto failed of success—that is, success in the commercial sense. However, the effort continues, and only last month it was reported that Professor George Lincoln Goodale of the botany department of Harvard University is going to Magdeburg, Germany, to study beet sugar, particularly the history of the beet itself, which was but an ordinary plant growing along the Mediterranean and has been developed by careful culture into the modern sugar beet. The same methods of culture, Professor Goodale expects to apply to the rubber plant, which he believes can be made to produce a high grade of rubber. America has, he thinks, as great an opportunity to supply the world with rubber, which is growing scarcer, as Germany had with its beet sugar. The electrical interests will welcome any method or discovery that will make good insulating rubber cheaper. And so more power to the Goodalian elbow!

In railroad shops, usually scattered over a considerable area, exceptional advantages are offered by the concentration of power-generating plant and the electrical transmission of power to the points of consumption. Of late years railroad engineers have recognized the importance of these considerations, and the Oelwein shops of the Chicago Great Western road and the Chicago shops of the Northwestern system may be mentioned as plants electrically equipped in accordance with the latest power-saving ideas. The electrical equipment of the Northwestern shops is described and illustrated in this issue, and the article and pictures show that the plant is carefully designed for economical power production and application. Direct-current, 220-volt motors and 110-volt lamps are operated on the three-wire system, and great economy of power, over the old system of scattered steam-raising units, will be realized. Steam-railroad men are gradually becoming convinced of the reliability as well as the economy of electricity as an agent in transmitting power, as shown by stationary factory plants, and the way is being prepared for the gradual and increasing substitution of electric motors for steam locomotives on trunk-line railroads.

Now that the campaign is over, it will be permissible, perhaps, to make public in this country the important statement of public policy made by the president of the United States to an Australian traveler and which we find in the Daily News of Perth, Western Australia, under date of September 11th last. The Western Electrician is a technical journal and does not ordinarily concern itself in affairs of state, but in this case we may plead the exceptional importance of the subject and the additional interesting fact that the announcement was confided to an electrical man.

Mr. L. J. B. Wall, of Splatt, Wall & Co., electrical engineers of Perth, traveled in Europe and America last summer, and on his return from a trip of five months' duration he did not escape the vigilance of a reporter for the Perth News, who found Mr. Wall "replete with observations gathered during his travels" and who interviewed him for a column accordingly. While in the United States Mr. Wall ran down to Canton, in Ohio, to have a chat with the president, and as it was at this meeting that the momentous declaration before referred to was made, we shall quote directly from the newspaper report.

According to Mr. Wall, Canton is an idyllic city of palatial residences, but, excepting the balustrade, which, for obvious reasons, is placed around the president's house, there is not a fence to protect the magnificent lawns and gardens which adorn the streets from end to end. How different from the dingy, crowded thoroughfares of the Canton of the East, and how honest must be the American "Cantonese!"

Mr. Wall's first words in acknowledgment of the welcome which he received on calling upon Mr. McKinley contained the assurance of the communion of sentiment existing between the two great offsprings of the British race at opposite corners of the world.

"No," replied the president, "not so far off. The progress of civilization is bringing us closer every day. In my opinion, the time is not far distant when all the English-speaking races will be under the one flag."

It will be seen that we have not exaggerated the importance of the opinion attributed to the president. But the declaration is tantalizing in that it fails to specify which flag. Is "the one flag" that is to wave its proud folds over the capitol at Washington and the Halls of Westminster to be the meteor flag of England or the Stars and Stripes with which we Americans are more familiar? The speculation is an interesting one, but as there is always some possibility of error in the reported opinions of public men, there is a chance that Mr. McKinley may deny that he took Mr. Wall into his confidence to the extent indicated, and in that event the discussion would become academic and not of immediate importance.

However, the interview with Mr. Wall is interesting throughout. The traveler says that the prosperity of America has been so great that he fears the "boom" must burst. Production is nearly treble local requirements. The tendency is for the rich to become richer and the poor poorer, and, when all conditions are carefully analyzed, it is seen that the working man is not well off in the United States. In Pittsburg, for instance, the men are entirely at the mercy of their masters. The presidential election paralyzed business completely. American politics are very corrupt; "to be a mayor commands no more respect than to be an ordinary townsman;" and, generally, those in the highest offices command the least respect.

Coming to electrical development, Mr. Wall is equally discriminating. "America, of course, is the home of electricity. In some places you can travel hundreds of miles in electric tramcars. From 150 miles north of Boston to 100 miles past Washington—a distance of about 800 miles—there is a continuous electric service. The trams have regular stopping places, and on the outskirts of the centers of population they travel at a speed of up to 50 miles an hour."

Mr. Wall of Perth is certainly an entertaining talker.

OBITUARY.

George H. Bliss.

To the older electrical men of the West the announcement of the death of George H. Bliss will possess a mournful interest, for Mr. Bliss was one of the very first to exploit the incandescent electric light in Chicago and the territory tributary to it. Mr. Bliss lived to be over 60 and he had a busy and varied career, associated closely with the electrical industry, for the lighting business was only one of several electrical pursuits in which he had been engaged. The deceased breathed his last at his home, 4528 Lake avenue, Chicago, on October 31st. The cause of death was consumption, with which Mr. Bliss had been afflicted for some time.

George H. Bliss was born on May 12, 1840, at Worcester, Mass., and removed to Chicago at the age of 14. He was educated in Chicago, being a student in the first high school in the city. While still in his teens he took up the study of the telegraph under the instruction of E. D. L. Sweet. His first services were rendered at Dixon, Ill., where he was an operator for the old Illinois and Mississippi Telegraph company. He served this company at Muscatine and Aurora and then was put in charge of the main Chicago office of the company.

In 1860 young Bliss entered the service of the Chicago and Northwestern Railroad company as telegraph operator, and in 1865 had so commended himself by fidelity and skill that he was made superintendent of telegraphs of the Northwestern road. He was one of the very first superintendents of telegraph in the West. He held this position for a number of years, and during that time displayed much ability and progressiveness in the operation and development of the telegraph system.

After leaving the railroad company Mr. Bliss in 1868 organized the first electrical supply house in the West, under the firm name of Bliss, Tillotson & Co. In connection with the general supply business, the firm did repairing on electrical instruments. This business was a successful one. After being burned out in the Chicago fire of 1871, Mr. Bliss bought out the interests of L. G. Tillotson, and organized and was made president of a stock company known as the George H. Bliss Manufacturing company. In this company and several other enterprises he was associated with E. B. Chandler and other well-known electrical pioneers. The business gradually dropped away, the stock of merchandise was destroyed by a second fire, and the company finally sold out to the Western Electric Manufacturing company, organized but a short time previous.

About this period (1875-77) Mr. Bliss took up several electrical inventions, one of which was the Edison electric pen. He pushed this article vigorously and sent the late Col. George L. Beetle to Paris to exploit it there. However, his anticipations were not realized and soon afterward he entered the employment of the Western Electric Manufacturing company as general agent. He had charge of the sales department of this company, now the Western Electric company, for a number of years.

Mr. Bliss had become associated with Mr. Edison's inventions and interests at an early period, and when companies were formed to exploit the newly invented incandescent lamp he was summoned to Mr. Edison's laboratory at Menlo Park to become instructed in the new system, with the idea of establishing a western agency. In December, 1881, Mr. Bliss opened up his office in the Major block, at the corner of La Salle and Monroe streets, where he acted as representative of the Edison Electric Light company and the Edison company for Isolated Lighting. During his agency in January, 1882, the first incandescent-lighting plant in the West was installed in the old Rand & McNally building. The new residence of J. W. Doane on Prairie avenue was soon afterward provided with 275 16-candlepower lamps, current being supplied from an isolated plant in the barn. This was the first residence in the United States to be lighted exclusively by electricity.

On June 1, 1882, the Western Edison Light company was organized to supersede Mr. Bliss' agency, but that gentleman was made the first general superintendent, a position which he held for three years and a half. While agent for the Edison interests and during his connection with the Western Edison company, Mr. Bliss probably did as much as, if not more than, any other man in the establishment of a practical electrical-lighting system in the city of Chicago. At that time the electric-lighting industry was at about the same stage in its development as the application of electricity to automobiles is to-day and Mr. Bliss' engineering ability and faith in the new enterprise did much toward establishing the industry on a firm basis in the West. It was during his connection with the Western Edison company that the first central-station plant in the United States was put in operation at Appleton, Wis. The first theater to be lighted by electricity was also wired by the company while Mr. Bliss was general superintendent.

After his retirement from the Edison company in 1886 Mr. Bliss became engaged in various enterprises in Chicago and the West. At one time he was Chicago manager of the Johnson Electric Service company of Milwaukee, and afterward he built the electric street-railway system in Dubuque, Iowa. He was interested in the Electrical Reminder company and had been connected with Dr. H. P. Pratt in several enterprises. During the World's Fair he leased and ran the Hyde Park hotel. In recent years Mr. Bliss had been connected with the Rowell & Potter Safety Stop company, but had devoted most of his time to exploiting electrical inventions. For several years he had an office in the Masonic Temple, where his services as electrical expert were often in demand.

Mr. Bliss was also interested in silver and other mining projects in Utah and other western states. His last trip West occupied the summer of 1899, when he visited Arizona and California. He came home sick from the trip in September of that year, and although he seemingly recovered from that illness, he had failed considerably during the last year. His death was the culmination of the tubercular disease with which he had been troubled for six or seven years previous.

In all his business connections throughout his varied career, Mr. Bliss bore the reputation of being an honest, faithful and competent man. He was rather conservative in his business relations, but was possessed of more than average ability. He was faithful to his employers and popular with those associated with him. Although not as prominent in his later years, his connection with the early electrical development in the West was an important one.

At the time of his death he was a member of the Royal Arcanum and the Old Time Telegraphers association and belonging to the Kenwood Evangelical Church. He is survived by Mrs. Bliss and four

GEORGE H. BLISS.

children, Mrs. Grace E. Mellop, Julian P. and George Edison Bliss of this city and Dr. Gilbert A. Bliss, instructor in mathematics at the University of Minnesota. The funeral services were held on Friday afternoon, November 2d, and were attended by a number of the older members of the electrical fraternity of the city.

George Tailleur.

George Tailleur, superintendent of the underground department of the Chicago Edison company, died in this city on November 1st. About 10 days previously Mr. Tailleur, while driving along in his buggy, was run into by another vehicle, which was on the wrong side of the street, and was thrown violently to the pavement. His skull was fractured and his death resulted directly from the accident.

Mr. Tailleur was a native of France and was born in Paris 43 years ago. He received his elementary training and also his engineering education in that city, and was engaged for some time in underground work in France and Italy. Coming to the United States, he was first employed by the Edison Manufacturing company of New York city and later went to Schenectady, where he held a position for some time as foreman in the tube works of the General Electric company. In 1893 Mr. Tailleur came to Chicago and secured employment with the Chicago Edison company. He had worked with that company ever since, holding the position of superintendent of the underground department at the time of his death.

The work of Mr. Tailleur in underground construction was of a high order, and he was considered an authority in that class of work. He was the inventor of the junction and service boxes and the high-tension coupling joint which bear his name, and just previous to his death was engaged in developing apparatus for locating trouble in underground mains. Mr. Tailleur was very popular with his associates, having a pleasant and congenial nature, and was at the same time thoroughly competent and faithful in his work. He is survived by a wife and four children.

Charles A. Gundaker.

Charles A. Gundaker, who had charge of the sales of incandescent lamps and meters in the New York office of the General Electric company, died at his home in Newark, N. J., on October 31st. The immediate cause of Mr. Gundaker's death was peritonitis. Mr. Gundaker's connection with the electrical industry dates back to 1881, when he began work at Mr. Edison's lamp factory at Menlo Park, not being then much more than a boy. The lamp factory had then been in operation a little over a year, having been started in 1880. From the lamp factory Mr. Gundaker was transferred to the New York office of the Edison General Electric company in 1891, being placed in charge of lamp sales. After the formation of the General Electric company, through the consolidation of the Thomson-Houston and Edison companies, in 1893, Mr. Gundaker took charge of meters as well as lamps for the supply department of the New York office of the new company. He remained in that position until his death. Mr. Gundaker was a thorough master of all the details of his business, a good comrade, a first-class salesman, and a man liked and respected by all who came in contact with him. Mr. Charles T. Hughes, the manager of the New York local office of the General Electric company, was deeply grieved to receive word of Mr. Gundaker's death, breaking, as it did, a friendly link which had continued without interruption for almost 20 years. The funeral services were held in Newark on Friday evening, November 2d.

C. H. Hooper.

C. H. Hooper, who had been long engaged with the Gregory Electric company of Chicago in its accounting department, died at Phœnix, Ariz., very unexpectedly, on Wednesday, October 31st. He left Chicago about September 15th, seeking to improve his health in a drier climate, having had trouble with his lungs. Marked improvement in his condition was reported, but he caught cold two days before his death, which brought on a fatal congestion. Mr. Hooper was born in Rutland, Ohio, and is survived by his mother, two brothers and a sister. The remains were buried in Phœnix, where he had relatives. Mr. Hooper, in his quiet manner, won the esteem of all who came in contact with him, and his death is sincerely regretted.

New York Electrical Society.

A meeting of the New York Electrical society was held at the College of the City of New York on the evening of October 30th. The evening was devoted to a symposium on "The Paris Exposition and the Paris Electrical Congress," and brief addresses were made by Carl Hering, A. E. Kennelly and C. O. Mailloux. Future features for the 1900-1901 season include a night at the automobile show, C. P. Steinmetz on "Alternating-current Engineering," Dr. Sheldon on "Electrical Measurements of Precision," C. O. Mailloux on "Electrical Europe of To-day," Dr. Louis Bell on "Electric Illumination," Kempster B. Miller on "Modern Telephone Engineering," and Frank J. Sprague on "Electric-railroad Work." At the meeting of October 30th many new members were elected, including Carl Hering and Dr. A. E. Kennelly as honorary members. The following-named committees have been appointed for the ensuing season: Finance, Arthur Williams (chairman), C. O. Baker, Jr.; papers and meetings, W. C. Burton (chairman), S. L. Coles; membership, F. V. Henshaw (chairman), S. L. Coles; constitution and by-laws Arthur Williams (chairman), H. A. Sinclair, G. H. Guy. Mr. Martin is president of the society, Mr. Guy (120 Liberty street), secretary, and Mr. Sinclair treasurer.

Chicago Electrical Association.

A successful meeting of the Chicago Electrical association was held at Room 1741 Monadnock building on the evening of November 2d, with upward of 80 in attendance. The paper of the evening was by A. M. Blumenthal on "Roentgen Rays." Mr. Blumenthal gave an interesting historical and scientific treatment of the development of the Roentgen rays and illustrated his lecture with apparatus, including two Crookes tubes, and views from a stereopticon. Several members took part in the discussion, which was made especially interesting by remarks made by Dr. H. P. Pratt and others. The next meeting of the association will be on November 16th, when W. B. Hale of the laboratory department of the Western Electric company will address the society on "Incandescent-lamp Photometry."

It is stated that an electrically operated gun has been invented by James Judge of Newcastle, England, operating on the centrifugal principle. An electric motor causes a disk to revolve at a rate of 12,000 revolutions a minute. The projectiles are introduced through the shaft of this disk and leave the muzzle with an initial velocity of 2,000 feet a second. A shot may be discharged at every half revolution, but in practice one shot every four revolutions will be sufficient. The tests made on the gun are said to have been satisfactory.

DEVELOPMENT OF THE TELEPHONE FIELD.

Notes from Ohio.

The United States Telephone company of Cleveland has increased its capital stock to $2,000,000, divided into 20,000 shares of $100 each. This company is building many long-distance lines and is rapidly becoming a great factor in the business in this state. Henry A. Everett of Cleveland is the president and J. B. Hoge is the secretary. It is under the management of Judge James M. Thomas, one of the best telephone men the state has ever produced.

The Norwalk and Huron County Telephone company of Norwalk has been incorporated, with a capital stock of $80,000. Its charter will allow it to construct and operate an exchange in Norwalk and such other places as the company may decide upon. The incorporators are R. P. Hyll, W. H. Harper, Jr., James King Duffy, H. O. Bentley and A. M. Beattie.

The new exchange of the United States Telephone company at Fostoria was put into operation last week. The switchboard has accommodations for 600 lines, with room for 50 more drops. The company has more than 400 subscribers now. The cost of the new system was $125,000. The system is of the common-battery variety and the apparatus was furnished by the American Electric Telephone company of Chicago. It was constructed by the Western Reserve Construction company of Cleveland under the supervision of W. F. Crossley, and it is said that he may be retained as manager of the office. Four operators will be employed in the daytime and two at night.

There has been some little trouble between the merchants and the Bell Telephone company at Toledo because of the inconveniences caused by putting in a new switchboard and other new apparatus, but it is thought that this will be all remedied when the work is completed. The construction men have done the best they could to avoid delay in any way, but in busy Toledo the people have not the patience to wait long.

The Warren and Niles Telephone company is adding another section to the switchboard at Warren which will add a capacity of 300 drops. Two new copper-wire trunk lines between the two towns, Warren and Niles, are also being put in.

The Independent telephone line from Marysville to Richwood has almost been completed. This line was built by private subscription and will be an experiment in this kind of work.

The new line of the Columbiana County Telephone company at East Alliance was tested a few days ago and found to be in good working order. R. E. Morgan is the manager.

Homer Robinson has been made manager of the Central Union Telephone company's plant at Urbana, and O. C. Obetz will be transferred to Hillsboro, Ohio.

The Columbus school board has adopted a resolution accepting the bid of the Central Union Telephone company to put five instruments in the public school buildings at $174 a year. The bid of the Citizens' company was $224 and it would not reduce it.

The West Manchester Independent Telephone company of West Manchester, Preble County, has been incorporated, with a capital stock of $1,000, by J. W. Holtsmiller and others.

The Conneaut Telephone company, Conneaut, has filed papers with the secretary of state, showing an increase of capital stock from $30,000 to $50,000. Ed. L. Barbour is the president of the company.

The Caldwell Independent Telephone company, Caldwell, Ohio, has been incorporated by W. H. Bowron, Frank M. Martin, John Emmons, Joseph H. Ryan and David Friedman. The capital stock is placed at $50,000.

The material for the Findlay Home Telephone company, Findlay, Ohio has arrived and work will begin within a few days. The company is endeavoring to employ mostly local laboring men for the work. The city Board of Improvements has accepted the plans of the company for the conduit system which will be put in. It is expected that the new plant will be in operation early in the year.

A rehearing of the case of the City of Zanesville against the Zanesville Telegraph and Telephone company has been ordered by the Supreme Court of Ohio. About two weeks ago that tribunal decided that the law allowing the probate judge to locate poles and lines where a city or town refuses to grant a franchise, or where they cannot come to a satisfactory understanding, was unconstitutional. It was thought this would decide the matter, but so many companies have been affected by the decision that the court decided to have a rehearing and go into the matter more carefully. C.

Telephone News from the Northwest.

The La Crosse (Wis.) Telephone company is building a line through the town of Campbell. An extension will be made this fall out of Houston, Minn., also.

The Minnesota Central Telephone company has completed an exchange at Raymond, Minn., with 28 connections.

The Northwestern Telephone Exchange company is building a 17-mile extension from Inkster, N. D., to Park River. Connections between Inkster and Park River have been very roundabout hitherto.

A telephone line is to be constructed this fall from Sanborn to Seaforth, Minn., by the Southern Electric Telephone company.

The Northern Pacific railway has installed a Zenith telephone in its office in Duluth, being the last railroad to yield and connect with the anti-Bell company there.

A line has been completed between Deerfield, Nora and Utica, Wis., with about 15 farmers' connections.

The Northwestern Telephone Exchange company is about to change the location of its central office in Sioux Falls, S. D., and to make a number of improvements to the system.

J. H. Jansen, manager of the Ashland office of the Wisconsin Telephone company, has been promoted to the Milwaukee office, where he will have charge of the linework.

John Bodin of Oshkosh, Wis., has been made manager of the Wisconsin Telephone company's offices at Washburn and Bayfield.

Fred H. Browne of Belle Plaine, Iowa, has formed the Harlan and Avoca Telephone and Telegraph company, to establish local exchanges in Harlan and Avoca, Iowa.

Farmers around Lineville, Iowa, have organized a telephone company to build to Adair. Materials have been ordered and the work will be prosecuted as rapidly as possible.

There has been a long contest between the city of Dubuque, Iowa, and the Standard Telephone company in the matter of the location of poles and similar work. Finally an amicable arrangement has been agreed upon, and the company need not fear further interferences.

The Iowa Telephone company is building a line between West Point and Farmington, Iowa.

F. C. Taylor has been given a franchise for a local exchange at Oakland, Iowa.

The Johnson County Telephone company of Iowa City, Iowa, proposes to build a toll line to Muscatine, Iowa, where it will connect with the exchange of the Mississippi Valley Telephone company, and through that system to its long-distance connections.

A long-distance line is now in operation between Bolster and Brewster, Wash., 120 miles.

The Beresford (S. D.) exchange has passed the limit of its switchboard, 50 connections, and will soon need a board with 100 connections. R.

In Colorado.

The Colorado Telephone company has adopted a new method of advertising in Denver. It has offered to school children of the city four prizes of $25, $15, $5 and $5 for letters not exceeding 300 words in length containing the most convincing arguments why every home should be provided with a telephone.

The trustees of the town of Montrose, Colo., have passed an ordinance taxing the franchise granted to the Colorado Telephone company. Five per cent. of the gross receipts is required.

Three employes of the Colorado Telephone company have been arrested and held for trial at Colorado Springs on the charge of stealing copper wire belonging to the company. One of the men when arrested had in his possession 298 pounds of copper which he was attempting to sell to a junk dealer. He confessed his crime and disclosed the names of two others who, he alleged, were parties to the theft. The company has sustained a number of losses of wire by theft, and it is hoped the detection of these men will break up the practice.

Telephone linemen at Colorado Springs went on a strike on November 2d for increased pay and shorter hours. They ask that they be paid $3 instead of $2.85 a day, and that they be required to work but nine instead of 10 hours. A few days before the application had been made to R. F. Morris, manager of the local office. It was forwarded to Denver, but no immediate action was taken because of the absence from the city of Superintendent Burgess. The men decided to strike at once, as they held that the petition could be acted upon at once by General Manager Field. It is believed that the trouble can be settled without difficulty and that work will be resumed. D.

GENERAL TELEPHONE NEWS.

The National Telephone company of Wheeling, W. Va., has commenced laying underground wires, and will expend $200,000 in construction.

The Citizens' Telephone company, of Shelbyville, Tenn., has been incorporated, with a capital stock of $10,000, by J. H. Hutton, S. J. McGraw, W. G. Evans and others.

A recent Illinois incorporation was that of the Illinois Telephone Construction company of Chicago. The company is capitalized at $2,500 and the incorporators named are Henry Shafer, S. W. Moon and Frank L. Bills.

The Georgetown and North Island Telephone company, recently reported as incorporated at Georgetown, N. C., will construct a 20-mile system at Annandale, S. C. The contract has been awarded to F. E. Johnstone of Georgetown.

Application for a charter for a new telephone company to be known as the Huntingdon and Clearfield company, to operate in Centre, Clearfield, Cambria, Blair, Huntingdon, Bedford and Fulton counties, of Pennsylvania, will be made. Among the incorporators are W. H. Denlinger, Thomas H. Murray and Allison O. Smith, of Clearfield.

The Chicago Telephone company has issued a folder containing information concerning its service and system of toll lines. A map is shown of the toll-line connections of the Chicago Telephone company, while a map of the United States, taking in the states east of Nebraska, indicates the lines and metallic circuits of the American Telephone and Telegraph company.

Through Manager F. J. Keech, of the Ann Arbor exchange of the Michigan Telephone company, free long-distance telephone service was given the students at the University of Michigan during the recent football game at Chicago between the Illinois and Michigan teams. The service was arranged by E. D. Trowbridge, superintendent of long-distance service at Detroit, and H. A. Ferguson, assistant superintendent of the Chicago Telephone company. The returns were received considerably faster than from the special telegraph wire that had been chartered, and they were said to be satisfactory in every detail.

TELEPHONE TALES.

The Chicago Times-Herald, dilating on "The Telephone Boor," thinks that "every telephone should have a pile-driver device concealed in its mechanism, so connected with the vibratory diaphragm that it would knock a man senseless the minute his voice reached a pitch denoting anger or a desire to do violence to the person at the other end."

A Nome correspondent of the Boston Transcript says that the Eskimo is becoming familiar with many of the adjuncts of civilization. "But the telephone is still beyond his comprehension. One of them pointed to the wire which runs from Nome to the military barracks at Nome River, three miles away, and passes along the tundra just back of my tent.

"'Him catch birds?' he asked.

"'No, John,' I replied (any Eskimo is John colloquially). 'Him telephone,' suiting my English to his as far as possible. But John did not look enlightened and I attempted further explanation.

"'S'pose man talk Snake River. Wire catch him. Man Nome River, he hear.'

"John looked at the wire, then at me, and his face took on a grieved expression. 'Humph!' he said. 'Plenty lie,' and he walked indignantly away."

Katie is just over and she is employed as a domestic in a big house surrounded by shade trees on the Cass farm. She is as willing as a hungry mosquito, but there are things she has not yet learned.

Katie is having a hard time in mastering the telephone. She has had many lessons and long, but there is a mystery about the whole thing that inflames her superstition.

"Anyone call or ask for me by telephone while I was out, Katie?" asked the mistress.

"Indade they did, mum. The box jingled and a lady wid a voice like a coffee mill says, 'Hello,' and I says, 'Hello yerself,' and she says, 'Who is this?' and I says, 'None of yer business.' And she says, 'Is Aunt Mary there?' And I told her she'd betther ask a policeman, and she foired sumthin' in my ear, and I dared her to show the ugly mug of her back of our barn and she said nuthin'. I'll talk in that machine no more, mum."—Detroit Free Press.

MANUFACTURERS AND DEALERS.

The Eureka Electric company of Chicago announces that its new "Twentieth Century" catalogue is now ready for distribution. The book illustrates and describes a large line of exchange switchboards, centralized-energy as well as magneto systems, and all other devices necessary for the complete equipment of a high-grade telephone installation, either for a toll line or an exchange. The company will forward a copy of the catalogue on application.

The Western Electric Construction company of Chicago, Ill., has recently made shipments of a 600-multiple transfer switchboard and a 600-line combined cross-connecting and lightning-arrester board to the Shamokin (Pa.) Valley Telephone company and 100-line Western express switchboards to the Home Telephone company, Chillicothe, Ohio, and the Citizens' Telephone company, Montevideo, Minn. This company is also building a 100-wire addition to a 500-multiple central-energy switchboard lately furnished by it to the Schuylkill Telephone company of Pottsville, Pa. Contracts have also been closed with the Staunton (Ill.) Telephone company for a 100-line Western express switchboard and 75 magnetos, and with Dr. J. H. Close, New Boston, Ill., for a 100-capacity switchboard; also for a 100-drop switchboard for the Columbia (Pa.) Telephone company. Another contract has been closed to furnish the North Oklahoma Telephone company with a 225-drop switchboard. Many orders are being received for the new Western express No. 3, five-bar bridging telephones. These instruments are built especially for heavy toll-line work and for farmers' lines.

Wireless Telegraphy by Hertzian Waves.[1]

By André Blondel and Gustave Ferrié.

Historical.

In this review we shall signify by the term wireless telegraphy the transmission of signals by Hertzian waves only without the intermediary of wire conductors.

In 1888 Hertz performed his famous experiments destined to verify the classic theory of Maxwell and to demonstrate the propagation of electromagnetic waves. Yet, in the absence of a sensitive detector, no one at that time dreamed of utilizing these waves, identical with those of light, for telegraphic communication at long distances. Only after the ingenious work of our compatriot, Branly, begun in 1890, upon the properties of conducting bodies in imperfect contact when subjected to the action of electric discharges (already mentioned in a long-unnoticed communication by Calzecchi Onesti), did we have at our disposal means appropriate for the detection of such waves.

In 1893 Professor Lodge utilized these radio-conductor tubes of Branly, which he called coherers, for the study of Hertzian oscillations. He employed in this an arrangement embracing a coherer, a cell, and galvanometer. To restore the resistance of the filings he usually tapped the tube by means of some clock movement. The presence of waves could thus be detected 40 meters from their point of origin. In the conference at Oxford in 1894 at the meeting of the British Association, Lodge delivered the opinion that the Branly tube ceased to be affected at a distance of half a mile! Moreover, no attempt was made by him to verify this opinion.

A number of physicists of all countries repeated the same experiments with arrangements more or less analogous to those of Professor Lodge. Popoff in particular rendered the action automatic by the addition of a relay energized by the current passing through the tube, and which in turn actuated a sounder. The hammer of the sounder was so arranged as to strike the coherer and restore it to the neutral state after each vibration.

At this time Popoff merely utilized the device to register lightning discharges and verified the theory that these were oscillatory, after the ideas of Lodge. For this purpose one of the terminals of his receiver was connected to a lightning rod or simply to a vertical wire, the other terminal being put to earth. He announced that this apparatus could also register signals sent out by a sufficiently powerful oscillator.

To Marconi, at that time a student in the University of Bologne, belongs the honor of having first employed the vertical wire of Popoff in the receiving of Morse signals, and he first produced an efficient form of wave from a second upright connected to an oscillator, the other terminal of which was grounded.

We will first describe in a general way the actual arrangements of installation:

A transmitting apparatus consists of an induction coil, in the primary of which are connected a source of energy (dry cells or accumulators), a Morse key and an interrupter. The terminals of the secondary are joined to two metallic spheres, forming the oscillator, and themselves connected, one with the upright wire, the other with the earth.

A receiving instrument consists, essentially, of a coherer whose electrodes are connected to the upright wire and to ground and at the same time to the terminals of a circuit containing a dry cell and a relay.

If the transmitter sends out a long series of waves, this will be indicated on the strip of the Morse inker by a series of dots, which may be easily transformed into a dash by certain devices of the construction, or by the employment of a second relay, as proposed by Strecker.

Mr. Marconi has suppressed, as completely as possible, all parasitical waves originating from contacts made and broken in the receiving apparatus itself and capable of actuating the coherer. To this end he has placed non-inductive shunts around each point where the circuit is broken and around all coils subject to the electromotive force of self-induction; the spools of the relay in particular have been thus shunted.

More recently Mr. Marconi has adopted a small step-up transformer, which he calls a "jigger," designed to increase the effect of the oscillations received by the aerial wire by augmenting the induced electromotive force acting upon the coherer.

To prevent the oscillations generated at a station from acting on its own coherer and rapidly destroying the same, Marconi encloses all the receiving apparatus, with the exception of the Morse instrument, in a metal box, and leads the connecting wires through choking coils encased in bands of tin, which are connected to earth.

In addition to the experiments of Marconi, we may mention those of Messrs. Slaby and Strecker, in Germany, of Messrs. Voisenat and Tissot, in France, of Popoff and Ducretet, in Russia, etc. Various refinements have been made in the apparatus, which we will notice later.

These numerous investigations do not now allow us to form a complete and verified theory of the phenomena utilized in wireless telegraphy. Yet we may adduce a certain number of facts, permitting us to outline a sufficiently plausible theory for the provisional guidance of researches.

1. Abstract of paper presented at the International Electrical Congress of 1900 in Paris.

Results, Distances Traversed, Laws of Vertical Conductors.

The quality of communication is about the same under whatever conditions, of fog, rain, wind, etc. However, it is decidedly easier to establish communication over water than by land. The heights of vertical conductors or "antennæ" required over land are always considerably greater than those sufficing for sea communication over the same distance.

As a notable instance of distances attained, in 1900 Marconi established communication between two stations 84 miles apart, with wires only 135 feet high.[1] A straight line joining the upper extremities of the two antennæ would pass 900 feet below the surface of the sea.

Experiments made inland are less brilliant. In most cases recourse has been had to captive balloons or kites to obtain antennæ sufficiently high. By such means Marconi, in 1899, telegraphed between Salisbury and Bath, 33.5 miles. It does not appear that in the Transvaal, in spite of the announcements of first results, much use has been made of wireless telegraphy in military operations.

Finally, trials have been made under special circumstances by Mr. Lecarme. In the Alps, between Mont Blanc and Chamonix (1899), communication was very reliable, despite the natural roughness of the land and lack of conductivity of the ice covering it. With a free balloon the results were equally interesting. Signals were received in the balloon when the receiving wire (150 feet) was parallel to the sending vertical wire (120 feet) and at a great height. The experimenters were thus able to communicate at a distance of five miles and a height of 2,400 feet.

Laws of Vertical Wires (Antennæ).—Marconi has deduced from numerous experiments on sea the following laws, which have been also verified by Mr. Gavey, engineer of the Postoffice:

First—To obtain the maximum of useful effect, the antennæ of the two stations should be equal and parallel.

Second—The height of antennæ required for good communication is related to the distance traversed by the formula $H = a\sqrt{D}$, a being a coefficient depending on the nature of the apparatus employed. This distance, as given by the formula for clear space, is diminished at least half when the two stations are separated by high intervening obstacles.

We have been able to verify, approximately, the correctness of this law, working between stations near Paris, for distances as yet not exceeding 8.3 miles.

The advantage of having the antennæ of like height seems to us very slight, and the results appear almost the same if we vary simultaneously the heights of the antennæ, keeping their sum constant. There is a lower limit, beyond which one may not go; this seems to lie between 15 feet and 30 feet for the distances indicated above.

The law, then, ought to be completed under the following form: $h_1 + h_2 = 2H$, for h_1 and $h_2 < \lambda$. As we have seen, $H = a\sqrt{D}$. In these expressions h_1 and h_2 are the heights of the two antennæ, respectively. H is the average height and λ is a minimum height for either antennæ, below which the law does not hold.

Theory of Wireless Telegraphy.

The phenomena of wireless telegraphy are very complex, and have given rise to various interpretations. The first idea is to suppose a mutual induction between the two nearly parallel vertical wires. But this will not explain the propagation of waves, and appears certainly to fail, when in consequence of the rotundity of the earth or by any obstacle the antennæ are screened from one another.

Certain authors have claimed an effect of electrostatic capacity between the uprights, as in the Edison arrangement, but it is clear that such an effect would diminish in inverse proportion as the cube of the distance, and very quickly reduce to nothing.

Other physicists, impressed by the influence of the ground wire at the sender, have been led to see in this propagation an effect of conduction by the earth. We can explain thus why transmission is better over sea than land. But this will not account for the excellent results obtained by Lecarme by means of a vertical wire from a balloon.

In reality, the phenomena appear to be a combination of several effects, one or the other of which predominates, according to the conditions.

Electric oscillations are produced along the wire and in the neighboring ether in the space between the antenna and the earth. From the seat of this disturbance originate the waves, which are propagated in all the surrounding space. These waves are polarized and form surfaces of revolution around the antenna. The lines of electric force are in meridional planes and connect perpendicularly with the earth; the magnetic lines of force are in circles having the antenna for a common axis. But as a result of this polarization and of the effect of concentration, well known in the propagation of waves along wires or metallic surfaces, the electric density is much greater at the surface of the earth, directly connected with the oscillator, than in the atmosphere; and in large part the magnetic lines appear to slip along the earth. This concentration, moreover, is the greater the more perfect the conductivity of the surface over which the waves proceed, and the loss of energy in this transmission is thereby lessened.

Yet this concentration does not prevent the diffusion of an important part of the energy into all space, under form of hemispherical waves, the effects of which are less intense than those near the earth, but, nevertheless, noticeable.

The receiving wire, cut at all points by the lines of magnetic force, is the seat of a resultant electromotive force proportional to the intensity of the field and to the rapidity of the oscillations. The higher the antenna, the more lines of force cut. With a given length fewer lines are cut as we ascend further from earth. It is not necessary that the receiving antenna be connected to earth, but the range appears to be slightly extended, due to the conduction effect mentioned above.

The magneto-motive force of the magnetic lines around the center of disturbance is, by the reciprocation of the law of induction, equal to that derived from the electrostatic flux, the variation of which produces it; or, analytically expressed, $H = \frac{df}{dt}$.

It is then theoretically important to increase as much as possible the capacity, the potential employed and the frequency of the oscillations in reducing the self-inductance. We have thus been led to try very large antennæ, formed of bands, also to substitute for these a horizontal disk above, and another placed below, the ground. But this last arrangement gives poor results if we do not add a vertical wire.

Apparatus in Detail.

Coils.—It seems, as result of experiments made, conforming to the preceding theory, that it is well to use a discharge spark as long as possible. Consequently we should employ very powerful induction coils. Those most used will give a discharge of 10 to 16 inches between points, but in operation these sparks are reduced to from two to 1.2 inches and become thicker.

All types of interrupters have been tried—those with turning contacts, mercury, hammer, turbine, etc.—but no one shows any marked superiority. For long operation the best are the last two types named. It is certain that the frequency should be small. Marconi has returned to the simple hammer interrupter. The Wehnelt, which has failed with some, has given us excellent results. To do away with interrupters, with their inconveniences when using large current intensities, we have tried alternating-current transformers, using 30,000 volts or less, with capacity in shunt with the secondary and self-induction in the primary (as preconceived by d'Arsonval). This apparatus presents the great advantage that the current given to the antenna is not affected by the length of the spark, and that it is thus easy, even with a moderate-potential transformer, to obtain oscillating sparks of great length.

Oscillators.—It is now recognized that the apparatus known as the Righi oscillator presents no advantage, for it plays the part of a simple deflagrator only. The majority of experimenters with Marconi himself, have returned to the spark-gap of Hertz, with two balls in air. The platinizing of these balls is unnecessary, providing they be polished from time to time.

Antennæ.—Although the spark may be better sustained when the antenna has a large surface, or if there is attached a supplementary capacity at its top or bottom, the transmission appears neither better nor worse than for the ordinary antenna with the same explosive potential. An insulation of rubber along the vertical wire appears useful in diminishing the partial discharge of the antenna by convection.

Theory and Construction of Coherers.—Of the theories advanced to explain the action of the coherer, that of Lodge, the theory of coherence or welding of the particles, is most generally admitted. This has been confirmed by the researches of one of the writers, who has demonstrated the necessity, for a practical coherer, of filings or electrodes of a metal slightly oxidizable. The researches of Dorn have shown, moreover, that the apparent oxidation, or the insulating film, is often only a film of gas, which can be removed more or less rapidly by a vacuum. The phenomenon of welding, which seems to explain the sudden diminution of the resistance at the passage of the waves, does not at all exclude the concomitant existence of the Branly phenomenon which is very delicate and less pronounced.

Now, in order to utilize the properties of the coherer, it is necessary that the critical potential at which the coherer breaks down shall not exceed the electromotive force of the cell plus the electromotive force of self-induction of the extra current at the break in the local circuit of the coherer and relay. It is then necessary that this inductance be as small as possible, and that the current flowing have but slight intensity. The first condition being difficult to meet, notwithstanding shunts around all inductive parts, it is necessary to reduce the current by the use of a low-voltage cell. We have used successfully the O'Keenan or Lalande cell, which gives, with negative electrode of tin, a potential of 0.25 volt.

We have obtained very good results with coherers using filings of gold, silver, or with silver alloyed with a hundredth part of copper, placed between german-silver electrodes. The employment

1. Since this paper was written Mr. Marconi has succeeded in transmitting messages from Poole to the Isle of Wight, a distance of 30 miles, by the use of metal cylinders four feet in height, thus dispensing with the 177 foot uprights previously employed over this range. At the same time he transmitted two simultaneous messages without interference.—Ed.

of a slightly oxidizable metal allows one to raise the critical potential sufficiently to use a cell which will work the relay.

Mr. Tissot has found that he can augment at will the pressure on the filings and, as a result, the sensitiveness of the coherer, by making filings and electrodes of a magnetic metal (steel, nickel or cobalt), and by bringing near the tube a small magnet whose lines of force are parallel to the axis of the tube.

Amplifying Transformers.—It was natural to attempt to increase the induced electromotive force acting on the coherer by a transformer analogous to those employed in telephony. Marconi has given no theory for the particular mode of constructing his transformer, which seems to reduce to a minimum the impedance and to realize the maximum of mutual induction for these high-frequency currents. Experience has shown us that the "jigger" acts very well as a transformer but that the condenser added in derivation by Marconi (with the idea of realizing by the combination an effect of syntony) is without sensible action. The favorable action of the transformer is most marked, as we have verified. According to Marconi, this device increases the range from 30 to 60 per cent.

Limitations of the Art.

Self-decohering Coherers.—The necessity of a tapper with existing coherers is very troublesome, and does not permit the use of the telephone as receiver. Various experimenters have therefore sought coherers decohering spontaneously, without tapping. Tommasina, using a coherer with magnetic filings, has attempted to replace the tapper by an electromagnet in shunt, magnetized only when the coherer is affected, thus attracting the filings and decohering them. But we have proved that this arrangement, with that of Tissot, before mentioned, offers a difficulty; the filings become magnetized and it is no longer possible to decohere them.

Tommasina has found it possible to obtain autocoherers with carbon. He obtained good results by forming his two electrodes of german-silver wire plunged in carbon powder similar to that employed in the Swiss microphone. This fact had already been determined by Hughes, the inventor of the microphone, as has been recently noticed.

Righi and Tuman have tried to obtain detectors formed of two platinum wires in close proximity and fused in a vacuum tube. One of us has experimented along the same line with a Geissler tube having large electrodes almost in contact, combined with a telephone. The cell should be insufficient of itself to break down the resistance of the tube, yet sufficient to produce a current at each passage of an oscillating current which traverses the space between the electrodes. These arrangements give signals at a short distance, but they lack sensitiveness compared with coherers.

Employment of the Telephone.—It has been many years since Colson and Narkevitsch Jodko mentioned the employment of the telephone to indicate electric oscillations. But the results thus obtained seem to us very uncertain, for the telephone is also acted upon at a distance by induction, even on open circuit, by alternating currents of high potential like those produced in induction coils. This was the arrangement of Edison mentioned above. There may be doubt then as to the cause of this sound heard in the telephone. The slight sensitiveness which it possesses in such use is probably due to the small radius of action of such alternating currents.

Syntonic Systems.—A serious inconvenience charged against wireless telegraphy, one which prevents its entry into the real domain of practice, is the fact that, with the ordinary apparatus described above, it is impossible to obtain at the same station two independent communications, every receiver placed in the radius of action of a transmitter being acted upon by the waves sent out. Various systems, founded upon different principles, have been proposed, with a view to avoid this fault.

Based upon the analogy presented from certain points of view between electric oscillations and sound waves, Messrs. Lodge and Muirhead have sought to obtain an electric resonance between transmitting and receiving circuits. For this purpose they make radiator and collector independent of all other apparatus, and attune these to the same period of oscillation, by modifying the self-induction of a coil having a variable number of turns.

Marconi, without in any way changing the installation of his stations, described above, relies upon capacity and self-induction to obtain resonance, placing parallel to the antenna a long metallic sheet connected to earth at one end, and connecting with his antenna a coil of variable self-induction.

Although Mr. Shaw (Society of Physics, London, March 23, 1900) has made experiments showing that it is possible to obtain a maximum effect by utilizing the capacity and self-induction, this method has not given good results, probably from the fact that the oscillations of the sending antenna are very rapidly damped and have not time to establish a veritable resonance at the transmitting station.

One of us (Mr. Blondel) has indicated another method of synchronization, which consists in setting in accord, not the frequencies of the electric oscillations proper, but a certain artificial frequency of a much lower rate and altogether arbitrary and independent of the antennæ—that is, the frequency of the spark and that of the vibrations of a selective telephone, such as the monotelephone of Mr. Mercadier. It is sufficient to keep the frequency of the interrupter constant and equal to that of the receiver itself. One may employ in connection with the telephone, as was seen above, a coherer of spontaneous decoherence or the carbon coherer of Tommasina. Each group of high-frequency waves, rapidly damped, acts en bloc as a simple percussion upon the slow-vibrating telephone, whose own oscillations, however, continue practically sinusoidal because of its inertia. One may thus in the receiver replace mechanical elasticity by an electric elasticity by adding in shunt a capacity such that the circuit formed by the tube, the telephone and the condenser may then be in resonance, or, rather, in pseudo-resonance, with the sending instrument. This arrangement will serve to select signals, using any telephone whatever, or the selective quality may be reinforced by a monotelephone of the same frequency. If there are several receivers at the same station, it will be advantageous to mount each upon a separate aerial wire.

Other inventors have proposed, in a method which seems yet premature, the employment of devices for multiple telegraphy of the Baudot type. This does, not, however, solve the same problem.

Finally, Guarini Foresio, starting with erroneous theories, has indicated a system of automatic repeaters, results from which are not yet known.

Desirable Improvements.

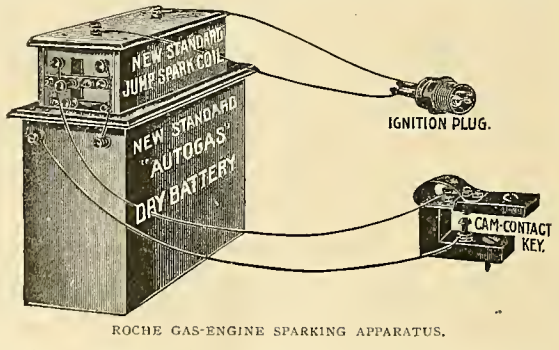
To sum up, thanks to the successive efforts of the scientists mentioned, and through the practical work of Marconi, wireless telegraphy has received numerous improvements, the effect of which has been a great increase of the distances traversed, especially over sea.

But over land its ranges are still insufficient to allow it to compete with visual signaling, and over water the usefulness of this kind of signals is very limited, as a result of the impossibility of differentiating messages from different sources, if one employs the ordinary coherers. The decohering coherers, combined with the system of pseudo-syntony, open new horizons, but the sensitiveness of these refinements is thus far very limited, and experiments are as yet too few to allow us to judge of the future reserved for this type.

We may hope, then, to see the apparatus still further perfected, notably coils, interrupters, relays, and, above all, receiving apparatus, which should not require the application of a tapper.

Roche Gas-engine Sparking Apparatus.

A new form of sparking apparatus for internal-combustion engines is shown in the accompanying illustration. The device is serviceable for automobiles and small engines as well as large ones. Both sides of the circuit of the sparking plug are insulated, thus doing away with short-circuits. In the ignition plug the metal points are made of solid platinum and are attached to solid steel rods. The plug insulation consists of a porcelain tube lined with asbestos. A small vibrating induction coil is used with the device, and a battery of four cells is placed in the lower compartment. When the apparatus is started four cells are connected with the primary of the induction coil, and as the cells are used up, the connection can be so changed as to include more cells. The dry cell used is of the well-known Autogas type. A vibrating fiber-insulated key, which can be applied to any type of engine, makes the circuit of the igniter and it can be operated by an attachment to the shaft of the engine, thereby allowing the engineer to obtain a spark at any point of the stroke. The batteries are enclosed in a hand-some wooden box, which will hold eight cells. The device was invented and is manufactured solely by William Roche, 42 Vesey street, New York city, who states that it has been successfully applied to a great number of gas engines.



ROCHE GAS-ENGINE SPARKING APPARATUS.

New Atlantic Cable Proposed.

The important announcement has just been made by the Hon. Mr. Dobell, a member of the Laurier cabinet of Canada, that the Dominion government hopes to have a short direct cable laid between Scotland and Belle Isle, on the Labrador coast of Canada, via the north of Ireland, thus giving Canada a new cable line to Great Britain. Mr. Dobell has apparently reason to hope that Denmark will join in the project, the idea no doubt being to have the line extended from Scotland to Denmark. In such case, Canada would have a new cable system from Quebec to Copenhagen, connected with British, Irish and Continental telegraphic systems. Mr. Dobell says that Canada's share of the cost would only be $875,000, and that the project would probably reduce the cost of cable messages from a shilling to sixpence a word.

Recent Electrical Fires.

In the quarterly "Fire Report" of the Electrical Bureau of the National Board of Fire Underwriters, compiled by William H. Merrill, Jr., are chronicled some curious electrical fires, the particulars of which are instructive to electricians as well as to insurance men.

A two-wire circuit of No. 00 cable ran from a dynamo room across the bottom and up the side of a freight-elevator shaft. Part of the circuit was in an unlined conduit. This conduit, some 30 feet long, extended from the dynamo room up the elevator shaft for about 15 feet. The contractor who did the construction work violated the rules by splicing on about 17 feet of weatherproof cable, drawing the same into the unlined conduit. The insulation on the weatherproof cable broke down, allowing the passage of current to the iron conduit. The conduit was in contact with a copper conductor that passed down the elevator shaft from the gutter on the roof. A burnout occurred at the point of contact.

In an electric-light and power station, a long lamp cord, with insulation not designed for portable use, was run into a clothes closet used by the central-station men. A short-circuit in the cord set fire to the clothes and woodwork and communicated fire to the building. After the fire had been extinguished the circuits were connected up temporarily and another fire occurred, owing to short-circuit where the wires left the building through the roof. This is the third electrical fire reported to have occurred in the plant in question. The loss to building and machinery was $20,000.

After the wiring of a residence had been completed the contractor installing the heater ran his pipes through partitions irrespective of the position of the circuit, making contact with the wire. The insulation held for five years after the job was completed, but the current finally arced to ground and set fire to the insulation of the wire. Fortunately smoke was discovered coming from the partitions before the fire had communicated to the lathing. The fire was extinguished with small loss.

A fire occurred due to breakdown of the insulation in a transformer, permitting the primary current on the secondary circuit. The building was a two-story frame, ironclad one. The insulation of the secondary circuit was poor, wires frequently touching the woodwork. The fire started at each point where contact with the woodwork was made, indicating that the entire secondary circuit was dangerously heated. The front of the ironclad building was so thoroughly charged with electricity that it could not be touched by the firemen, and the projection of a stream of water against it resulted in severe shocks to the pipemen. The main feeder wires were finally cut, when the fire was easily extinguished.

In a drug-store window a chain carrying a glass globe containing colored water was attached to a screw-eye on a metal ceiling. The chain came against a brass unlined socket, and the shell being alive, the chain carried the current to ground on the metal ceiling. The cut-out, which was placed too close to the steel ceiling, did not instantly cut off the current, which arced to the ceiling on the blowing of the fuse. The fire was promptly discovered and extinguished.

Altogether, 21 fires of electrical origin are reported for the quarter. The losses aggregate $519,700, distributed as follows: Hotel, $350,000; factory for electrical appliances, $35,000; business blocks, $30,000 and $7,000; newspaper building, $75,000; manual college, $15,000; club-house, $5,000; mercantile risks, $2,700. Four fires, involving losses aggregating $51,200, are reported as caused by lightning discharges entering buildings over aerial wires.

British Pacific Cable.

Mail advices from Australia received at Ottawa, Ont., convey the intelligence that the government of New South Wales is taking steps to carry out the Pacific cable scheme, so far as the contribution of that colony is concerned. The lowest tender for the line is £1,975,000, but from reliable information it appears that, including extras, the total cost of the cable will be £2,066,000, whereas the original estimated cost was £1,730,650. The contributors to the cost of construction are Great Britain and Canada, each of them paying one-third of the cost, and the four Australasian colonies, New South Wales, Victoria, Queensland and New Zealand, paying the other third. Some difficulty has arisen in regard to the appointment of a successor to Sir Julian Salomons, on the Pacific cable board, and until this is settled, it is not likely that the contract for constructing the cable will be awarded. It is officially estimated that the cable will take 18 months to lay and complete.

Bids for lighting the city of Portland, Ore., will be received at the office of the auditor until November 20th. T. C. Devlin is the city clerk.

Systems and Apparatus for Light and Power Distribution.[1]

By C. P. Steinmetz.

Part I.

It is with some hesitation that I undertake to speak on the problem of power distribution for lighting before an assembly of men who have made the solution of this problem their life work, but while I cannot expect to offer much that is new, I shall endeavor to consider the problem from a somewhat different point of view. Having designed very many machines and apparatus of all kinds, watched their operation personally or with the eyes of others, and studied their nature theoretically and experimentally, I shall try to discuss in the following the nature and behavior of those types of apparatus which are of interest to you.

As you know, there is a considerable difference between satisfactory operation and satisfactory operation. A machine may be satisfactory, that is, it fulfills all the guarantees asked by the customer and given by the manufacturer, and when properly handled and taken care of, under reasonably fair conditions, it does its work, and does it well. But the more you become familiar with it, the less you are confident that you can rely upon it in any emergency, and that it will not go back on you just where you need it most. That is the feeling experience has given me regarding 60-cycle converters, for instance. Other machines, again, the longer you operate them, the more you become confident that you can rely on them under any conditions, normal or abnormal. This different behavior is inherent to the type of apparatus, equally good design and construction presupposed.

I shall not reopen the question of alternating or continuous-current distribution, since, for your class of work, experience has pretty well decided in favor of continuous current for most cases, and relegated alternating current to pioneer work in outlying districts.

The usual system of light and power distribution in larger cities is the continuous-current, Edison three-wire system, supplied from a number of stations located in the centers of distribution, and operating direct-connected units, or pairs of 125-volt, face-commutator machines. This type of machines has the advantage to be more economical in space than any other type, and thus is specially suited for this class of work, where 125-volt machines are used. When using 250-volt machines, the carbon-brush, separate-commutator type is generally employed.

Series arc lighting is done by belt-driven arc machines. Outlying districts are supplied with alternating current by belted, or, occasionally, direct-connected alternators.

In these stations the storage battery has been successfully introduced. It increases the station capacity by supplying power during the peak of the load, increases the economy by permitting to shut down smaller stations during times of light load, increases the distance feasible for power supply, and permits an almost unlimited supply of current for a short time. In this class of service, where abuse of the battery can be avoided, its depreciation is moderate, and its low efficiency, which probably does not exceed 70 to 80 per cent., is no serious objection, since the battery receives power when there is a surplus and returns it when power is most valuable.

The lesser economy of operating a number of smaller stations in unfavorable locations led to the desire of generating the power in one large station in favorable location outside of the city, by steam or waterpower, and distributing it to the substations.

The power is generated in one station by a number of large direct-connected three-phase alternators, transmitted at high voltage to sub-stations, and there transformed or converted into the different forms of power required, low-voltage, continuous current for the main distribution, alternating for outlying districts and pioneer work, and constant current for arc lighting.

The first and most important question to be considered is that of frequency.

Incandescent lighting is feasible at 30, and satisfactory at 40 cycles.

Arc lighting is feasible at 40 and satisfactory at 60 cycles, but still better at 125 cycles.

Rotary converters are feasible at 60 cycles, but perfectly satisfactory only at 25 cycles.

In direct-connected, slow-speed alternators the lowest frequency is the most desirable.

Where a continuous-current network is an important part of the system, and even where only a noticeable part of the power is to be transformed to continuous current, the rotary converter is the most efficient and reliable apparatus for use.

A number of converters are in satisfactory operation at 60 and even 66 cycles, under favorable conditions as regards steadiness of power supply, low resistance of transmission line, careful attendance of commutator and brushes, etc.

The converter, however, is essentially a commutating machine like the continuous-current generator, differing therefrom only in so far that it must run in synchronism with the alternating supply current.

1. Paper read at the annual meeting of the Association of Edison Illuminating Companies at Saratoga, N. Y., September 4-6, 1900.

The most essential part of the commutating machine, and that which, under unfavorable conditions of operation or design, is most troublesome, is the commutator. It is obvious that the lower the peripheral speed of the commutator, the lower the volts per commutator bar, and the wider the commutator bars, the better is the commutator. Assuming thus, as conservative values a width of bars of three-eighths inch, a peripheral speed of 3,000 feet per minute and eight to 10 volts per segment, values which, while higher than customary in the continuous-current generators with which you are familiar, are still within good and conservative practice under the favorable conditions existing in the converter (absence of armature reaction and high number of revolutions), at 250 to 300 volts, eight to 10 volts per bar give 30 bars from brush to brush, and three-eighths-inch width of bar then give a commutator pitch of 30 by three-eighths inch = 11¼ inches, which is to be passed over during each half wave of the alternating current. At 3,000 feet per minute this gives $\frac{3,000 \times 12}{11\frac{1}{4} \times 60} = 53.3$ half waves, or about 27 cycles per second as the upper limit of conservative converter design. As comparison may be stated that the frequency of large, low-speed, direct-connected, continuous-current generators averages eight to 12 cycles, and about twice this value in high-speed machines.

At 60 cycles, where the commutator has to move the distance from brush to brush in one one-hundred and twentieth of a second, conservative design of the commutator is not possible any more, and such machines thus are satisfactory only under favorable conditions of operation, although it must be conceded that the voltage of 250 is relatively the best suited for 60-cycle converters.

The converter, necessarily, is a multipolar machine, and the number of poles must be the larger, the higher the frequency. This requires that the armature reaction of the machine, considered as continuous-current generator, must be high, to avoid cross-currents between the poles and unequal current distribution between the different sets of brushes of equal polarity, and consequent heating and sparking. Due to the unavoidable inequalities of the different poles, the voltages induced thereby are more or less different, and this difference has to be compensated by the magnetizing effect of the armature reaction. For instance, in the face-commutator machines, with which you are familiar, you will find, by disconnecting the brushes from each other, differences of voltage between different poles amounting, in extreme cases, to 10 per cent. or more. With the very high armature reaction of these machines, a very slight difference of current takes care of this inequality, but with a machine of very low armature reaction, as the 60-cycle converter (in which the space per pole on the armature surface is limited by the frequency), unequal current distribution may become serious. This feature is the cause why in double-current generators close regulation is not permissible by good design.

The higher the frequency, the greater must necessarily be the perinheral speed of the armature of the converter, and the greater thus its momentum. High momentum, however, predisposes to hunting directly as well (the momentum entering as terms in the equations of hunting) as indirectly, by making the machine less able to follow slight pulsations of frequency, as due to the pulsation of the engine speed.

For these reasons it is very undesirable to choose a higher frequency than 25 cycles for converter work, and where the continuous-current service is a very small part of the total load only, and thus 60 cycles chosen to accommodate the alternating load, it is preferable rather to use motor-generators entirely or partly for the continuous-current supply.

To understand the phenomenon of hunting, let us take the simplest case—a generator of absolutely steady and constant electromotive force, feeding a converter or synchronous motor, over a circuit of certain resistance and self-induction or reactance, with a constant load on the converter. The usual theory of the textbooks then shows that the counter electromotive force of the converter adjusts itself to a definite phase relation with regard to the generator electromotive force, depending upon the load and the excitation.[1]

Closer investigation shows, however, that the phase of the counter electromotive force of the converter, and thus its speed, and in consequence thereof the current, can pulsate around a mean position, and the power supplied by the generator pulsates correspondingly, with a period depending upon the electromotive forces, the impedance, the momentum of the moving masses, and several other constants, but usually of a magnitude of somewhere near one cycle per second. During the time of acceleration the generator supplies an excess of power, which is stored by the moving masses, and returned during retardation, where the generator supplies less power than the load on the converter represents. This period is entirely definite and independent of wave shape or engine pulsation, although the latter may start the oscillation.

Since several of the constants entering the equations of hunting are beyond the control of the designer, as well as the user, the tendency to hunting cannot always be avoided, but the hunting can be suppressed by damping devices, where the conditions are made favorable therefor.

The most efficient damping device is copper bridges between the pole-pieces. During the oscillation the alternating power supplied, and thus its armature reaction in the converter, pulsates, and since the mean values of alternating and continuous-current armature reaction neutralize each other, an oscillating armature reaction remains (which during excessive hunting causes the vicious periodic sparking, by producing an active magnetic field at the brushes). By intercepting this oscillating magnetic field by the low-resistance closed circuits of the copper bridges between the field poles, the currents induced therein exert a damping action, and thus suppress the oscillation. Obviously, 25-cycle converters, with their higher armature reaction, are preferable in this respect also.

As a compromise frequency, 40 cycles has been proposed, and has in some instances been used to advantage. As a rule, however, a compromise frequency is undesirable for your class of work, as being not best suited to any application. For small transformers and for arc lighting, especially indoor lighting, 40 cycles is rather below best practice, while for converters and slow-speed generators, it is inferior to 25 cycles, although better than 60 cycles. The proper field of application of 40 cycles is power and light distribution for mills, factories, etc., with numerous small and moderate-sized motors, especially of the induction type, and incidental incandescent and arc lighting, either directly from low-voltage, slow-speed alternators, or by a small number of large step-down transformers. For very long transmission lines of very high voltage, under circumstances excluding 25 cycles, 40 cycles is also to be recommended.

In the generating station the number of poles of the generator obviously is directly proportional to the frequency. At 75 revolutions a 25-cycle generator requires 40 poles and a 60-cycle generator 96 poles. The smaller the number of poles, however, with the same engine, the steadier is the frequency. In the steam engine, with the steam impulses the speed periodically rises and falls. Assuming, for instance, in a cross-compound engine with four impulses per revolution, that the engine speed rises one-tenth per cent. during the impulses and drops behind as much between the impulses, for each impulse the armature moves, in a 40-pole, 25-cycle alternator, over 10 poles, and thus dropping behind one-tenth per cent. amounts to one-tenth per cent. of 10 poles, or one-one-hundredth of the pitch of one pole. Since each pole gives one-half wave of alternating current, or 180 degrees of phase, one one-hundredth pole amounts to a dropping behind of the alternator wave by 1.8 degrees; and if at the same moment another alternator connected in parallel is ahead by the same amount, the electromotive forces of the two machines are out of phase with each other by 3.6 degrees, and a cross-current flows between them, which equals sine 3.6, or six per cent. of the short-circuit current. With a 96-pole, 60-cycle alternator moving over 24 poles per impulse, the phase displacement will be 8.6 degrees, giving a cross-current equal to 14.4 per cent. of the short-circuit current.

It immediately follows that the larger the short-circuit current, that is, the closer the regulation of the machine, the greater must be the cross-current. Thus, too close regulation is undesirable, and with such large units, unnecessary also. As a rule, the lowest regulation permissible by the nature of the load gives the most reliable and best operating machine.

Experience has shown that a deviation from uniformity of the frequency by 2.5 to three degrees in phase (that is, a maximum phase displacement between two alternators of five to six degrees) constitutes about the upper limit of good practice. This is obviously much more difficult to secure with high than with low number of poles. It should preferably be secured by the design of the engine, that is, by balancing the momentum of the reciprocating masses against the steam impulses, and not by very large flywheel capacity, since large flywheel capacity rather predisposes to hunting.

With multiple expansion engines, however, especially of the vertical type, the speed variation due to the finite length of the crank shaft is frequently more serious than that due to the steam impulses. While the former is less in magnitude, it extends over a greater period, one-half a revolution, so that the phase displacement caused thereby is larger.

Essential, however, is that the uniformity of rotation of the engine unit is maintained also when operating in parallel with another unit.

The steam-engine governor inherently tends to hunting. That is, if the engine speed is slightly low, the governor opens and admits more steam, sufficient not only to carry the load at the normal speed, but also to accelerate it, and not only this, but it keeps opening until the speed has recovered. That means when the speed has become normal, more steam is admitted than required, and the engine continues to accelerate until the governor begins to close, and now overreaches in the same manner in closing. Obviously, the higher the flywheel capacity, the slower is the engine to recover its speed, and the greater the overreaching.

Where one engine only is operated, the governor usually comes to rest soon. When running in parallel with another machine, however, the governor of the second engine may take up the oscil-

1. Such a phase relation that in the polar diagram the generator electromotive force, the converter electromotive force and the electromotive force consumed by the current in the line impedance form a triangle, and the product of the current and the projection of the electromotive force upon the current equals the load.

lation, thus causing a hunting between the governors.

The remedy, necessarily, must be looked for in the design of the engines and their governors.

While the uniformity of speed during the rotation should be as great as possible, a close speed regulation from no load to full load is not necessary nor desirable with large units, but it is rather preferable that the speed from no load to full load should drop several per cent. to insure good division of load between the machines operated in parallel.

[*To be continued*].

CORRESPONDENCE.

London Letter.

London, October 23.—Opposition from a hitherto unsuspected quarter is likely to be raised when Mr. Yerkes applies to the new House of Commons for permission to amend certain particulars with regard to the much-talked-of underground railway from Charing Cross to Hampstead. The committee will, in effect, have before it as an alternative an immense plan for completely honeycombing London with "tubes" and joining all the great termini with a central station at Piccadilly circus. A feature of these proposed railways is the doubling of the "tubes" giving lines for an express service, as well as for the trains which stop at all stations, and the promoters of the new lines claim priority in the case of some of the new features of the Yerkes syndicate's undertaking. The conflict is interesting, as showing the great anxiety of engineers and financiers to give Londoners additional facilities for underground traveling. In an interview, Mr. H. C. Davis of New York, who is vice-chairman of the Yerkes syndicate, said that he did not fear the threatened opposition. He said they would probably commence work on their railway in February next, and it is hoped that it may be finished in two years. The power station for generating the electricity which will provide the motive power will be at Highgate road. There will be two sets of lines, one starting from Hampstead, and the other from a station adjoining that of the Midland railway at Kentish Town. They will unite at Camden Town and run to Euston station. The line will go under Tottenham Court Road, to a station connected with the Central London company at Oxford street, and thence to Charing Cross, thus linking together the Midland, London and Northwestern, Central London, and Southeastern railways. The trains are to be worked on the multiple-unit system, each car carrying its own motors. The corridor cars will be glazed at the ends, so that passengers can see from one end of the train to the other. There will be an all-night service, and during the busy portions of the day trains will run every 2½ minutes. The journey from Hampstead to Charing Cross is expected to take 20 minutes. Mr. Davis said there would be no company floated here, the Yerkes syndicate being prepared to find all the capital.

What will be the dividend on the Central London Railway company's deferred shares? The preference shareholders are entitled to a fixed four per cent., but, although the common stock is quoted at one-eighth higher, it is hardly likely that four per cent. dividend will be paid on it for some time to come. Even with the bloom of novelty casting a glamor over the line, the receipts average slightly under $25,000 a week. Allowing 50 per cent. for working expenses, the balance would not suffice to pay three per cent., so that the enhanced value of the common stock is rather difficult to understand.

The new electric lights in the Strand are being opposed by a new gas installation, which is being tried at the junction of Wellington street and the Strand. The radiance there is cast by six lamps, each affording a light equal to 1,000 candlepower. It is said that the cost does not exceed half that of the electric light to do the same work. The result is obtained by raising the pressure of ordinary gas by means of a small hydraulic ram. This ram is actuated by the water from the street mains. The whole process is automatic.

The vestry of St. George's, Hanover Square, has made an agreement with the Westminster Electric Supply corporation for lighting the public thoroughfares of the parish with electricity. The installation is to consist, in the first place, of 600 arc lamps, for continuous current of 500 or 750 watts, as the vestry may require. In passages, mews and other places where arc lamps are not required, incandescent lamps of 60 or 120 watts are to be fitted to existing gas brackets where necessary. The number of these will be comparatively small. The work is to be begun immediately, and to be completed, so far as the 600 arc lamps are concerned, by June 30, 1902. The total cost of lighting the 42 miles of public ways contained in the parish is estimated at about $85,000 per annum, as compared with $55,000, the present cost of lighting with gas. For this additional expense the ratepayers are promised from 15 to 20 times the amount of light which they enjoy at present. The agreement is to remain in force for 31 years, or until the undertaking is purchased by the local authority, whichever shall first happen, but after 10, and again after 20, years, the local authority is entitled to refer to an arbitrator the question whether the payment per lamp, per annum, fixed by the agreement, should be varied in consequence of any substantial alteration in the cost of lighting. The company is not to lose by any award which the arbitrator may make, but on the other hand, any increase of profit may be apportioned between the company and the local authority in such manner as the arbitrator may think fit to award. The annual cost of each lamp will be: 750-watt arc lamp, $160; 500-watt arc, $110; 120-watt incandescent lamp, $20; 60-watt incandescent, $15. These rates are to be subject to a cumulative rebate of one-half per cent. per annum for each year after the first full year during which any lamp has been used.

An event of considerable municipal importance was the laying of the foundation stone last week of the new electrical station and refuse-destructor works at Hackney. The scheme is estimated to cost altogether $1,250,000, and the building will stand on a site five acres in extent. The electrical supply will involve the laying down of 100 miles of cables, and the necessities of the residents in 50 miles of streets will be catered for. The buildings have been designed to afford sufficient space to accommodate 6,000 horsepower in boilers, engines, dynamos and switch gear, while the land is sufficient to permit a further extension of 6,000 horsepower being added as occasion may demand. A battery of accumulators, having a capacity of 2,300 ampere-hours, has been ordered, the primary object of which is, as far as possible, to store for future use the energy developed in the refuse destructors at times when it would otherwise be wasted. In the first instance, it is not proposed to erect plant for more than about 3,000 horsepower. The mains will be of ample section to meet any probable requirements for some time to come. Power may be supplied to factories. The refuse destructor will consist of 12 furnace cells, capable of burning a maximum of 150 tons of refuse per 24 hours.

The projected run from London to Brighton, a distance of 60 miles, of a Joel electrical voiturette by the National Motor Car syndicate, duly took place last week. Although the speed at the end of the journey was not quite up to expectations, the trip was made on one charge of battery. The accumulators were recharged on Friday, and the return trip to London made on Saturday. Some slight modifications have since been made in the car, and a further run will be made over the same route on Thursday, when the distance is expected to be covered, not only on one charge, but at an average speed of 10 miles an hour, the car being only geared up to a maximum of 14 miles.

W. H. B.

New York Notes.

New York, November 3.—It is now thought that Forty-second street may be abandoned as the location for a section of the rapid transit tunnel. The crosstown connection between Park avenue and Broadway may be built under one of the streets north of Forty-second, with the advantage in favor of Forty-sixth street. Arguments in favor of this change of route are the difficulties of construction to be met with under Forty-second street and the expense of land for station facilities at Broadway and Forty-second street.

At a meeting of the Rapid Transit commission held last week the following tunnel appointments were announced: Julian Thornley, assistant engineer, $1,800 a year; Robert F. Walker, cement inspector, $1,800; Enos W. Cory, cement inspector, $1,200, and four inspectors of masonry. The commission received a large number of complaints from people living near Broadway and One-hundred-and-fifty-seventh street of reckless blasting for the tunnel. Chief Engineer Parsons reported that some of the blasts made had been much too large, but that the matter had now been remedied.

The Manhattan Railway company has all along intended to lay conduits of its own to carry the current from the central power house at Seventy-fourth and the East River, across the city to operate the Second, Third, Sixth and Ninth avenue lines and the minor branches. This involves permits from two city departments. The Consolidated Telegraph and Electrical Subway company and the Empire City Subway company hold a monopoly of the right to lay private conduits and charge high rental for them. The Manhattan company wishes to lay independent ducts, and unless the corporation consul holds that the railroad may lay wires where electric-light companies are debarred from so doing, the issue will undoubtedly be taken into the courts.

The first annual exhibition under the auspices of the Automobile Club of America opened to-night in Madison Square Garden with a large attendance. Automobiles of every type stretched in long lines underneath a canopy across the amphitheater, while the overflow exhibits were on a promenade platform erected above the north tier boxes. In the restaurant and down in the basement added displays were to be seen. A feature of the show is to be an exhibition of hill climbing. A runway of solid timber has been built on the roof, beginning at the center of the roof garden, running along the Madison avenue side, there turning, and continuing to the second story of the tower. The grade is steeper than that to be met with in ordinary road climbing. By this exhibition have been brought together the manufacturers of automobiles, and arrangements have been made for a meeting of the makers at the Hoffman House, for the purpose of forming an association of manufacturers. The makers are also arranging for a large automobile train, which will make an 8,000-mile trip around the country. The idea is to have the automobiles visit in turn the great cities of the country. The machines will be exhibited through the streets of a given city until it is time to travel on to the next place.

In the sound-money and prosperity parade today the section of electrical interests made a showing fully in keeping with the anticipations, notwithstanding the inclement weather. It was estimated that about 3,000 men were in line in this section. The preliminary drilling of the Western Electric, Crocker-Wheeler and Sprague men was shown by the fine appearance made. The men marched with great rapidity, and with every line carrying the full 16 men or more, stretched from curb to curb. While the second division of electrical workers was passing a counting machine on the governor's grand stand showed a total of 107,000 men as having passed the stand. Part of the fourth division was devoted to the automobile section, which consisted of about 200 men bearing black flags on which in white letters were the words "Automobile Division." Over $2,500 was subscribed by the electrical men for the expenses of music, banners, badges, etc.

M. L. G.

Canadian Intelligence.

Ottawa, Ont., October 31.—P. McCullough of Sherbrooke, Que., has been appointed assistant manager of tramways at Liverpool, England. The salary is $2,500 per annum.

J. W. Marr, late chief engineer of the Metropolitan railway of Toronto, Ont., has been appointed to take charge of the electric plant of the Toronto Evening Telegram.

W. B. Anderson, assistant engineer for the Lake Superior Power company at Sault Ste. Marie, Ont., has been appointed mathematical lecturer at the Royal Military College at Kingston, Ont.

L. W. Gill, B. A. Sc., of Montreal, has been appointed lecturer in the newly created chair of electrical and mechanical engineering in the Kingston (Ont.) School of Mining

Work is progressing on the electric railway to run from Preston, Ont., to the cities of Berlin and Waterloo and the town of Port Dover, and it is expected that cars will be running by the first of January next on part of the system.

The Western Telegraph company will build lines through the Nelson and Slocan districts of British Columbia, to connect the boundary country and Vancouver.

The electric street railway of St. Thomas, Ont., has passed into the control of a new directorate, of which E. H. Coughall and J. W. Moyes, the latter of the Metropolitan electric railway of Toronto, are members. It is said that the road will be extended to Port Stanley, and the company has already running privileges in Yarmouth and Southwold, Ont.

The Woodstock (Ont.) Electric Light company offers to sell its electric-light plant to the town of Woodstock for $14,000, but the town will not pay a greater price than $13,000.

The condition of affairs in the International Order of Railroad Telegraphers, and especially among the delegates who attended the special session at St. Louis, Mo., has revived the desire on the part of the Canadians to cut loose from the present organization and form a Canadian organization. If the latter is instituted, it is said that it will include the New England states and the state of Michigan, both having expressed a desire for such a movement.

Hugh Montagne Allan of Montreal has been made a member of the board of directors of the Montreal Electric Street Railway company, to fill the vacancy made upon the board by the retirement of R. B. Angus. Mr. Allan is the son of the late Sir Hugh Allan, and is at present a director in many prominent Canadian companies.

E. E. Cary and G. A. Powell of St. Catherines, Ont., N. L. Henderson, S. F. Washington and W. E. Boyd of Hamilton, Ont., have been incorporated by the Ontario government, under the name of the Hamilton Electric Supply and Construction company. The new company starts out with a capital of $40,000, and proposes to deal in electric supplies and to install electric plants. Its head office is in Hamilton, Ont.

The business of the Eugene F. Philips Electric Works at Montreal, Que., has so largely increased that the manufacturing capacity of its works has become altogether inadequate, and arrangements are being made to enlarge the factory. For many months past the works of this concern have been operated day and night.

Messrs. Ahearn and Soper of Ottawa have purchased the waterpower on the Ottawa River, known as the Little Chaudiere, the consideration being $6,500. They already own the adjacent Tetrauville waterpower, having purchased it two years ago. It is understood that it is the intention to develop the waterpower at an early date. It is expected that the firm will be able to develop about 10,000 horsepower, which will be used for manufacturing purposes.

The Canadian Correspondence Schools of Toronto, Ont., enter as a new factor into the educational development of Canada. The purpose of these schools is to carry on correspondence instruction by mail, after the manner of the correspondence schools in the United States. Among the subjects the schools will have courses in electrical lighting, electrical engineering, stationary-steam and hydraulic engineering. A. J. Pell is manager and E. H. Richard superintendent.

Hon. C. H. Mackintosh of Rossland, B. C., formerly a mayor of Ottawa, and later the lieutenant-governor of the Northwest Territories, and who so successfully placed the Le Roi mine on the British market, has just secured control of the waterpowers of Stave Lake in British Columbia, situated about

36 miles from Vancouver. Mr. Mackintosh proposes very shortly to transmit 18,000 horsepower of electrical energy to that city, thereby making it the chief manufacturing center on the Pacific coast. On the list of the present board of directors and shareholders are the names of the most influential men of the cities of British Columbia.

Unless all signs fail, the city of Belleville, Ont., will have its street-railway and street-lighting facilities put upon a permanent basis at an early day. The mayor of Belleville last summer received a communication from John Shibley of Boston, Mass., setting forth that certain capitalists, for whom he was authorized to act, were desirous of acquiring franchises of street-lighting and street-railway plants in Canada. Mr. Shibley proposed to purchase the Belleville street railway, at present owned and operated by the Bank of Montreal, together with the Belleville gas works and the whole plant and power of the Trenton Electric and Power company, which generates its power on the Trent River and transmits it to Belleville, a distance of 12 miles, furnishing electric light and power both in Trenton and in Belleville. It is understood that the Belleville street railway will be extended, possibly to Tweed, Ont. Mr. Shibley and his experts have examined the plants of the various concerns, and, it is said, have secured options upon the same.

The Canadian Pacific Telegraphic company has installed a plant of motor-generators in its office at Toronto, Ont. The plant is located in the old battery room, which formerly was filled with battery stands, supporting some 2,000 cells, all of which have now been done away with. The machines consist of 12 Lundell motor-generators, resting on two heavy wooden stringers, raised 30 inches above the floor. By means of a double-throw, two-pole main switch on the switchboard, connection can be had with either the overhead or underground circuits of the Toronto Electric Light company. On the upper part of the switchboard are located the secondary switches, by which connection is made with the cable leading to the operating room, where the secondary currents are distributed to the wires through lamp resistances. A. V. W.

From the Buckeye State.

Columbus, Ohio, November 2.—The Lucas county commissioners have granted the Shore Acres Railway company a franchise to build an electric line from Toledo to Point Place, the work to be completed within 18 months.

At a meeting of the stockholders of the Toledo Traction company a few days ago, the expenditure of a goodly sum of money was authorized for the coming year. This will be used in repairing the lines and buying new equipment. During the last year many new cars have been purchased and put into service, and some of the winter cars are yet to be delivered. The power house will be enlarged and the conduit system will be completed. The election of officers of this company took place last week, and resulted as follows: President, Albion E. Lang; vice-president and general manager, Thomas H. McLean; treasurer, J. B. Dennis; secretary, Barton Smith.

It is stated that the construction of the Toledo, Fremont and Norwalk line has made it improbable that the Toledo, Bowling Green and Fremont line to Fremont will ever be built, but it is stated also that the latter company is planning to build a line to either Findlay or Fostoria or both. The Findlay people are especially anxious to have the new line with connections with Bowling Green.

Work is progressing rapidly on the line from Toledo to Monroe, Mich., and it is believed that it will be completed by January 1st.

The Western Ohio Railway company was incorporated recently by F. D. Carpenter, L. M. Coe, Jacob Mayer, Frank N. Wilcox and James J. Hogan. The capital stock is placed at $1,000,000, and the office of the company will be at Lima. Cleveland men are largely interested in the new company. It is proposed to build a road between Lima, Allen County, and the village of Minster, Auglaize County. The plans have as yet not been announced.

The officials of the Steubenville, Mingo and Ohio Valley Traction company are preparing to extend their line from Mingo to Brilliant, and have asked the county commissioners for a right-of-way along the pike, between the two places. This work will likely be done this winter, and after it is completed the company will likely begin work on a line to Martins Ferry, Bridgeport and Wheeling, W. Va.

The Ohio Valley Electric Railway company, operating a line between Ironton, Ashland and some other towns on the river, will shortly begin the reconstruction of its switches, and the property will be put in good condition. It is the intention to have a 10-minute schedule on the road, and six cars will be put into service. Some very important improvements will also be made on the power plant at Ironton.

J. J. Walsh of Ironton has taken a position with the Consolidated Electric companies of New York, to manage one of the company's electric-light plants, of which it has 39. He does not know yet just where he will be located.

The City Council of Akron has granted the Northern Ohio Traction company a franchise for its extension on West Market street, that city.

It is said that an electric line will shortly be built from Lakeside, through Port Clinton, Oak Harbor and Elmore, to Genoa, where it will connect with the Toledo, Fostoria and Norwalk line. It is also reported that the Tiffin, Toledo and Sandusky line will be built and put in operation within the next year. Should both of the roads be constructed, Ottawa County people will be well supplied with traveling facilities.

T. W. Shelton of Indianapolis has been made electrical engineer for the Northern Ohio Traction company at Akron, to succeed David W. Pell.

The car sheds of the Cleveland and Eastern Electric Railway company at Gates Mills were burned a few days ago. A number of cars were also destroyed, and it is estimated that the loss will be about $100,000.

As a condition upon which the company shall build a double track through Summit County, the citizens have asked for a five-cent fare to Harvard street, Cleveland.

The Toledo, Fremont and Norwalk Railway company has made a proposition to the Sandusky, Milan and Norwalk Electric Railway company to use its tracks in getting into Norwalk. It is said if this proposition is refused the Toledo company will purchase a private right-of-way from Monroeville to Norwalk, going into the town on Whittlesey avenue.

It is stated that the Sandusky and Interurban Electric Railway company has about concluded negotiations for the plant of the People's Electric Railway company in that city. This would give the interurban road important interests in the town, as well as outside.

Contractors are now at work on the Toledo, Fremont and Norwalk line between Bellevue and Norwalk.

Construction work on the Seagrave line from Toledo to Sylvania has been begun.

The officials of the Toledo and Maumee Valley road are exulting over the splendid business they did the last year. This is said to be one of the best paying lines in the state.

The annual election of the Toledo, Fremont and Norwalk Railroad company resulted in the choice of the following-named officers: President, S. F. Angus; vice-president, W. B. Comstock; treasurer, A. W. Comstock; secretary, W. A. Comstock. Mr. Angus was re-elected president in recognition of the splendid work he has accomplished. He originated the plan of building this road and has personally supervised its construction and business since the company was organized.

The Columbus Railway company has been granted a franchise to build a branch to Arlington, a distance of about three miles. The cars that now operate on the Oak street line will be run over this line. The company pays the county $5,000 for the use of the Goodale street bridge. The franchise is for 25 years.

The City Council of Fostoria, Ohio, has taken a hand in the light matter and claims that the franchise of the City Heat and Light company gives that body the right to regulate the price of incandescent lights. The city clerk has been instructed to ascertain what people in other cities are paying for the same service and report to the council.

City Clerk Shoemaker of Columbus has been instructed to advertise the notice of the application of the Columbus, Mechanicsburg and Urbana Electric Railway company for a franchise to come into the city.

The Northern Ohio Traction company is planning an extension of its line in Akron from the terminus of West Market street to the Portage path, a distance of half a mile.

A meeting of those interested in the Stark Electric Railway company was held a few days ago, and it was decided to commence grading the line between Alliance and Canton at once. It is thought the grading will be completed this fall, but no track will be laid until spring.

Harlan Wellman, superintendent of the Ohio Valley Electric Railway company, has been in Pittsburg for some days looking after machinery for the new power plant which is to be built at Ironton. It is stated that the company will expend about $55,000 for this machinery.

The Central Ohio Traction company will build an extension from Galion to Crestline and another from Bucyrus to Upper Sandusky, the entire work to cost in the neighborhood of $200,000.

The Kercher Light and Power company of Youngstown has disposed of its plant to Peuhale & Fisher of New York, the same firm that, in connection with Devitt & Co. of Chicago, purchased the other electric-lighting and railway companies at that place a few weeks ago.

George Stillman, formerly an electrician at Coshocton, Ohio, committed suicide at Poplar Bluffs, Mo., a few days ago by shooting himself.

The Mount Vernon extension of the Columbus Railway company will be completed within a short time.

Fostoria papers announce that the Dover Construction company says cars will be in operation on the Toledo, Fostoria and Findlay electric line within two months. If the road is completed in that time, it will be about the quickest work on record.

The Railroad Construction company of Cleveland filed papers of incorporation with the secretary of state recently. The capital stock is placed at $10,000, and the incorporators are Frank A. Ginn, Allison J. Thompson, V. F. Behnard, John M. Griffith and Frank M. Cobb. The company will conduct a general construction business in steam and electric railroads.

The Dayton and Marysville Electric Railway company was incorporated recently by Martin V. Whitacre, S. Woodward, F. M. Cowden, M. H. Blair, H. Rice and H. L. Day. The capital stock is placed at $10,000. The company proposes to build a line commencing at Dayton and extending through Montgomery, Warren, Clinton and Brown counties. It will pass through the towns of Lebanon, Morrow, Blanchester, Georgetown and Ripley.

The Toledo Interurban Railway company of Toledo has been incorporated, with a capital stock of $100,000, to build a line from Toledo to the Indiana line in Northwest Township, Williams County, passing through Lucas, Fulton and Williams counties. Grant Williams, Charles L. Reynolds, S. D. Carr, George D. Palmer and James J. Robison are the incorporators. O. M. C.

Northwestern Notations.

Minneapolis, November 3.—Alexander Hughes of Bismarck, N. D., has submitted a proposition to the council of Jamestown, N. D., for the installation of an electric-light plant for that place.

The street-railway company of Omaha, Neb., will put into service 20 new cars December 1st. The company has expended $150,000 this year in rebuilding its tracks.

The electric-light plant at Casselton, N. D., has furnished arc and incandescent lights for the city to the value of $1,200 and has sold lights to consumers to a sum within $65 of the cost of its operation.

W. F. McNally of New Richmond, Wis., has been placed in charge of the Gas and Electric company of Grand Forks, N. D., and of the Waterworks, Power and Light company of Crookston, Minn., with headquarters at Minneapolis. McNally is a brother-in-law of W. J. Murphy of Minneapolis, the proprietor of these plants.

Chester H. Kiehl and associates of Seattle, Wash., have been granted a franchise at Montesano, Wash., for an electric-light and power system. Kiehl has secured an option on the Montesano Water company's plant, and intends to run the lighting plant by waterpower, obtained at Silvia Falls, just north of town.

The street-railway company of Des Moines, Iowa, denies that it intends to extend lines to the Saylor and Des Moines mining camps.

A pole line is being constructed between the power plant at East Helena and Butte, Mont., to transmit power to the smelters and other industries of the latter city. The pole line will go through a wild country, where, in many places, they will have to build roads before they can haul the necessary materials in for the line.

The Twin City Iron Works of Minneapolis was awarded the contract to furnish the equipment and power plant for the new system of the Hutchinson (Minn.) Lighting and Manufacturing company.

The ladies of St. John's Church in Butte, Mont., were given charge of the street-railway system October 11th. The gross receipts for the day amounted to $427.35, of which the church received half.

The engineer of the Washington building in Tacoma, Wash., is under suspicion of having arranged a scheme whereby the building secured its lighting from the city plant, without paying for it. The Washington building had a plant of its own, which was supposed to run from 7 a. m. to 11 p. m. One of the tenants in the building had a saloon, and wanted light after 11, so he had a meter and a switch with the city system, which was to be used after 11 p. m. He discovered that the switch was thrown on to the city system at 8 p. m., and he was therefore paying for three hours' service, which the building should furnish him. Investigation showed the fact that the Washington building did not pay anything to the city for light. The city has billed the Washington syndicate for $300, and threatens a suit to collect it.

The street-railway company of Winona, Minn., will have its rails welded by the process used by the Falk company of Milwaukee.

The electric-light plant at Grundy Center, Iowa, was destroyed by fire, with a loss of about $2,000, fully covered by insurance.

The Light and Power company of Olympia, Wash., is completing a large flume for the development of the waterpower at Tumwater. The work is to be completed about the middle of November.

The differences between the council of Houghton, Mich., and the Houghton County Street Railway company have been settled. The council will permit the company to set poles, as desired, but stipulates that they must be iron poles.

The Lakeside Street Railway company has filed a deed transferring its property to the Duluth Street Railway company of Duluth, Minn., for a consideration of $1.

An incoming car in Seattle, Wash., attempted to descend the hill at Fourth avenue without the counterweights, and got beyond control, and collided with an outgoing car. There were 12 passengers aboard, and all but one jumped from the car while it was going at full speed. Several were bruised, but none were seriously hurt. A few days later a passenger car collided with a freight car on the line between Seattle and Renton. Fourteen persons were injured, principally by painful bruises.

The report of City Engineer Claussen of St. Paul shows that the city can light its streets at a saving of almost 50 per cent. The council is considering the matter of a municipal plant.

Citizens of Merriam Park, a suburb of St. Paul, want a 10-minute service on that line between five at seven o'clock in the evening. R.

PERSONAL.

The trustees of the Massachusetts Electric Companies have elected Reginald Foster as trustee, to succeed the late Amos Breed.

Mr. H. H. Vreeland, president of the Metropolitan Street Railway company of New York, reached Denver on November 3d in a special car from the West. Since the Kansas City convention Mr. Vreeland has been enjoying a pleasure trip, and in his party are Mrs. Vreeland, Dr. J. J. Higgins of New York, Miss Hoff of Brooklyn, and Miss Crosley and Miss Wells of Brewster, N. J. The members of the party went as far west as Seattle and Tacoma. They left Denver for the East on November 4th.

D. H. Louderback left Chicago on October 30th, for London, where he is to take charge of the Charing Cross underground railroad, in which Charles T. Yerkes and other Chicago and eastern capitalists are interested. He will be the personal representative in London of the American syndicate, and will assume the direction of the work as soon as he arrives there. Mr. Louderback has had long experience in planning and building street and elevated railroads in Chicago, and was one of the first projectors of the Northwestern elevated line. The erection of the Union Loop in the city was managed by him, and prior to his entrance in the elevated field he had control of the most of the outlying suburban lines now merged into the Consolidated Traction company.

ELECTRIC LIGHTING.

W. S. Bumbus of Pembroke, Ky., will erect an electric-light plant at that place.

A new light plant, costing $20,000, is to be put in the state capital building at Springfield, Ill.

The electric-light plant at Grundy Center, Iowa, has been burned. The loss suffered was about $2,000.

Contracts will soon be let for erecting an electric-light plant at Pembroke, Ky. W. S. Bumpus is interested.

The Lacombe Light company of Denver, Colo., is building a new plant at South Eleventh and First avenues.

The city of Kingfisher, Okla., has voted the sum of $26,000 for the purpose of putting in an electric-light plant.

Preparations are being made for the installation of a new electric-light plant at Kasson, Minn., to cost $60,000.

The Rawlings (Wyo.) electric-light plant is to be enlarged and its capacity doubled. The improvement will cost $5,000.

The Ohio Valley Electric company will spend a large sum of money in improving and enlarging its plant at Ashland, Ky.

A company has been organized at Bloomington, Ill., with the name of the Consumers' Heat and Electric company, and will be capitalized at $75,000.

The Elizabeth (Pa.) Electric Light, Heat and Power company offers its electric-lighting equipment for sale, including arc and incandescent machinery.

The Rockingham County Light and Power company of Exeter, N. H., has been incorporated, with $350,000 capital stock, by W. D. Lovell, J. E. McReed and R. N. Elwell.

The city of Ruston, La., has awarded the contract for the construction of its proposed waterworks and electric-light plant to R. N. Adams of Detroit, Mich., for $30,000.

The board of trustees of the state normal school of Terre Haute, Ind., has decided to ask the Legislature for an appropriation of $9,000, to be used in providing an electric plant for the school.

The San Diego Gas and Electric Light company of California has decided to put in a complete duplicate plant. The new plant will have a 380-arc-light capacity, and will involve an expenditure of $25,000.

The city of Tampa, Fla., will vote upon an issuance of bonds for municipal waterworks and electric-light plant, to be secured either by purchase or construction. J. A. Weller, city auditor, should be addressed.

ELECTRIC RAILWAYS.

A. N. Dukes, of Peru, Ind., is the promoter of the Towpath electric line from Ft. Wayne to Lafayette, through Logansport.

Work has commenced on the new interurban electric railway, to extend from Lima, Ohio, to Minster, a distance of about 30 miles.

The town of Otsego, N. Y., has granted a franchise to the Oneonta, Cooperstown and Richfield Springs Electric Railroad company.

The Dayton, Springfield and Urbana Electric Railway company has been incorporated by F. Colburn, J. G. Webb, J. S. Harshman and W. H. Hanford.

The St. Louis, Clayton and St. Charles Railway company has petitioned the St. Louis County Court at Clayton for franchises for the construction of three new electric lines in St. Louis County.

The St. Thomas (Ont.) Street Railway company has increased its capital stock from $100,000 to $250,000, for the purpose of extending its system to Port Stanley. J. H. Still is president of the company.

The Hannibal Railway and Electric company of Hannibal, Mo., has been incorporated, with $100,000 capital stock, to construct a railway in Hannibal. E. D. Brewington, E. P. Bowman and H. J. Blathy are interested.

A new electric railroad will be built between Cincinnati and Piqua, Ohio, and will be known as the Troy, Tippecanoe and Dayton Interurban railway. E. H. McKnight, P. Schwab and Col. F. Foster will be owners of the new road.

The New Mexico Construction company has been incorporated at Santa Fe, N. M., for $10,000, by G. Nelson, M. W. McGrath and J. P. Victory. The company will construct an electric tramway system in Santa Fe for local capitalists.

The Newcastle (Pa.) and Sharon Street Railway company was incorporated for $150,000, to build and operate an electric street railway between Newcastle and Sharon, a distance of 20 miles. The president is W. R. Wright of Philadelphia.

The Tri-city Railway company held its annual meeting in Davenport, Iowa, recently and re-elected all the old officers. The company has improved the service on the bluff lines in Moline. It has also increased its capital stock from $600,000 to $1,200,000.

The gross earnings for the Twin City Rapid Transit company, operating the lines in Minneapolis and St. Paul, for September were $371,652, as against $245,880 for the corresponding month last year. The earnings for nine months of 1900 were $2,102,030, as compared with $1,845,978 for the corresponding period for the previous year.

G. F. Greenwood, chief engineer and general manager of the Havana Railroad company, states that that company will begin running trolley cars in and around Havana on February 1st of next year. It will have 100 cars, each with seating capacity for 32 passengers. There will be three power houses, the engines of which are now being completed in Milwaukee.

At a special meeting of the selectmen of the historic town of Concord, held on October 30th, a franchise was granted to an electric street-railway company, to operate a line extending from Concord to Waverley, from which town connection can be made for Boston via the Boston elevated railway. The road is named the Boston and Concord. The Lexington and Boston road was a petitioner for a franchise also, and would have connected via Lexington and Arlington, but its petition was acted upon unfavorably.

At a meeting of directors of the Boston Elevated Railway company last week a statement was made showing gross earnings for the year ended September 30th of nearly $10,150,000. The company carried, in round numbers, 250,000,000 passengers, of which nearly 50,000,000 were free transfers. Earnings for the year ended September 30, 1899, were $9,071,440, an increase of $492,344. The increase the last fiscal year was $489,000, or about the same ratio of increase as the year previous. Net earnings for the last year have not been made up. If the same relative increase in operating expenses occurred the last year as in 1899, expenses have been about $7,000,000, which would leave net earnings of $3,150,000, as compared with $2,844,290 in 1899.

AUTOMOBILES.

The Automobile Club of France, in conjunction with the German Club, has decided to hold a race from Paris to Berlin early next year. It is stated that Emperor William has offered prizes to the value of 50,000 francs.

The Woodruff Motor Carriage company of Cleveland was incorporated a few days ago, with a capital stock of $50,000, by George E. Woodruff, Albert M. Woodruff, Charles O. Drabek, T. W. Nubemeyer and Louis J. Grossman. The company will manufacture automobiles and gasoline engines.

Under the German tariff law, motor vehicles are now classified as machinery, and bear an import duty of $2.38 per 100 kilogrammes. This rate is likely to remain unchanged until the new German tariff shall take effect in January, 1903, at which time it is probable that the duty on most manufactured articles will be increased.

Clarence W. Dolan of New York is testing in Newport a new electric automobile that he has made for touring purposes. It is said that this machine will run 120 miles without being recharged, and is designed for an average speed of 25 miles an hour. The machine is built for speed and endurance, and is long and narrow, to reduce the atmospheric resistance.

The automobile drivers of Chicago have formed a union, taking the name Local No. 59 of the International Brotherhood of Electrical Workers. The membership is restricted to those who handle vehicles with electric motors, the gas, oil and steam automobilists not being included. It was stated that the purposes of the organization are to advance the wages of drivers and to better their condition generally.

The Say sugar refinery of Paris is using a 20-ton electromobile for the transportation of sugar in that city. The vehicle, unloaded, weighs 11 tons, including its battery, and is intended to carry a nine-ton load, although it has carried 17 tons. It is capable of a speed of 7½ miles an hour, and a run of 25 miles without recharging. Electric motors are used to steer the two front wheels. The vehicle is 18 feet long by 7½ feet wide. It is said that the company will order 10 other such trucks.

The Touring Club of France is compiling a card of electric stations in that country at which electromobiles can be charged, and has sent to private persons owning electrical installations a number of questions as to the nature of the current produced by their machines, whether continuous or alternating; if the current is alternating, whether they have rotary converters to obtain continuous current. Other questions are: What is the voltage? Are the owners willing to sell current? etc. Such a card should be of great service to the automobile tourist.

Owing to the failures of attempts to establish a trolley line between Sea Cliff, L. I., and its railroad station 1½ miles distant, a contract has been entered into for a line of automobiles. The railroad company will sell railroad tickets, the cost of which will cover the "auto" fare. Fifteen cents will be charged for a round trip, which is five cents less than the stage fare. Commuters may ride to and from the station for a week for 30 cents, and school children will pay by the week 25 cents. The automobiles are to be built specially for this traffic.

Columbia University has the honor of originating the first automobile club among the colleges. This club was formed last January by six undergraduates —W. B. Shoemaker, H. R. Worthington, L. Iselin, C. A. Dana, H. W. Shoemaker and E. L. Tinker. The club at present has 25 members. There is an effort on foot to hold a university automobile meet in which the clubs recently formed or contemplated at Harvard, Yale and Princeton will be invited to co-operate. The Columbia Club members have been partly responsible for the erection of supply stations along the post road and along the Jersey coasts, where the good roads attract drivers of automobiles.

"We have no doubt that there is a field for the automobile which is large and important," says the Iron Age. "The industry promises to be very profitable to those who can meet the public requirement, but the evolution of a satisfactory type of motor vehicle, which will meet the average requirements as to safety, speed and durability, is likely to be preceded by the loss of millions of dollars through unwise investments in ventures predestined to failure. The business should be undertaken, if at all, by a strong syndicate, able and willing to spend as much money in preliminary investigations and tests as may be necessary to thoroughly demonstrate the advantages and objections of every type of motor available for vehicle propulsion, and from the knowledge thus gained develop the automobile, which will displace the horse in actual service. The cost of such an investigation, however great, would be much less than that involved in commercial development, nine out of 10 of which are certain to end in disaster because premature. The results would be satisfactorily profitable to those whose enterprise and capital had been wisely employed. A standard type of carriage motor would greatly simplify the business and permit carriage makers in all parts of the country to manufacture automobiles at moderate cost, buying the actuating mechanism for much less than they could make it."

PUBLICATIONS.

A pamphlet descriptive of the School of English Branches has been issued by the International Correspondence Schools of Scranton, Pa. Two courses in English are outlined, one affording instruction in arithmetic, spelling, grammar, penmanship and letter writing, the other including, in addition, geography, United States history and United States civil government.

The October, 1900, edition of the supplement to the National Electrical Code, containing a list of electrical fittings that have been examined and approved by the Underwriters' National Electric association, is now ready for distribution. Copies may be obtained in any numbers desired by addressing the office of the Electrical Bureau of the National Board of Fire Underwriters at 67 East Twenty-first street, Chicago.

Recent bulletins of the Emerson Electric Manufacturing company, St. Louis, Mo., are devoted to illustrated descriptions of electric coffee mills, electric pumps for deep wells and electric motors for attachment to sewing machines. All these different devices are arranged to be fitted with alternating-current motors for almost any voltage or frequency and also with direct-current motors, for operation on 110 and 220-volt circuits.

A third edition of catalogue No. 96 on steel-plate fans has been issued by the B. F. Sturtevant company of Boston. It is a 132-page publication and shows all the various types of steam, pulley and electric fans manufactured by the Sturtevant company. Another publication of the company treats

of the Sturtevant system of heating, ventilating and moistening textile manufactories. It is revised from a paper by Eugene N. Foss, general manager of the Sturtevant company, that was presented before the New England Cotton Manufacturers' association, April 24, 1889.

SOCIETIES AND SCHOOLS.

An eight-kilowatt, rotary converter has been added to the equipment of the electrical laboratory of the University of Michigan. The machine was manufactured by the Fort Wayne Electric Works.

A system of electric signals is being installed at Tufts College, near Boston, Mass. Owing to the long distances between some of the buildings, confusion has been experienced in recent years by the inability of the students and professors to hear the college bell.

Orders have been placed for several new pieces of apparatus for the electrical engineering laboratory equipment of the University of Illinois, comprising polyphase rotary converters, transformers and regulators for polyphase work, induction motors and Weston instruments. This apparatus will afford much needed additional facilities for regular electrical laboratory training, owing to the increased number of students in attendance in these courses.

As a result of several letters recently sent out by the National Electric Light association, there has been a large increase in the membership, which is now larger than at any time in the history of the association. New applications are being received every few days. Secretary George F. Porter is sending to the active members copies of Mr. Francisco's book, "Municipalities Versus Private Corporations," which is a publication that ought to be of considerable interest to them, and in many cases of real value.

A paragraph going the rounds of the press states that the leading philosophical, historical and scientific associations of the world, at the suggestion of the Berlin Royal Society, have lately formed a union for the purpose of co-operating in the prosecution of literary undertakings and scientific investigation. The academies of Amsterdam, Berlin, Brussels, Budapest, Christiania, Göttingen, Leipsic, London, Munich, Paris, St. Petersburg, Stockholm, Washington and Vienna will constitute this new body, it is said, which is to meet in joint session once in three years. The general work is carried out between the sessions by a representative commission of 30 members. The new association is pronounced to be the most powerful union of the forces of learned scholarship that the world has ever witnessed.

POWER TRANSMISSION.

The Golden Belt Power company of Hailey, Idaho, has been incorporated, with $600,000 capital stock.

The Mammoth Power company of Hanford, Cal., has been incorporated, to generate and sell electricity. The directors are H. G. Lucey, O. M. Lacey, J. S. Eastwood, S. E. Biddle, and the capital stock is $5,000,000.

Work on the great power plant erecting at Massena, N. Y., is progressing satisfactorily, and the electrical machinery, of 75,000-horsepower capacity, is nearing completion in the shops of the Westinghouse Electric and Manufacturing company, at East Pittsburg. The power house now being built on the bedrock of the Grass River is 700 by 150 feet in area. The turbines will be placed on 80-foot horizontal shafts, in sets of three each. Two turbines of each set will be sufficient to operate one of the generators, allowing any one of the three to be cut out without interfering with the work of the other two. Each of the main generators will weigh 175 tons, stand 22 feet above their foundations, and cover a floor space of 22 by 18 feet. The canal from the head of the Long Sault Rapids on the St. Lawrence, to the Grass River, will carry water sufficient to develop 150,000 horsepower.

MISCELLANEOUS.

Forty-two thousand seven hundred and ninety exhibitors out of 75,531 received awards at the Paris Exposition. Of these the United States obtained 1,981 awards, 220 of which were grand prizes, 486 gold medals, 583 silver medals, 422 bronze medals, 270 honorable mentions, and a long list of gold, silver and bronze medals of collaborators. In the last exposition only 1,000 prizes, including those for collaborators, were given.

During a recent heavy rainstorm in Milwaukee seven trees or posts in different parts of the city caught fire from electric currents, the fire department's services being necessary to extinguish the flames in two places. The fires were all caused by leaks from guy wires attached to trees or wooden trolley posts. When the rain fell the hardest the fires blazed brightest. Considerable difficulty was experienced in extinguishing the flames.

In Utica, N. Y., a block of new apartment houses has recently been furnished with complete installation of electric cooking utensils in each flat. The electrical kitchen furniture consists of three round platters or "stoves," an oven and a broiler. It is said that meats broiled on the electric gridiron are much more palatable than those cooked in the ordinary way over hot coals. A valuable feature of these electrical kitchens is that the stoves, etc., are simply placed on an ordinary kitchen table, and when the cooking is completed can be stowed away in a convenient closet, leaving the kitchen free of even a trace of cookery. All of the heat is used in the cooking, and not in warming and vitiating the air of the room. The flats in Utica are also provided with electric curling-tongs heaters.

TRADE NEWS.

The American Bridge company is furnishing from its Minneapolis plant the structural steel for the roof of the state hospital at Glenwood, Iowa.

The Lea-Hooven Manufacturing company of Anderson, Ind., has been incorporated, with a capital stock of $15,000. The directors are E. W. Hooven, C. A. Eastman and A. G. Lea. The company will make electrical supplies.

The Modern Engineering company of Wellsville, W. Va., has been incorporated for the purpose of manufacturing and selling mechanical and electrical devices. The company is capitalized at $10,000, with privilege of increasing to $150,000. The incorporators are Howard L. Kerr, Charles R. Dallas, G. B. Thurber and C. B. Reed, of Pittsburg, and Thomas C. Charlton, of Chicago.

The Automatic Railway Switch company has been organized in Denver, with a capital stock of $60,000, to manufacture a device designed to throw a switch on street railways and to obviate the necessity of the motorman leaving the car or reaching over the platform. The incorporators are Henry V. Johnson, Roswell E. Goodell, J. T. Eskridge, William F. Hutton, Edgar R. Rust, Robert H. Buck and E. B. Mills.

A. C. Banker of Chicago (Morgan and Pratt streets), maker of gasoline engines for automobiles and for other uses, has had difficulty in securing a battery for spark-coil ignition with sufficient length of life for his purpose. He desires to be placed in communication with someone who can supply his need—a battery with a capacity of about 100 ampere-hours and an electromotive force of about six volts. Either storage or dry battery will answer.

Judge Freedman, of the New York Supreme Court, has appointed Francis N. Sanborn temporary receiver of the American Impulse Wheel company of New York, on the application of Herbert R. Campbell, James R. Vandyck and Lester B. Churchill, directors, in proceedings for the voluntary dissolution of the company. The receiver's bond was fixed at $35,000. The company was incorporated in December, 1896, with a capital stock of $20,000. Bonds to the amount of $25,000 were afterward issued, and it is said that about $75,000 was expended in building up the business. The company manufactured high-pressure waterwheels and hydraulic machinery in connection with electrical transmission of power from water. The liabilities are $51,198, of which $26,198 are accounts payable and $25,000 mortgage bonds. The assets are said to amount to $17,428.

The new factory of the recently organized Economy Electric company at Warren, Ohio, is practically completed and will soon be opened with a working force of 50 men. The building is 30 by 80 feet in size and two stories high. Although the company plans eventually to manufacture electrical machinery of various kinds, it will first engage in the business of restoring burned-out incandescent lamps. The incorporators of the Economy Electric company are P. L. Webb, George H. Jones, Henry W. Smith, J. W. Powers and George B. Sawyer. J. W. Holloway of Syracuse, N. Y., will be manager of the company.

The Gregory Electric company, 54 South Clinton street, Chicago, has recently made two large purchases in the electrical line. One of these comprised the entire stock of completed machines, instruments and supplies of the Siemens & Halske Electric company of America, contained in its large Grant works at Chicago. This stock includes a large number of new machines and others that have been only slightly used for testing, besides all the fine testing instruments and apparatus from the engineering department of the Siemens & Halske company. The other purchase referred to was that of the entire stock of completed dynamos and motors of the Gibbs Electrical Manufacturing company of Milwaukee. All of these goods from both stocks are ready for immediate shipment, and the Gregory company will cheerfully furnish full information about any of the apparatus on request.

BUSINESS.

The George A. Fuller company has orderd from the Western Electric company, Chicago, two 100-kilowatt and one 50-kilowatt, type L machines, to be installed in the Willard Hotel, Washington, D. C.

The Electric Appliance company, Chicago, says it has in press a little book entitled "Skepticism," written especially for those who have doubts as to the Gutmann wattmeter being the best instrument of its kind on earth.

The Northern Pacific Railroad company will build new shops at Brainerd, Minn., the steel work of which will be furnished by the American Bridge company. It is also to be remarked that the structural steel work of the Germantown Junction station of the Pennsylvania Railroad company will be furnished by the American Bridge company.

The American Electric company of St. Paul has closed a contract with the W. H. Walker Milling company of Alden, Minn., for a 31-kilowatt, belted Western Electric generator and a quantity of supplies for line construction and inside wiring. Another large order placed with the American company was given by the Great Northern Railway company for electrical supplies to be used in wiring a steel elevator which the company is building at West Superior. The Western Electric motors now being installed by the American Hoist and Derrick company of St. Paul were sold by the American Electric company, which is the Western Electric company's selling agent in the Northwest.

The Commutator company, Minneapolis, Minn., manufacturer of commutator segments, moved into new quarters at No. 119-121 First street, North, last June. This move was necessitated by an increase in the volume of the company's business of 200 per cent. over the previous year. Since June there has been a further increase in its business of nearly 100 per cent., and the company once more finds itself cramped for room. It is starting work on an extensive addition to its shops, which will enable it to handle its business with greater ease and also take care of the rush of work succeeding election. This company has aimed to manufacture along strictly modern lines, and in this increase in its equipment the same high standard will be maintained. The company is also working on something new in the commutator line, which it expects to have ready to put on the market in the course of a few months.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 30, 1900.

660,551. Electric Fan. John T. Beswick, New York, N. Y. Application filed May 8, 1900.

In the electric fan shown are comprised a containing case, a standard, the inner portion of the upper end of which is concave and slotted at one side, and a column connected at one end to the containing case and provided at the other end with a convex head seated in the concavity of the standard. Means are provided for defining the position of the containing case and column, relative to the standard.

660,561. Electric Indicator. Charles L. Clarke, Rye, N. Y. Application filed July 10, 1900.

The invention relates to an electrical indicating apparatus in which are combined two alternating-current motors, a stroboscopic system having each of its elements independently operated by one of the motors, and a magnetic shield located between the motors. The two alternating-current motors have energizing coils upon their armatures connected to a source of continuous-current supply.

660,572. Telephonic Apparatus. Raimund Günther, Vienna, Austria-Hungary. Application filed November 18, 1898.

In the telephone circuit considered, with the receiver, transmitter and signaling device, are associated an auxiliary circuit, a switch for connecting the auxiliary circuit to line and simultaneously disconnecting the subscriber's station and signalizing devices. Electromagnetic devices are placed in parallel in the auxiliary circuit, one of these devices being arranged to operate a phonographic recorder, and the other organized to set in motion means for driving the phonogram blank. (See cut on page 312.)

660,613. Process of Amplifying Electric Currents. Joseph B. Baker, Newton, Mass. Application filed November 23, 1899.

The process of generating amplified varying signaling currents described consists in causing a conductor so to move in a magnetic field, which is generated in whole or in part by the varying signaling current, that the electromotive force generated in the moving conductor is independent of the position of the conductor within the magnetic field. (See cut on page 312.)

660,620. Non-interference Signal Box. Frederick W. Cole, Newton, Mass., assignor to the United States Fire and Police Telegraph company, Boston, Mass. Application filed November 13, 1899.

A signal-box transmitter comprises a train, a signal wheel, two circuit contacts, and a signaling key having two arms. One of the arms occupies a position between the signal wheel and circuit contacts to be engaged and operated by the signal wheel, while a locking lever for the train is adapted to engage the other arm of the signaling key when the transmitter is at rest, and to hold the signaling key with the aforesaid circuit contacts closed.

660,634. Rotary Snap Electrical Switch. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing company, Hartford, Conn. Application filed June 27, 1900.

A snap switch is described having, in combination with a rotary handle and its spindle, a rotatable spring plate, and a spring for throwing the spring plate, made tense by the turning of the handle. Independent studs are movable into and out of the path of the spring plate, while

guides are placed for directing the movement of the studd, and a cam engaging the studs and adapted to be rotates by the turning of the handle.

660,659. Shaped Spool for Drum Armatures. Alexander Rothert, Riga, Russia. Application filed January 30, 1900.

A combined shaped coil for drum armatures contains several elements having equal or unequal numbers of turns and having the armature wire wound on suitable formers in sufficient number of turns for all the elements forming one coil or winding member. The wire is of suitable cross-section and severed at suitable points, and the whole coil is thus subdivided into several elements having each the number of turns comprised between two severed points, that is, between one of the points and the beginning or end of the wire.

660,713. Electric Motor. Thomas S. Watson, Milwaukee, Wis., assignor to the Browning Manufacturing company, Milwaukee, Wis. Application filed October 4, 1899.

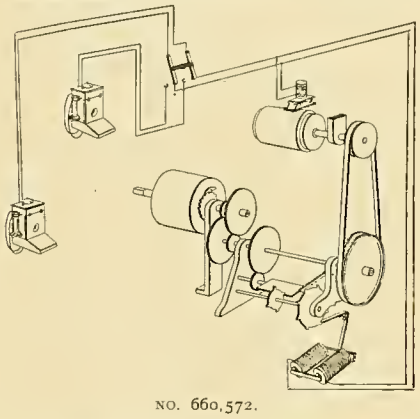
The invention is one of an electric motor for rotary dental tools and the like. With a hollow standard expanded into a ring at its upper end is the motor having an annular magnet frame fitting within the ring of the standard, while conducting wires lead up through the hollow standard and connect to the motor. Hemispherical shells are fastened to the standard ring and inclose the motor, one of the shells having a central aperture for the passage of the shaft of the motor through it.

660,724. Electric Conveying and Elevator Apparatus. George K. Fischer, Salt Lake City, Utah, and Frank Klepetko, Great Falls, Mont. Application filed August 23, 1899.

In combination with the rails and trolley conductors of an electric railway are described, an elevator car, car rails and one or more trolley conductors carried by the elevator car. Means are provided for locking a tram-car when in position on the elevator car, consisting of a blocking device, a crank shaft, a crank arm on the shaft, and a link connecting the crank arm and blocking device.

660,738. Third Rail for Electric Railways. Benjamin C. Seaton, St. Louis, Mo., assignor of one-half to Benjamin Eiseman, St. Louis, Mo. Application filed March 5, 1900.

With a third rail for electric railways, are combined an insulated conductor, a continuous guard on one side of the conductor, and a continuous shield on the opposite side of, and extending over, the conductor.



NO. 660,572.

660,779. Fender for Trolley Cars. Lajos Madas, New York, N. Y., assignor of one-half to Adolf Stern, New York, N. Y. Application filed August 17, 1900.

This car fender consists of stationary bracket arms, a main frame pivoted at its rear end to the bracket arms, rollers at the front part of the main frame, and guard fingers on the main frame forward of the rollers. A net is hung on the main frame, and means are furnished for maintaining the main frame in a normal raised position. Means for automatically dropping the main frame, and an equalizing device for securing the dropping of the main frame evenly at both sides are also shown.

660,786. Sparking Plug for Explosive Engines. Edward T. Birdsall, New Rochelle, N. Y., assignor to Desberon Motor Car company, New York, N. Y. Application filed May 9, 1900.

A sparking plug is described consisting of a metallic supporting plug, and two or more insulating tubes, having their ends only "nested" the one within the other. In combination are an electrode rod extending therethrough, and means for securing the parts together.

660,795. Electric Arc Lamp. Charles E. Harthan and George E. Stevens, Lynn, Mass., assignors to the General Electric company of New York. Application filed November 2, 1898.

In the electric arc lamp described are shown in combination a base, downwardly extending side rods, and a yoke, coiled springs for supporting the yoke on the ends of the rods in such a manner that it is vertically movable. An arc-inclosing cylinder is included, a holder therefor which is carried by the yoke, and a cap for closing one end of the cylinder. This cap is mounted on the side rods and is capable of being adjusted vertically thereon. (See cut.)

660,803. Measuring Instrument. Franz Schrottke, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Original application filed September 2, 1899. Divided and this application filed February 12, 1900.

The method of correcting errors in alternating-current-measuring instruments described consists in setting up lines of force by the current that is to be measured, subjecting a movable element of the instrument to the lines of force, and adjusting the reluctance in the magnetic circuit threaded by a portion only of the lines of force.

660,804. Measuring Instrument for Alternating Currents. Karl O. F. Schrottke, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed September 2, 1899.

The alternating-current-measuring instrument described consists of a movable member, a field portion, a winding therefor for association with an alternating-current circuit, and an adjustable portion included in the same magnetic circuit with the field portion, and adapted to vary the reluctance of a portion only of the magnetic circuit, including the field portion.

660,815. Electric Distribution System. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed July 28, 1900.

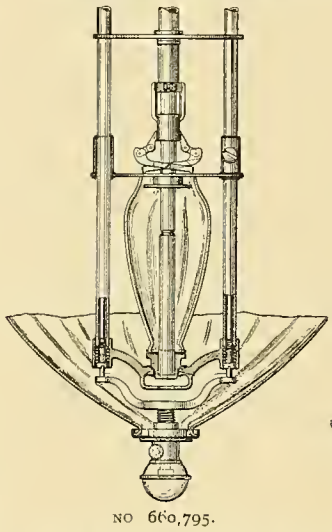
The inventor describes a system of distribution for alternating currents, combining a triphase circuit a single-phase circuit, two independently movable double-throw single-pole switches pivoted to the terminals of the single-phase circuit, and two switch contacts in alinement with each switch, one pair of contacts being connected to one of the triphase mains, and the other to the other two mains respectively. The double-throw switch described comprises a pivoted switch blade, contacts at each side of the pivot, and arcing strips mounted on the switch blade and connected together by a spring. Arcing tips are also connected to the contacts adapted to detain the strips after the switch blade is opened, and a buffer is provided to arrest the movement of the arcing strip when the switch is closed suddenly.

660,816. Producing High Vacuums. John W. Howell, Newark, N. J., assignor to the General Electric company of New York. Application filed August 31, 1899.

The process of producing a high vacuum in an incandescent lamp consists in exhausting the air and other gases from the bulb in which the filament is mounted, then admitting a compound, gaseous at ordinary atmospheric temperatures, having an affinity for the residual gases in the bulb, such as phosphoreted hydrogen, and then exhausting the bulb.

660,818. Electric Switch. Charles H. North, Cleveland, Ohio, assignor to the North Electric company, Cleveland, Ohio. Application filed November 15, 1899.

The invention relates to an electric switch, having in combination a book lever and a plurality of switch members, the switch members being resilient. Certain members are made to tend to separate from their adjacent members, there being an outer member tending with greater force to crowd the others into contact. Means are operated by the lever for controlling the outer member.



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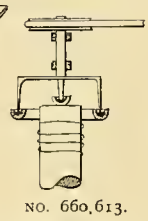


NO. 660,613.

660,819. Magnetic Signal. Charles H. North, Cleveland, Ohio, assignor to the North Electric company, Cleveland, Ohio. Application filed April 21, 1900.

A magnetic signal combines with a box-like frame including two iron side plates and a rigid iron end plate connecting them, a magnet core and winding within the frame. Means are provided for engaging the rear end of the magnet core and the end plate for adjusting the magnet longitudinally, and also means for engaging the forward end of the core and the side plates, and adapted to slidably support the core. A pendulum armature is placed between the side plates and pivotally supported by them in proximity to the magnet core, and an indicator is governed by the armature.

660,820. Magneto-electric Generator. Charles H. North, Cleveland, Ohio, assignor to the North Electric company, Cleveland, Ohio. Application filed August 24, 1900.

A magneto-electric generator is described having in combination a compound driving shaft, consisting of a tubular member and an inclosed rod, between which there is limited a relative rotative movement. An armature is adapted to be driven by one member of the shaft, and driving means are connected with the other whereby the armature may be rotated. A plug is shown within the sleeve, and means whereby the relative rotative movement described can move the plug, and a switch member actuated by such movement.

660,826. Telephone-call Recorder. Harold D. Stroud, Chicago, Ill., assignor of one-half to James E. Plew, Chicago, Ill. Application filed February 23, 1900.

In this telephone-call-recording system, in combination with a subscriber's telephone set, is a register instrument located at the subscriber's station, comprising a mechanism for recording a call upon the register each time the subscriber asks for a connection. A second registering instrument is located at a station remote from the subscriber's station, and electrical connections extend between the two registering instruments, whereby a series of accumulated calls recorded by the register at the subscriber's station may be automatically transferred and registered at the exchange station.

660,836. Electrogalvanic Battery. Horatio J. Brewer, New York, N. Y. Application filed July 7, 1899.

A galvanic battery is described in which the electronegative element consists of a vertical plate of carbon forming the electrode, with a slab of depolarizing material suspended upon the carbon plate by means of interlocking shoulders formed respectively upon the vertical carbon plate and the slab of conglomerate. The interlocking shoulders are integral with and of the same material as the parts upon which they are formed, whereby the weight of the conglomerate is utilized in maintaining a close electrical contact between the carbon and conglomerate.

660,852. Electrode for Arc Lamps. Frederick Hachmann, St. Paul, Minn., assignor of three-fourths to Louis Hill and Max Toltz, St. Paul, Minn., and Elizabeth Baasen, Milwaukee, Wis. Application filed December 22, 1899.

This electrode for an electric-arc lamp comprises a tubular shell of hard carbon and a filling of calcium carbide with an adhering and binding material.

660,867. Electromagnetic Tooth-stopping Hammer. Curt Ostmann, Breslau, Germany. Application filed June 5, 1899.

A dental plunger has within its barrel an electromagnet provided with circuit terminals, the electromagnet being provided with a two-part core of magnetizable material, one part adapted to carry a dental tool, and the other carrying a circuit-breaking contact, both sections being elastically mounted.

660,907. Single-phase, Alternating-current Generator. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed May 24, 1899.

In this dynamo-electric machine, the armature core is provided with a plurality of groups of slots or channels, the sides of which in each group are parallel to each other, and to a radial plane, in combination with a winding consisting of a plurality of groups of substantially concentric turns located in the core slots or channels.

660,908. Variable-speed Electric Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed June 5, 1899.

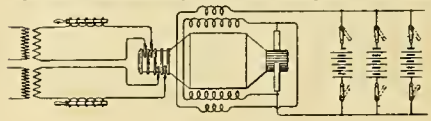
This invention is a method of gradually varying the speed of a direct-current motor provided with two armature windings of different lengths. It consists in connecting the windings in series for one rate of speed, gradually reducing the exciting current for the motor field, cutting the shorter windings out of circuit, making a further reduction of the exciting current for the motor field, then connecting the windings in opposition, again reducing the exciting current, and finally cutting the longer winding out of circuit.

660,910. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed April 14, 1900.

In the system of electrical distribution considered are shown the combination with an alternating-current circuit containing inductive resistance, of a rotary converter connected to the alternating-current circuit and to a direct-current circuit containing translating devices. The rotary converter has shunt and series field-magnet windings arranged and connected in opposition. (See cut.)

660,911. Alternating-current Induction Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed April 14, 1900.

With an alternating-current induction motor, and a transformer having a loaded secondary, means are provided for connecting the transformer primary in circuit with the secondary winding of the motor, and means for varying the active length of the transformer primary to provide a constant torque with variable speed of the motor.



NO. 660,910.

660,930. Method of Varying Active Lengths of Electrical Conductors. Charles F. Scott, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed August 21, 1897.

This method of varying the electromotive force supplied by a transformer consists in gradually cutting in or out a subdivided portion of the primary or the secondary winding of the transformer, and when such portion is all inserted or cut out, of simultaneously cutting out or reinserting the portion, and inserting or cutting out another portion of the same length, and finally gradually inserting or cutting out the subdivided portion.

660,979. Electrical Accumulator or Secondary Battery. Henri Weymersch, Paris, France. Application filed February 19, 1900.

In the manufacture of electric accumulators or secondary batteries, the process described consists of increasing the electrical capacity and duration of the plates, which consists in dipping the plates when dry alternately in a bath of acidulated water and in a mixed solution of pyridin water and alcohol.

660,987. Electricity Meter. Paul Eibig, Berlin, Germany, assignor to Martin Behrendt, Berlin, Germany. Application filed October 7, 1899.

In this electricity meter are combined with fixed coils, a pressure coil arranged to oscillate between the fixed coils and connected with a frame, a brake disk hung within the frame, and a pawl and ratchet connection between the frame and brake disk. An armature is periodically energized and connected with the frame to return the same to its initial position.

661,020. Electric-railway System. Byron E. Osborn, Auburn, N. Y. Application filed April 5, 1900.

In an electric-railway system, two series of contact stands are disposed at intervals to one another on opposite sides of a railway, and a prime conductor passes through one series of the stands, which are normally "dead." An oscillating contact lever normally "dead" is carried by each of the latter, the contact members having electrical connection with the prime conductor. Shoes are carried by a car, one of which shoes being designed, as it traverses a contact stand through which the primary conductor passes, to tilt the oscillating lever against one of the contact members, and hold the latter against the contact stand; the second shoe is adapted to contact with a stand in the return circuit. A motor and electrical connections are shown between the return circuit and the shoes.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, NOVEMBER 17, 1900. No. 20

Some French and Belgian Exhibits at Paris.

By Frank C. Perkins.

The electrical transmission of power in the south of France has been largely developed through the Société l'Eclairage Electrique of Paris. The electrical apparatus of this firm is designed by E. Lahour and includes direct and alternating-current dynamos, motors and transformers. The power-transmission plants installed include both single-phase and three-phase machinery and the apparatus is working at various line potentials from 5,000 volts to 15,000 volts. The Allevard installation operates at 5,000 volts; the Chapareillan-Chambery transmission uses both single-phase and three-phase machines, working at 5,000 volts. There are 35 towns receiving current from the plant at Lancey, the line potential being 12,000 volts, and the apparatus of the single-phase type. The Grenoble-Engins-Voiron transmission utilizes three-phase apparatus and the line potential is 15,000 volts. Most of the above plants have the alternators wound for low pressure, and step-up transformers are used to obtain the high line pressure and step-down static transformers are utilized for reducing the tension for general distribution.

The interesting feature of the Paris exhibit of the Société l'Eclairage Electrique is a single-phase, alternating-current generator, which furnishes a current of 30,000 volts' potential directly from the armature, ready for the transmission line, without the necessity of using step-up transformers. This high-tension, 30,000-volt alternator is seen in Fig. 3 (next page), at the left. It has a capacity of 200 kilowatts, and is of the single-phase type. The armature is stationary and the field revolves at the rate of 428 revolutions a minute. At this speed the frequency of the alternator is 50 cycles a second.

At the right, in the same illustration, may be seen a Labour direct-current, multipolar dynamo of 100 kilowatts' capacity. In the center of the space there are a number of single-phase static transformers, of capacities from one to 40 kilowatts, and a number of three-phase transformers, of from 10 to 100 kilowatts' capacity. These are wound for 110 to 3,000 volts' potential. Two high-tension transformers are exhibited, designed by Mr. d'Arsonval, for 50,000 volts and 100,000 volts.

The direct-connected, three-phase alternator shown at the left in Fig. 1 is a 1,200-kilowatt Lahour generator. It is operated by a Dujardin tandem-compound engine, whose capacity is 850 horsepower at 80 revolutions a minute. The alternator has a frequency of 50 cycles a second, and generates a current of 3,000 volts' potential. The external diameter is 5.6 meters (18.4 feet).

The continuous-current, multipolar generator seen at the right in Fig. 1 is of 200 kilowatts' capacity. It is operated by a 300-horsepower Collman tandem-compound engine, constructed by Bietrix, Leflaire, Nicolet & Co., at their works at St. Etienne on the Seine. The speed of the engine is 110 revolutions a minute and the flywheel is two meters (6½ feet) in diameter and weighs four tons. The exciter for the 1,200-kilowatt, three-phase alternator is a multipolar, continuous-current generator, directly coupled to a Boulte-Larbodiere high-speed engine, operating at 420 revolutions a minute.

The electrical apparatus manufactured in Belgium is rapidly coming to the front, and is recognized as exceptionally well made and well designed. One of the most interesting and important stands at the exposition is that of the Compagnie Internationale d'Electricite of Liege, Belgium, a firm which occupies a leading position in the electrical world. The works of this company, which are situated at Liege, have recently been considerably enlarged in order to meet its increasing trade. They are fitted throughout with first-class, modern machine tools, and arranged in the most perfect order.

In the illustration (Fig. 2) can be seen a large Belgian three-phase generator, with an output of 1,000 kilowatts at 2,200 volts. It is coupled direct to a steam engine of corresponding power, running at a speed of 83⅓ revolutions a minute. This engine was built at the works of Van den Kerchove & Co., Limited, Ghent, Belgium. The generator has a fixed armature and a revolving field, with 72 poles, and its frequency at 83⅓ revolutions a minute is 50 cycles a second, the number most frequently adopted at the present time in Europe. The armature is star-wound; the coils are built upon standard jigs, and are, therefore, interchangeable. The American practice of working to standards has been adopted by the Compagnie Internationale d'Electricite for all the parts of its dynamos and motors. The efficiency of the three-phase generator described above is 94 per cent., and attention may also be called to the exciter, placed in between the dynamo bearing and the revolving magnets, at a very short distance from the hub of the latter. This 1,000-kilowatt generator is utilized for the service of the exhibition.

A second three-phase-current dynamo, for belt driving, has been installed a short distance from the one just described, and is seen at the right in the illustration. This dynamo has an output of 80 kilowatts at 530 volts, at the speed of 600 revolutions a minute; its frequency is 50 cycles, and its efficiency 90 per cent. The exciter, a continuous-current dynamo of 20 amperes at 110 volts, has its armature keyed on to the shaft that supports the magnets of the generator. The three-phase current of the 1,000-kilowatt generator is conducted to a main switchboard, seen at the extreme right in Fig. 2. The switches on the board are connected to the different circuits, one of which supplies a 10-kilowatt, three-phase, step-down transformer, reducing the potential from 2,200 volts to 190 volts.

In the Palais du Trocadero are exhibited a number of step-down transformers, ranging in capacity from three to 20 kilowatts each. They reduce the potential from a 1,000-kilowatt, three-phase generator to 190 volts for use about the exposition. A 10-kilowatt transformer is connected up, star-wise, to a secondary switchboard, and supplies current at 110 volts to arc and incandescent lamps. There are also three three-phase motors of one, three and eight brake-horsepower, respectively, running at speeds varying from 1,500 revolutions a minute for the one-horsepower to 1,000 revolutions for the eight-horsepower; their efficiencies follow an ascending scale from 73 per cent. for the smallest type up to 85 per cent. for the eight-horsepower type.

Included in the alternating-current apparatus exhibited by the Compagnie Internationale d'Electricite are several special motor-generators, or rotary transformers, each consisting of a three-phase motor, coupled direct to a continuous-current dynamo. The three-phase motor of 150 horsepower, shown in Fig. 2, operates at a speed of 410 revolutions a minute. The frequency is 50 cycles, the potential is 2,200 volts and it has a minimum efficiency at normal load of 91.5 per cent. The continuous-current dynamo driven by the three-phase motor just mentioned has an output of 100 kilowatts at 240 volts, and operates at 410 revolutions a minute. Its commercial efficiency is 92 per cent. This dynamo is connected to a secondary switchboard, which supplies a number of continuous-current motors. An electric motor of four horsepower, operating at a potential of 220 volts and at a speed of 1,400 revolutions a minute, is seen at the right of Fig. 4, and is direct-coupled to a Beduwe pump.

The electric jib crane, shown in Fig. 4, was also manufactured by the Belgian firm, the Compagnie Internationale d'Electricite. It has a capacity of 30,000 pounds and is operated by two ironclad electric motors, the first of 15 horsepower, at 500 revolutions, the second of six horsepower, at 800 revolutions, the voltage of both being 240 volts. These motors have efficiencies of 88 and 86 per cent., respectively. They are supplied with metallic starting and reversing switches.

In the foreground at the left, and in the distance at the right, in Fig. 4, may be seen two very interesting steam dynamo plants. The first-mentioned consists of a continuous-current dynamo, with an output of 270 amperes at 500 volts, direct-coupled to a high-speed steam engine, running at 470 revolutions a minute (manufactured by Van den Kerchove & Co., Ghent). The efficiencies of these dynamos are, respectively, 92.5 and 91 per cent.

The main switchboards seen at the right in Figs. 2 and 4 are composed of several white-marble panels; on these are symmetrically arranged the measuring and regulating apparatus, as well as the switches. The apparatus of each panel serves for different parts of the installations. The switches, which themselves are placed at the back of the board in order to prevent anyone approaching them, are operated from the front by means of cranks and insulated levers.

Some examples of the Belgian arc lamps are exhibited, which clearly show the numerous improve-

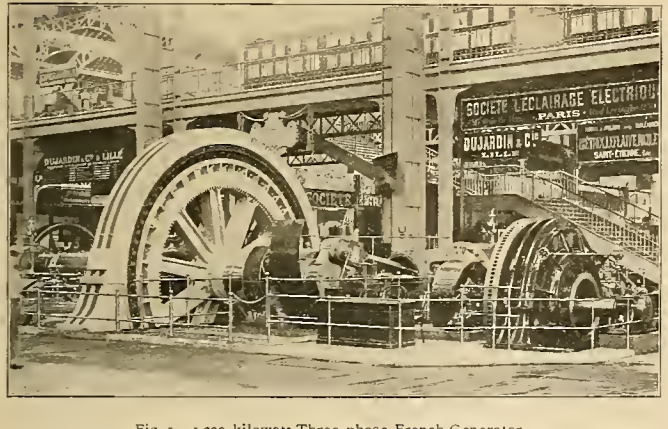


Fig. 1. 1,200-kilowatt Three-phase French Generator.

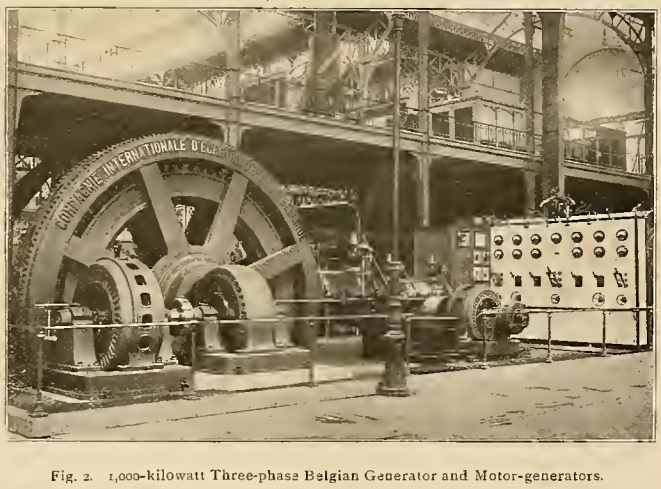


Fig. 2. 1,000-kilowatt Three-phase Belgian Generator and Motor-generators.

SOME FRENCH AND BELGIAN EXHIBITS AT PARIS.

ments that have been made in the construction of these lamps. The old-fashioned clockwork movement, formerly used in Belgium and elsewhere, has been replaced by a simple and strong mechanism, and the number of parts has been considerably reduced, which greatly facilitates the regulation and manipulation of the arc lamp.

The quality of the material used and the workmanship are excellent, and the Belgian electrical machines fully answer every demand of modern science, while at the same time they are strong and well made.

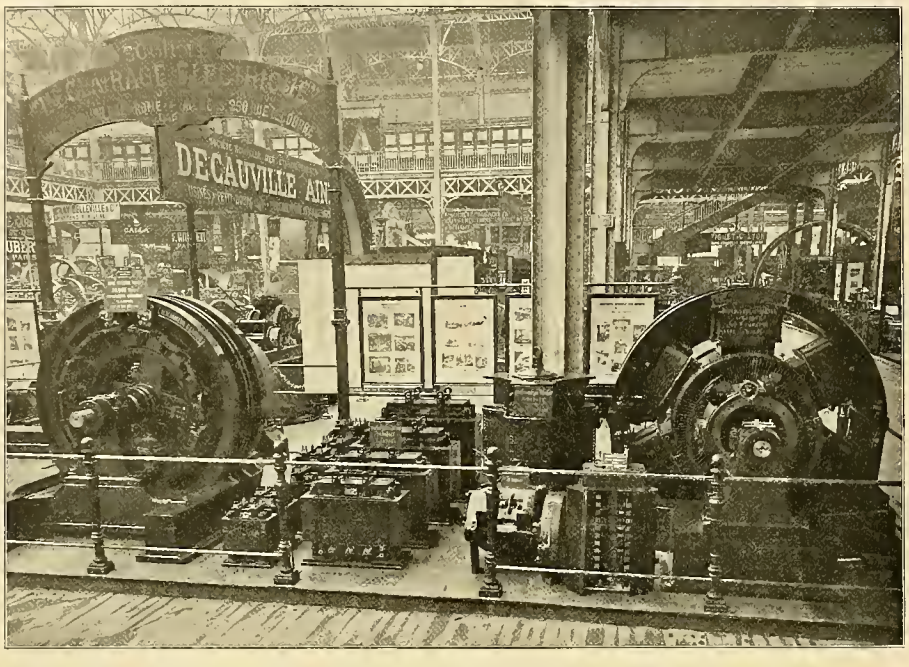


FIG. 3. SOME FRENCH AND BELGIAN EXHIBITS AT PARIS.—LABOUR 30,000 VOLT ALTERNATOR, TRANSFORMERS AND DIRECT-CURRENT GENERATOR.

Big Niagara Falls Contract.

The Niagara Falls Power company has awarded the General Electric company of Schenectady, N. Y., the contract for the construction of six dynamos which are to be installed in the new power house to be erected over the wheel-pit now in course of construction. These six dynamos will be the initial installation in the new central station, and their output capacity will be 30,000 horsepower. All the dynamos in the present power house of the Niagara Falls Power company were built by the Westinghouse company. The new machines will have the same general appearance and characteristics, but they will possess certain features that are expected to be advantageous. When they are completed they will be installed with all possible rapidity in order that a full supply of current may be ready for the Pan-American Exposition.

It was on Monday, November 12, 1899, that ground was broken for the new wheel-pit now building. In all ways the work has progressed satisfactorily and the present depth of the pit is about 120 feet. The pit will be 180 feet deep when finished.

Frequency of Alternating Currents.

A. Samojloff, writing in the Annalen der Physik, describes a novel method of determining frequencies of alternating or interrupted current. Using a rotating disk containing white and black sectors, he noticed that when illuminated by an incandescent lamp on an alternating-current circuit the disk appeared to stand still when revolving at a certain rate. That rate was the rate at which the alternations of black and white at any given point of the disk were synchronous with the alternations of the luminosity. Although imperceptible to the eye, the periodic partial extinctions of the light were yet sufficient to make the intermediate grades between a maximum or minimum of whiteness disappear, and thus to produce the appearance of a disk at rest. Hence if one place a revolving disk near the lamp and alter its speed of revolution, a velocity will be found where the disk appears to stand still. The product of the number of white sectors by the revolutions a second then gives the frequency of the current. To determine the frequency of a Wehnelt interrupter, it was mounted in parallel with an arc lamp, which then acted as an alternating-current lamp, so far as its light on the revolving disk was concerned.

An ordinance has been introduced into the Homestead (Pa.) council by the Homestead Belt Line Street Railway company, asking for a grant to build a road to encircle Homestead and West Homestead, starting at Seventh avenue and Hays street.

The Alternating-current Arc.[1]

By C. Wiler.

The advance in the art of alternating-current arc lighting during the last two years has attracted the attention of engineers and central-station men throughout the country. The arc lamps and their movements have been described in various papers, the devices for operating large numbers of lamps in series have been set forth, and indoor, as well as outdoor, illumination from alternating arcs has been a topic of discussion in the meetings of various associations.

The physical nature of the open or enclosed alternating arc has been a salient factor; this, however, is the key for many phenomena of the arc. If we establish an arc between carbon electrodes, we find that the arc voltage increases with the length of the arc; if we keep the arc length constant and increase the current, the arc voltage begins to decrease with the current. The apparent resistance of the arc is therefore unlike a wire resistance, which requires a higher electromotive force with an increase in current, but it decreases with increasing current, so that an arc on a constant-potential circuit takes a constantly increasing current. In order to offset this tendency, a steadying device is required, which does not depend for its resistance upon the current and which will thereby fulfill the fundamental requisite for the application of the arc to lighting purposes.

On a constant-potential circuit a series resistance or series reactance will render the arc stable. The larger the resistance, the less the variation in current and the steadier the arc. On a constant-current circuit, where the arcs are connected in series and the main regulating coils offer no perceptible impedance, the dynamo or transformer decreases the terminal pressure with increasing current. The more drooping the characteristic or the relation of current and electromotive force on the dynamo or transformer for either fixed-brush position, fixed position of movable coil or core, the steadier the arcs.

The resistance of a stable direct-current arc is of constant value for any particular current. The resistance of the alternating arc varies with the current. During the first part of the positive half of the cycle the resistance drops from its maximum value at zero current to its minimum value at maximum current and rises again during the second part, so that the wave form of the resistance will describe during one-half cycle of the current a complete cycle and the resistance of the arc will pulsate at the rate double the frequency of the current.

Considering instantaneous values of the alternating arc, we may take it for granted that the law of the direct-current arc can be applied to them. The transformation of electricity into light is certainly not different for a current of momentary value than from that for a current of continuous value. Hence, during the positive part of the cycle the upper carbon will be the seat of the light. It has been shown by exploring the distribution of potential in the direct-current arc that the larger part of the energy is expended at the crater of the arc, producing there the highest temperature, while the smaller part is expended along the vapor column and at the negative-carbon tip. For the low values of the impressed alternating electromotive force an arc cannot be formed or maintained between solid carbons, if they are separated for the full arc length corresponding with the normal voltage. The available voltage is not sufficient to overcome the high resistance at the positive-carbon tip. The current will therefore be zero for the low values of the impressed electromotive force. It is only for the higher values that the current will find its path through the arc to the negative carbon.

After the current and electromotive force have reached their maximum values, the current will gradually drop, and either fall off very abruptly near the zero line or cause a rupturing of the arc. As soon as the negative cycle starts, a shifting of polarity will take place, so that the lower carbon becomes positive and the upper negative, whereupon the same cyclic variation will be repeated. During the larger part of the cycle the current is zero or very small, and the arc tends to extinguish. This action takes place when an alternating arc is to be maintained between solid high-voltage electrodes; it clearly demonstrates that the attempts which have been made from time to time to operate open alternating-current arcs with solid carbons conflicted in their very beginning with the laws of nature, and it shows also that the enclosed arc between solid carbons, which has a much larger resistance in the vapor column than the open arc, is bound to be a failure.

The effect of the cored carbon upon the alternating arc can be explained by comparing it with a liquid, whose resistance is lowered by the insertion of salts, and whose transitional resistance at the electrodes is changing therewith. For a low-voltage carbon, whose core contains the salts of sodium or potassium, a large electromotive force is not re-

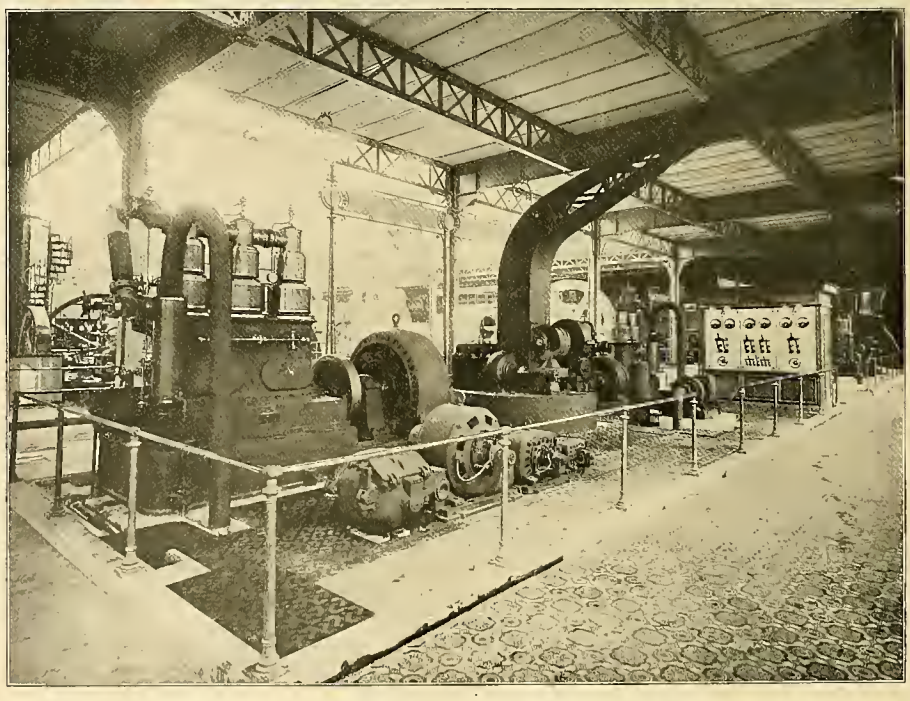
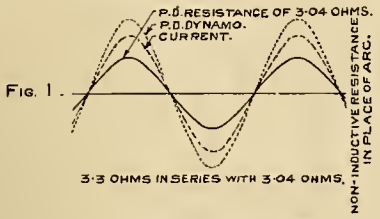
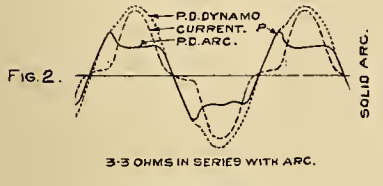


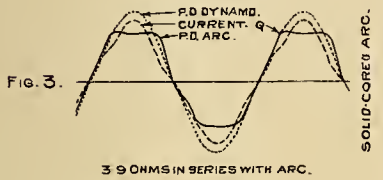
FIG. 4. SOME FRENCH AND BELGIAN EXHIBITS AT PARIS.—BELGIAN ELECTRICAL MACHINERY.

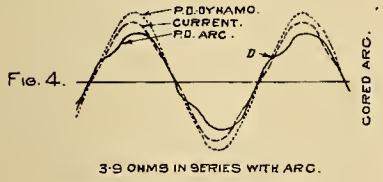
1. Read before the Chicago Electrical association, October 19, 1900.

quired to overcome the resistance at the crater, as the core and the surrounding gases of high conductivity will not then offer a very high resistance to a current of low value and they will offer but a small resistance to a current of high value. The resistance of the arc, under these conditions, is so modified that it acts more like an ohmic resistance, and the current and voltage rise and fall in unison. This has been recognized for several years, and the success of open alternating arc lamps in Europe is due to the high grade of cored carbons, which meet the inherent defects in the arc. It is apparent









THE ALTERNATING-CURRENT ARC.

that an open alternating-current arc between two cored carbons will not require a large amount of steadying resistance, on account of the characteristic just mentioned. It is surprising, however, that only a short time ago Blondel stated at the Paris Congress: "The alternating-current arc requires less stability resistance because of the greater sensibility of its mechanism under influence of vibration." (Western Electrician, Vol. xxvii., No. 13.)

Whatever resistance is required by an open alternating-current arc between cored carbons is necessary at the moment, when the current is near its zero value, when the polarity of the carbon reverses and the arc stream changes its direction. It is a

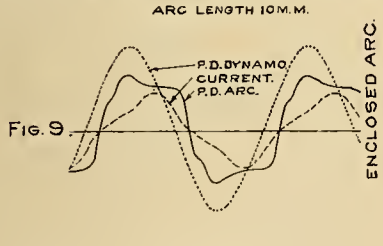
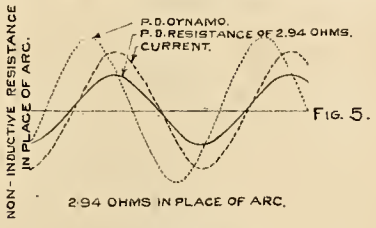
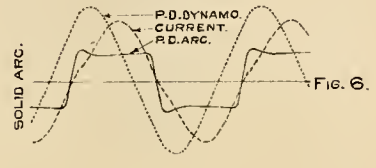


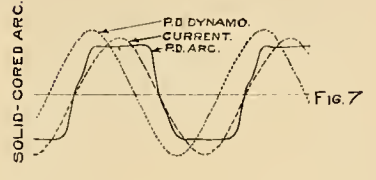
FIG	P.D. ALTERNATOR TERMINALS. VOLTS.	CARBONS. BOTH.	ARC LENGTH MM	CURRENT AMPS.	P.D. BETWEEN TERMINALS OF ARC. VOLTS.	POWER ARC. WATTS.	POWER FACTOR ARC.
9	100	CORED "SIEMENS" IN DAVY ENCLOSED	10	9·4	70·5	542	0·915
10	82·5	CORED "SIEMENS" IN HANG LAMP	10	8·5	42·2	338	0·945

THE ALTERNATING-CURRENT ARC.

matter of experience, and also borne out by theoretical investigations, that this is better accomplished by a small inductive resistance than by an ohmic resistance. The electromotive force of the latter will vanish with the current, while the leading electromotive force of the former will be ready to help the lagging current over the zero point or the dead center of the arc. It is here that the effect of what may be termed the "momentum of the arc," i. e., of the frequency, becomes plainly visible. The higher the frequency, the quicker the change in the polarity of the carbons, the shorter the time during which the current is of small value and the carbons and the arc can decrease their temperature and, by their increasing resistance, oppose the establishment of an arc. We might expect from the foregoing that a low-frequency arc is less efficient than a high-frequency one; but Blondel has shown that for open alternating-current arcs the opposite is the case. (Electrical World, Vol. xxix., "Luminous Efficiency of the Alternating-current Arc.") He attributes this "to the greater distance between the







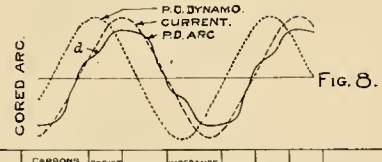


FIG.	CARBONS. TOP.	CARBONS. BOTTOM	RESISTANCE IN SERIES OHMS.	SELF-INDUCTANCE IN SERIES HENRYS.	IMPEDANCE OF INDUCTANCE COIL OHMS.	P.D. ARC. VOLTS.	POWER ARC. WATTS.	POWER FACTOR ARC.	NOTES.
1	3·04 OHMS IN PLACE OF ARC.		3·3	VERY SMALL	·	45·1	666	1·00	TO BE COMPARED WITH FIG 2
2	SOLID	SOLID	3·3	"	"	53·2	581	0·74	SLIGHTLY HISSING
3	"	CORED	3·9	"	"	37·4	521	0·94	NOT HISSING
4	CORED	"	3·9	"	·	32·0	470	0·99	"
5	2·94 OHMS IN PLACE OF ARC		0·3	7·6 10^{-3}	4·77	43·4	642	1·00	TO BE COMPARED WITH FIG. 6
6	SOLID	SOLID	0·3	7·6 "	4·94	50·2	635	0·855	SLIGHTLY HISSING
7	"	CORED	0·3	7·6 "	4·79	37·8	536	0·96	NOT HISSING
8	CORED	"	0·3	7·6 "	4·80	31·6	461	0·985	

carbon points that is realized for the same voltage at high frequencies."

The effect of the frequency and the conductivity of the arc stream is of the greatest importance for the starting and controlling of arc lamps, and many problems met in practice can be considered and solved accordingly.

The study of the alternating arc in the past has been mostly pursued by obtaining the wave forms of the current and electromotive force through the slow, tedious, contact method. Of late the more rapid and accurate oscillograph method has been applied by Messrs. Duddell and Marchant, and the results have been communicated to the Institution of Electrical Engineers, London. (Journal of the Institution of Electrical Engineers, Vol. xxviii., London.) An oscillograph is a galvanometer, whose deflections are proportional to the instantaneous value of the current; a mirror attached to the movable part reflects a beam of light upon photographic plates, so that a continuous record of the wave form may be obtained. By employing several instruments, the wave form of the current, the wave form of the potential difference of the arc and of the dynamo, can be traced simultaneously and the effect of changes in any of the waves can be recorded and noted. The curves obtained by Duddell and Marchant are undoubtedly the most interesting and accurate known. In Figs. 1 to 10, curves as obtained by them on a 100-cycle alternator with small armature self-induction are referred to.

Fig. 1 shows the wave forms of the potential difference of the dynamo, the current and the potential difference across an ohmic non-inductive resistance of 3.04 ohms in series with 3.3 ohms. The current was 14.8 amperes.

In Fig. 2 the energy taken by the resistance of 3.04 ohms has been replaced by an open arc between solid carbons, adjusted for the same current, 14.8 amperes. The length of arc was three millimeters and the steadying resistance same as in Fig. 1. The arc voltage was 53.2 and the power factor 0.74. For the low values of the available voltage at the arc the current hardly begins to rise, so that the potential-difference arc wave runs up very abruptly, until it can get the current through the arc; thereupon it decreases again and stays nearly constant until the decrease in current produces a slight rise. The waves of current and the potential difference at the arc appear, therefore, considerably distorted from Fig. 1. The front peak in the potential-difference arc wave is very much more pronounced than the back peak, which finds its explanation in the well-known fact that an alternating-current arc is easier to maintain after the carbons have been heated and their conductivity raised, than in the cold state.

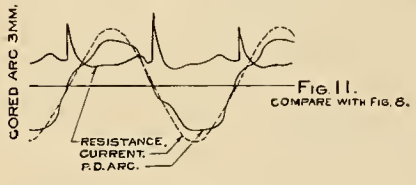
In Fig. 3 the lower carbon has been replaced by a cored carbon. The arc length and the current are kept constant for all experiments on open arcs. The arc voltage is reduced to 37.4; the power factor of the arc increased to 0.94. The front and back peaks on the potential-difference arc wave have disappeared.

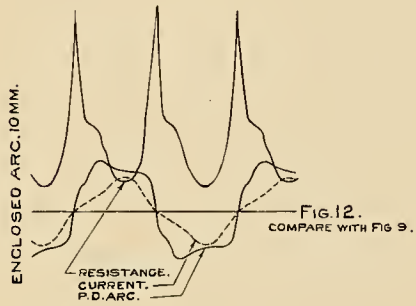
In Fig. 4 top and bottom carbons are cored; arc voltage is 32; power factor, 0.99. A comparison with Figs. 1 and 2 shows that the waves are not very much distorted, and that the arc resistance has undergone a complete change.

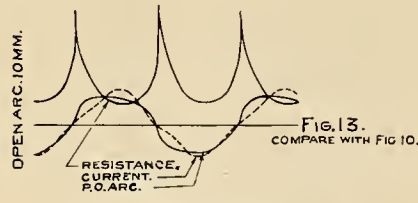
In Fig. 5 a non-inductive resistance has been put in place of the arc; in series therewith is an inductive resistance of 4.77 ohms' impedance.

Figs. 6, 7 and 8 show the wave forms for an arc of the same length, steadied by an inductive resistance; Fig. 6 for solid carbons; Fig. 7 for solid and cored, and Fig. 8 for two cored carbons. The power factor of the arc between solid carbons is considerably higher when the arc is steadied by the inductive than by the ohmic resistance. The cause therefore has already been referred to.

In Fig. 9 the waves for an enclosed arc between







THE ALTERNATING-CURRENT ARC.

two cored carbons, steadied by a choke coil and the regulating magnets, are shown. The current was 8.4; arc voltage, 70.5; power factor, 0.915.

In Fig. 10 the enclosing globe has been removed and the waves have been recorded for the same arc length and current as in Fig. 8. The power factor has increased to 0.945. The distortion of the waves is therefore greater for an enclosed than for an open arc, and for the latter it increases with the length of the arc.

In Figs. 11, 12 and 13, the writer has plotted the resistance curves of the arc corresponding with Figs. 8, 9 and 10. During a large part of the cycle the resistance of the open arc between cored carbons is of constant value, while the resistance of the enclosed arc varies continuously.

It is now well established and conclusively shown by the curves that no phase difference is produced by the alternating arc, either open or enclosed, with solid or with cored carbons, although the mere quotient $\frac{\text{watts}}{\text{current} \times \text{voltage}}$ would indicate it. This calculation, however, is only correct for sine wave. Current in the arc and arc voltage cannot be sine waves simultaneously, as shown in the foregoing.

The curves in Fig. 9 of the enclosed arc are the only ones ever obtained on an alternator with small armature self-induction, with which the writer is familiar. A further investigation of the enclosed arc by the oscillographic method would be of great interest, and perhaps of considerable value. The power factor of an enclosed arc changes with the carbons; it increases with the size of enclosing globe, and decreases with the area of the opening

left around the carbon in the gas cap. The reasons are self-evident from the foregoing. The more rapid consumption of the carbons by alternating-current enclosed arcs, when the arc descends in the inner globe, may also be attributed to the increasing power factor, as it seems that under these conditions the influx of air into the inner globe is facilitated.

A comparison of the resistance curves of the enclosed arc and of the open arc would lead one to expect that the open alternating-current arc was the steadier and more peaceful of the two. The open alternating-current arc, however, requires for its successful application for commercial lighting high-grade carbons and different sizes for changes in current. These two points were, with the decreased luminous efficiency of the open alternating-current arc, the humming, the rapid consumption of the carbons, the sensitiveness to atmospheric conditions, responsible for the many failures in alternating arc lighting with open arcs. The enclosed alternating-current arc cannot very well be used commercially above 7.5 amperes, and one size of carbon is therefore sufficient for all conditions. The use of high-grade carbons has become universal with the increase in life, on account of the use of enclosing globes, and the humming is practically eliminated and a better distribution of the light and greater steadiness is obtained.

The amount of steadying resistance necessary for an alternating-current arc is, as explained above, considerably less than for a direct-current arc. Recently the Western Electric company has advocated the use of alternating-current arc lamps in series on constant-potential circuits, with 72 volts at the arc, 6.6 to 7 amperes, and only 78 to 80 volts' terminal pressure at a frequency of 60 cycles, and with no other regulating device during normal operation than is contained in the lamp. A large number of installations, comprising circuits of three to 50 Western Electric series-alternating lamps, have shown that alternating arc lamps operated in series direct on the mains, or on a constant-potential transformer, possess a remarkable stability and an extremely large range for the variation in terminal pressure caused by inductive loads. This feature is of great importance for successful operation of alternating arc lamps on light and power circuits. The present practice of connecting alternating-current arc lamps singly on circuits of 104 volts, as required for the incandescent lamps, meets the demand for small installations. The power factor of these lamps is very low (about 65 to 70 per cent.), mainly due to the abnormal reduction of the line voltage to the arc voltage. The power factor of the series lamp, on the contrary, is, with a reduction from 78 or 80 volts to 72, very high, averaging about 85 per cent. This great advantage should lead central-station men to the consideration of operating alternating arc lamps in series on the mains, or, if insulation of the arc circuits is necessary, they can be connected on constant-potential transformers in groups of three on 220 to 240 volts, seven lamps on 500 to 550 volts, or 13 on 1,000 to 1,050 volts, and so on, to as large units as desired.

The alternating arc, which gave so much promise in the early decades of the century, has reached at its end a high degree of perfection, so that, in its new form, it has once more taken up the competition with its former rival—the direct-current arc.

Large Electrical Contract in London.

Several of the great electrical manufacturing companies of the world are preparing bids for the $25,000,000 contract for the equipment of the London Metropolitan District underground railway. The extraordinary size of the contract, which contemplates the reconstruction of more than 50 miles of subterranean railroad, has enlisted the attention of the largest concerns in the business. The prize will be awarded, it is said, on December 1st. American bids will be made by the Westinghouse and General Electric companies. The British competitors include Mather & Platt, the Brush Electric company, Crompton & Co., Thomas Parker & Co. and Dick, Kerr & Co. Germany is represented by the Allgemeine Elektricitäts Gesellschaft, Siemens Brothers, Schuckert & Co. and Felten & Guilleaume, while the Bregguet Electrique company and Hutin and Leblanc will attempt to secure the order for France.

A Railway Franchise Sold for a Dollar.

The franchise which was asked by the Syracuse and Oneida Lake Electric Railway company was sold at auction in Syracuse on November 9th. It was the first public sale in that city of a franchise under what is known as the White charter. One dollar was the sum which was secured for the franchise, and an interesting fact in connection with the realization of this sum is the payment of $504 to the official papers for publication of the notice of sale, and the franchise also caused other expense to the city. Prospective bidders were required to deposit a certified check for $5,000 with the city treasurer as a guarantee that the conditions of the sale would be complied with by the successful bidder. Only one check was so deposited. It was drawn by Benjamin Stolz, who represented the Syracuse and Oneida Lake Electric Railway company, and who was also the only bidder.

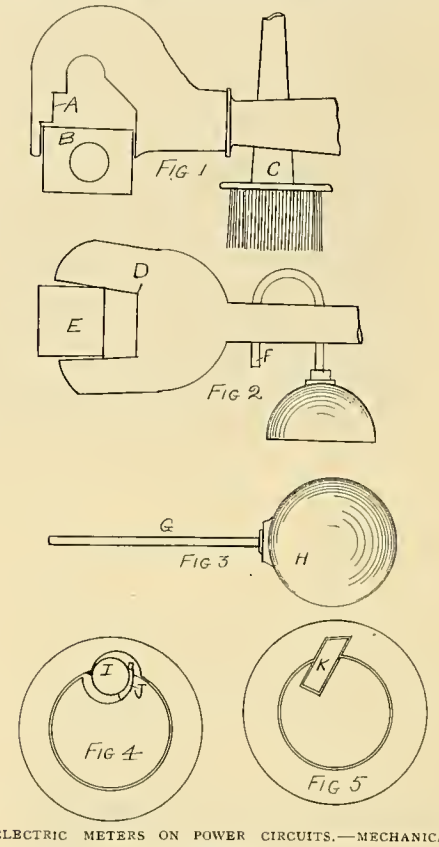
The Goshen, Wawasa and Southern Electric Railway company has been incorporated in Indiana to build an electric line from Goshen to Wawasa. J. J. Burns is president of the company.

Electric Meters on Power Circuits.

By P. I Panamolo.

The efficiency of electric meters depends to a very great extent upon the care and treatment they receive in the works in which they are employed. I have seen the best makes of electric meters put out of service through the careless operations of incompetent help. Electric meters were not very extensively used several years ago, and being of comparatively recent introduction, many are not familiar with their use and application.

The use of a meter on motor service teaches the users to keep shafting well lined, freely oiled, and all parts well adjusted and operated to the best and most economical advantage. In many places where electric meters have been established, decided savings have been made immediately, because the users have gone to work and cleaned up gummed bearings so as to permit the machinery to run freer, belts and pulleys are put in better working order, and loss of power through various conditions is overcome.



ELECTRIC METERS ON POWER CIRCUITS.—MECHANICAL DETAILS.

In installing meters for motor service, the meters are usually placed on the station side of the controlling switch, instead of the motor side, as in some cases. The different forms of recording meters have potential windings of fine grades of wire, the mechanical strength of which is usually low. When the controlling switch is used, this fine wire is altered in temperature, causing constant contraction and expansion, which in time results in the weakening of the wire. Often this wire will chafe badly and break off. This trouble can be avoided by placing the meter on the service side of the switch.

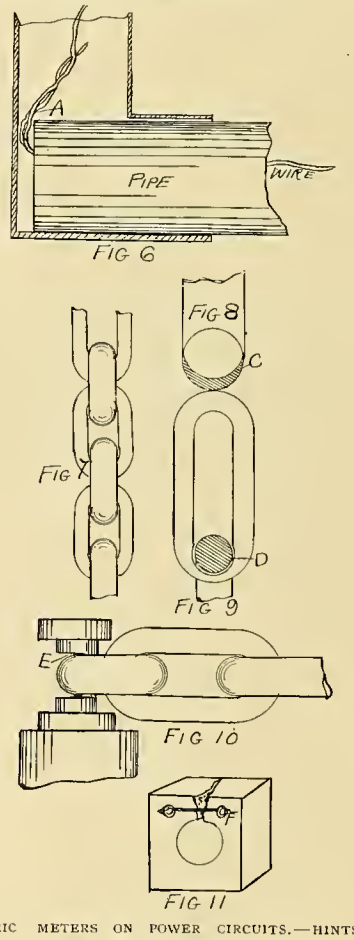
In the making of alterations on meters, some special tools are needed, and it will be found handy to have a wrench made after the design shown in Fig. 1, in which the jaws are cut out to receive the different sizes of nuts, as at (A), where the nut is marked (B). This form of wrench can be slipped over the different sizes of nuts used on the mechanical work of the meter and the same can be readily handled. Then it is best to have a hand brush like that in Fig. 1, marked (C), made with fine, stiff bristles, for the purpose of clearing the foreign accumulation from the parts of the meter. The delicate mechanisms of the meter often get out of service through the presence of dust, which could be swept off readily with a brush of the kind shown. The dust should be carefully avoided and every means taken to prevent it from settling on the parts that have frictional service to perform. Then, again, the rust should be kept off by means of frequent cleaning and application of oils or greases by means of wiping rags.

Wrenches, made after the plan in Fig. 2, may be used, if the jaws are well strengthened by means of using good steel and proper proportions. In some places where I saw meters in operation the attendants were in the habit of tightening and adjusting the nuts and set-screws with wrenches made on the S plan, the jaws of which were as badly out of true as at (D), and when placed over the nut or set-screw head (E) the wrench would probably slip off, or at least turn the edges of the nut.

In another place I saw that the workmen had an oiling can of the pattern shown in Fig. 2, with a spout (F) which carried the oil over and down into certain bearings of a motor to which a meter was connected, the excuse being that the meter people had insisted upon free application of the lubricant. The parts were deluged in oil and the oil had begun to gather dust and turn to gum, clogging the parts and creating considerable trouble, which was overcome by a thorough scraping and washing. The custom of pouring streams of oil on to bearings of motors, for the sake of making the motor run a little easier to please certain manufacturers of attachments, is not a good one. The oil is costly, and when it is properly applied, in small quantities, it is as serviceable as if an ocean of it were applied.

I also saw at one place where they were using electric meters a device for squirting oil like that in Fig. 3. The ball (H) is rubber, and to it is attached the tube (G). The ball is filled with oil, and then it is taken between the hands or in the fingers of one hand and pressed until a stream of oil is sent flying over the parts. This makes a free application of oil, sure enough, but the oil seemed to me to be spattered all over the floor and the belt and the machinery in general, as well as in the special parts desired to reach. Of course, only the apprentices and careless machinists permit anything of this sort to continue. The regulation oil-can serves all purposes, and is used in the majority of shops.

Although some manufacturers of electric meters have an inclination to get the motors in such shape



ELECTRIC METERS ON POWER CIRCUITS.—HINTS FOR POWER USERS.

that the meter will be favored at the expense of the motor, as a rule the results are equally balanced, from the fact that good electric meters are sometimes put at fault through the poor mechanical condition of the motors. I saw at one place where they had some new meters attached that the service was very poor, and that it was claimed that the meter was a bad one, and it was the intention to remove it soon. An examination brought out that the motor shaft was provided with a bad coupling, and one of the keys was in the condition shown at (I), Fig. 4. It seems that the original key had been lost some time before, and a new key of much smaller size was inserted. This key was packed

into the key-seat with side bushings, so as to fill out the space at (J). So long as this space remained packed, and the bushing held its position, all went well. But finally the bushing loosened and came out, with the result that the coupling loosened and trouble ensued. The machinists supposed that something was the matter with the meter, which had been lately attached, and instead of overhauling the motor to locate the real trouble, they wrote to the makers of the meter, who sent men to the shops, and the latter soon discovered the trouble and rectified it promptly by substituting a key of proper proportions.

In another similar case the style of key used was like that at (K), in Fig. 5—an odd pattern—so that when this key dropped out one day and was lost, difficulty was experienced in finding another like it. In fact, the sort of key put in the place of this one was untrue and unsatisfactory, and the service which resulted caused the condemning of the meter which was attached, until the true cause of the unsteady motion and loss of power was located.

"Electric meters are not cleaned often enough," is the cry of nearly all of the manufacturers of these money-saving devices. It is claimed that the meters are put in place by expert workmen from the shops of the makers, and that as soon as these workmen depart, various troubles arise as a result of the lack of care of the new apparatus. It is asserted by the manufacturers of the meters that the meters should be frequently examined for the first year of service until the parts get to running well and freely, after which they need not be examined so often. In fact, I am informed that when the meters have been first installed some of them have given much trouble for the first six months, when the trouble suddenly ceased, and no more difficulty was experienced. In one place, for example, where they had meters in use, some of the wires had to be carried in pipes, and at one elbow the interior pipe was shifted out of position, as in Fig. 6, and contacted at (A) with the wires, causing trouble for a long time, until the true cause was located and the pipe withdrawn to proper position, after which no further annoyance was experienced.

Again in places where chain work is employed in connection with mechanical levers, of the pattern shown in Fig. 7, it often happens that the links get badly worn and become extended. The chain links may wear off, as at (C), in Fig. 8, so that the connecting link is extenuated just so much and the chain lengthened. This may change the conditions of parts which are joined and cause trouble until remedied by taking up the chain or until a new chain is put on. In some instances the links are as badly worn as is shown at (D), Fig. 9.

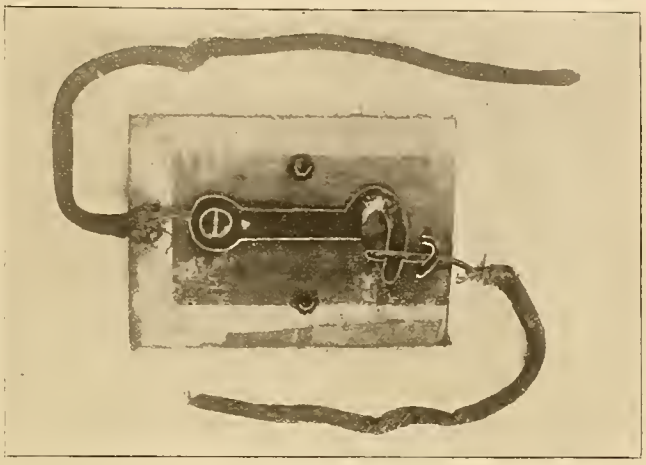
Again, we may find that a chain is linked to a stud, as in Fig. 10, and if this stud is worn into, as at (E), the chain is, of course, let out just that much, and the calculations of the workman who set the parts in the beginning are altered to that extent. The best remedy is to put on a new stud, or if that cannot be done, the chain can be taken up a little and made to do service for a while longer.

I have seen in some places nuts patched and put together as shown in Fig. 11. This ought not to be in these days of cheap bolts and nuts, when it is not necessary to be so saving. Full assortments of nuts, bolts and set-screws should be kept on hand for use in connection with the motors and meters.

To locate an injured jewel in a meter, take the shaft between the thumb and fingers and move gently along. Any roughness may be detected in this way and overcome. If the surface is rough, an injured jewel may result. Take a thin piece of steel and remove any particles of metal left held by the damping magnets. Then wind cotton tape about the commutator, below the brushes, hold the ends in the hands and revolve armature very slowly, thus cleaning both commutator and brushes. Lint must be thoroughly removed from the commutator, and it is best to have a magnifying glass at hand for this purpose. Before finishing the work and closing up the meter, test for speed. This testing is described in circulars of information provided by the makers of the meters. Then comes the sealing up of the meter; this is an important piece of work for meters, and should not be omitted, as I have seen done by some who depend upon the covers only.

A Unique Switch.

Inspectors for municipal authorities or the fire underwriters often unearth extraordinary specimens of electrical apparatus, such as connections, plugs, etc., often the handiwork of janitorial "electricians." Some of these makeshifts are interesting and amusing, if not altogether beautiful or safe. The accompanying picture illustrates a remarkable single-pole switch, discovered by Charles Smith, electrical inspector of the Louisville (Ky.) Board of Fire Underwriters. The switch was located in the basement of a large mercantile establishment, and was used to control a circuit of five 16-candlepower lamps of 52 volts. The exact means of operating this switch and the identity of its self-reliant designer were not disclosed in the report. The accompanying illustration is used by the courtesy of the Electrical Bureau of the National Board of Fire Underwriters of Chicago.



A UNIQUE SWITCH.

Montreal Electric Railway.

The annual meeting of the Montreal Electric Street Railway company was held at Montreal, Que., on November 7th. The president, Hon. L. J. Forget, submitted the annual statement of the company's affairs to the shareholders. The statement showed a net profit in the last year's business of $647,246, as compared with $630,870 for the previous year. Dividends, amounting to 10 per cent., have been paid during the year, totaling the sum of $512,500, and leaving a surplus of $134,746 over the year's operations. The operating expenses show an increase of 1.11 per cent. as compared with last year, due mainly to the more frequent and extended car service demanded by the city, and other increases, including that of wages of employes. The company's rolling stock has been increased during the year by the addition of 56 closed motor cars, 45 open motor cars, seven supply cars, 80 trucks, and the electrical equipments for the cars have been increased by 128 motors and 83 controllers. There are at present six extra-long closed motor cars, mounted on double trucks, under construction, making in all 25 cars of this new type. The system of cast-welding rail joints has been extended. During the last year the company has paid the city of Montreal tax on earnings and other taxes, $168,679. The financial statement shows that the company's total assets amount to $7,570,964, giving a contingent account of $164,333 and a total surplus of $560,318. The gross receipts amounted to $1,769,904. The net income per cent. of capital is 12.63. The number of passengers carried was 43,362,262, or an increase of 3,175,769 persons.

The Moulineaux Traction Station of Paris.

What is probably the largest central station in France is now being equipped at Moulineaux, Paris, by the General Traction company and the French Westinghouse company. Although, in comparison with some American stations, its output is considerably surpassed, the new station stands first, or nearly first, in Europe. The equipment is at present only partially completed, and a large portion of its output is temporarily used for other than permanent purposes.

The electric lines of the Western Railway company of France, which owns the station, are not yet in operation, but the station is well located with respect to future requirements. It stands on the south side of the Seine, and about 11 miles from the Invalides station, to which the company's trains will eventually be run. Much of the line is to be underground.

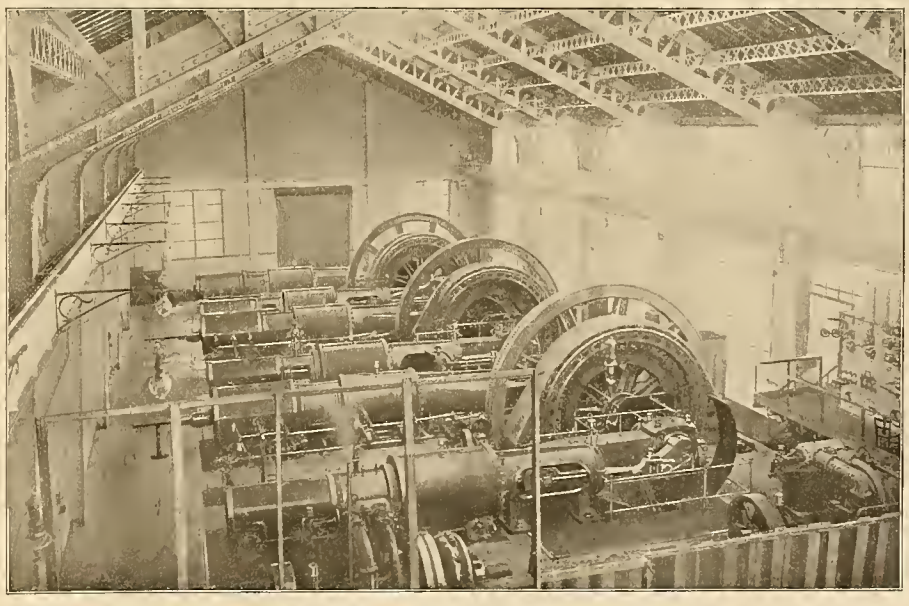
The engine and boiler room, built side by side, measure 370 feet in length. In the latter is a battery of 27 semi-tubular boilers, each having a heating surface of 235 square meters.

The power equipment will comprise nine direct-coupled generating units and two exciters. Six of the engines, as shown in the accompanying illustration of the interior of the power house, are of the horizontal triple-expansion type, with Corliss valves, and were built by Dujardin & Co. of Lille. Each engine is capable of generating 1,500 horsepower, although designed for 1,200 horsepower. The Garnier firm is installing three more machines of the same type. Thus the total capacity of the station will be 13,500 horsepower. Each engine is coupled to a three-phase, 800-kilowatt Westinghouse generator, having a pressure of 5,000 volts, with a frequency of 25 cycles. The revolving fields of these alternators have 38 poles, and weigh 50 tons. Each of the two exciting units is a direct-coupled Westinghouse engine and generator, giving a current of 1,087 amperes at 185 volts.

The switchboard, which is of the Westinghouse type, is an elaborate structure of white marble, one section being for the alternators, the other for the exciters. The arrangement is such as to permit the exciters to be run in parallel. In the pumping station of the plant are centrifugal pumps, operated by Westinghouse motors, taking water directly from the river.

The larger portion of the current output has been used for the two transportation systems within the exposition grounds, the overhead electric railway and the moving platform. The remainder of the current is at present absorbed by the electric tramways of the Ouest-Parisien company. The high-tension alternating current from the main station is converted to 500-volt, direct current in three substations at Moulineaux, Vougirard and Bagneux, and thence is distributed to underground feeders or trolley wires. Within the city limits this company is using the Diatto surface-contact system.

When the Moulineaux station is complete, says the Tramway and Railway World of London, its most important service will be to operate the suburban line of the Chemin de Fer de l'Ouest, between Versailles and the Invalides station, 11.5 miles in length. Trains will be run by Westinghouse electric locomotives, equipped with four 150-horsepower motors each.



MOULINEAUX TRACTION STATION OF PARIS.—PART OF ENGINE ROOM.

Western Electrician.

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All engineers, technical writers and others who strive to keep abreast of the industrial and technical advance of the world have felt the need of a good polyglot technical dictionary. Such a dictionary should be available, and as the work of preparing it would involve much labor and considerable expense, it might well be undertaken by some of the great engineering societies or by several of them in collaboration. The Society of German Engineers of Berlin (Verein Deutscher Ingenieure) has interested itself in the project of issuing a technical dictionary in German, English and French, and has invited the co-operation of similar organizations. The plan is most praiseworthy, and we hope that it will be carried into execution and that American co-operation will not be lacking.

Mr. Villard, the recently deceased financier, was a man who made warm friends and bitter enemies in his eventful career. A man of great force of character, entertaining projects of vast magnitude, he was accused of being ruthless to those who opposed the realization of his ambitions. On the other hand, he was devoted to his friends, and among the latter were many electrical men, who realized and appreciated the great assistance rendered by Mr. Villard to the industry when it was really "in its infancy." Gifted with keen foresight, Mr. Villard, early in the '80's, anticipated the great development of applied electricity which the world has since seen, and he promoted the young industry with his means and with his influence. This was a great service and one that should not be lightly passed over in making an estimate of the character of this remarkable man.

A remarkable book has just been published in Germany. Its author is Dr. Vosberg-Rekow, president of the German Bureau for the Preparation of Commercial Treaties. Dr. Vosberg-Rekow has traveled in the United States and is familiar with industrial conditions here. His book treats of "The Commercial Treaties of 1903," and in it he reviews the competitive industrial relations of the great nations with signal ability and candor. He points out the strong industrial position of the United States with startling directness and earnestness, and advocates, for Germany, a close trade union with Russia, which may furnish the indispensable raw materials and also reimburse Germany for the loss of the American and other foreign markets.

Dr. Vosberg-Rekow says that the United States, as far as its strength and characteristics are concerned, has very little in common with any other nation, including Great Britain and Russia, the two others of the triumvirate of world powers. The Union forms a great economic realm which possesses inherently all organic conditions for economic activity and prosperity, and is sufficiently developed to feed plentifully its population, which latter is ample in numbers and in culture to make its bountiful resources available. The influence going out from such a people cannot be otherwise than powerful in a high degree. "Scarcely has this immense country been brought under cultivation," says the author, "before its influence is felt across the oceans. Europe, with her old-established industries, is so hard pushed by the young American competition that the necessity of uniting in a common customs league against the bold intruder has become a matter of serious consideration. Many European lines of manufacture—and by no means the least important—have severely suffered and are still suffering. And while Europe year after year takes more goods from the United States, the latter's imports from Europe diminish more and more." Last year Germany, for instance, imported from the United States to the value of 907,200,000 marks and exported thereto 377,600,000 marks. However, to quote again, "Our chief danger lies in the probable eventuality that America's wholesale production of manufactured articles will drive us out of the foreign markets by underbidding us in price. In short, the Americans are the sole commercial-political opponents whom we must earnestly dread. Russia will remain a profitable customer to us in the future; with Great Britain, we are united by bonds of common interests; the United States is—in an economical sense—our enemy."

It is interesting and instructive to note the causes assigned for this state of affairs. "Germany's industrial advancement is principally due to the thoroughness of her technical education. It is strengthened by the continuous substituting of machinery and machine tools for hand labor. Still, in this respect the English industry in some branches is ahead of us. It is worthy of note that in this evolution, too, the United States has the foremost place and has made gigantic strides, not only in applying machine tools, but in inventing and manufacturing them; so that to-day she supplies us. This signalizes in an extraordinary degree American intelligence. Thus, the Americans, though wanting our superior technical education, thanks to their practical eye, improve upon our methods and apparatus. Theirs is rather the activity of an experimentalist than that of a trained craftsman, but a clever faiseur, if he but have assurance and luck, may distance the educated master. The Americans have no thorough education; nor do they possess a modern industrial system as we Europeans understand the term. The American applies himself to a single branch or to a specialty, with utter disregard of European methods and their results; he devotes to his work an amount of energy which stupefies Europeans, and, for a while, he succeeds in driving us out of the line of articles on which he has centered his energy. Against such peculiar activity a general trade policy is quite ineffectual; we must put ourselves in condition to counteract this artificially forced growth of specialized industry."

This is seeing ourselves as others see us in a picture made in strong outlines and with vivid colors. American competition is pestiferous; it is without precedent or rule; but the practical intelligence and extraordinary energy shown are marvelous. Such seem to be the conclusions of Dr. Vosberg-Rekow's rather hopeless review of the situation as it affects Germany. The American mechanic, or faiseur, receives back-handed praise, but he knows his faults, or many of them, and, if the present movement toward more exact and scientific training in this country is any indication, he is striving to correct them.

Massachusetts has a state commission that seeks to regulate the public relations of its gas and electric-light companies in a manner satisfactory to both buyer and seller. It is now proposed to establish a similar body in the state of Illinois, although the project has gone no farther than the introduction in the City Council of Chicago of a resolution requesting the Legislature to enact the necessary statute. Alderman Butler, the sponsor of the project, says that such a law would prove a panacea for all the complaints about the high price of gas and electric lighting. He would have the governor appoint three citizens as gas and electric-light commissioners at a salary of $5,000 a year each. The commissioners must not be connected in any way with any gas companies or own any gas or electric-light stock. A secretary, at $4,000 a year, is to be appointed, and the office of the commission would be at Springfield. Each company would be required to send in a report annually as to its business. The commissioners are to have supervision over the companies and are to test the quality of gas or electric lights on the complaint of 20 customers. The mayor of any city or 20 customers may make complaint in the name of the people against the excessive price of gas or electric lights. A public hearing will be ordered by the commissioners, and the courts will be asked to enforce the commission's orders relating to the lowering of the price of gas. The right of another company to enter the field is left to the city councils or boards of trustees for decision. The annual report of each company shall set forth the indebtedness and financial standing of the company, with an itemized statement of its income and expenses, its dividends paid or declared, and the amount of the salaries paid its officials. It is specified that no company may transfer its property by lease or sale to another without the consent of the Legislature, and no company may issue stock at less than par value and not for an amount exceeding its capital.

Some of the provisions of the proposed Illinois law seem to be inequitable. For instance, if a lighting company is required to submit to state regulation of its prices, it is but just that the state should not only fix a rate giving a fair return on the capital invested, with due regard for depreciation, but should also give the company exclusive privileges in its territory. If the state-supervised company is giving good service at an equitable price, why should it not be protected against competition? Certainly, there are two sides to the story, and the companies should be maintained in their rights. The commission idea may be worthy of consideration, but the arrangement must not be a jug-handled one and must be entirely divorced from politics.

New York Automobile Show.

The automobile exhibition held last week in Madison Square Garden, New York, was a large and satisfactory display. It was the first annual exhibit held under the auspices of the Automobile Club of America, and was a success financially and socially, as well as technically.

All told, there were more than 70 exhibitors, showing about 300 styles of motor vehicles, with a total value of nearly $500,000. Bicycles, tricycles, quadricycles, runabouts, stanhopes, victorias, landaus, surreys, cabriolets, coaches, cabs, omnibuses, delivery wagons, trucks, racing machines and some nondescripts were included. The biggest machine shown was a 20-horsepower steam omnibus capable of carrying 18 passengers. A motor bicycle of 125 pounds, having a gasoline motor of 2¼ horsepower, was the smallest machine exhibited. These two vehicles represented respectively the most expensive and the cheapest machines in the show, the bus being worth $4,000, the bicycle $280.

One of the novelties was a tire that is pneumatic and yet partly solid by reason of a triangle of rubber inside that projects upward from the thread and fits into a corresponding depression or groove in a piece of solid rubber that extends downward from the inner side. The air fills two apertures at the sides, and in case of puncture these inner extensions made on the tongue-and-groove plan, come together and afford what is practically a "cussion tire."

A new thing in the electric line shown was a "quarter-in-the-slot" charging apparatus for electric automobiles. This was a ponderous piece of mechanism, of more than half a ton, six or seven feet long, 3½ feet tall and equally wide. The engine and dynamo formed one part and the delivery mechanism, which is similar to other slot machines, constituted the second part of the machine.

A track 20 feet wide and banked at the turns ran around the main part of the floor, and on this the contests between the various vehicles were held. Much amusement was furnished by the contests, if not much valuable scientific data. The constant activity on the track had a strange fascination for the public, many spectators watching the passing machines for hours together. Though often traveling three abreast on the 20-foot track, scarcely a collision occurred during the exhibit.

The obstacle contest for gasoline vehicles was won by F. W. Walsh, whose best time in two trials was 36 3-5 seconds. Walsh won the braking contest, also covering 150 feet in 7 3-5 seconds, and coming to a full stop in 16 feet nine inches from the place where the word was given.

The inclined runway on the tower was 200 feet long and 53 feet above the ground at the point where it abuts the tower. It was eight feet wide and built of planks laid on scantling work, and was divided into four portions by platforms, each division having a different grade, the first a 20 per cent., the second a 35 per cent., the third a 43½ per cent. and the last a 45 per cent. grade. The hill-climbing exhibitions here seemed to be the sensational feature of the show. The first record time for the trip of 200 feet was broken by a run up the first three grades in 14 seconds. The time made does not properly represent the rate of speed, because of the pauses on the landings. The climbing up the steepest grade, 45 per cent., was done at the rate of about 10 miles an hour. The braking competition was won by an electric machine, with a gasoline carriage second and a steam vehicle third. The best time and distance of sliding in each case were: 6 2-5 seconds and 14 feet 6 inches; 5 3-5 seconds and 17 feet one-half an inch, and 5 1-5 seconds and 20 feet 4½ inches.

One of the pleasing incidents of the show was the midnight supper given in the concert hall of the Garden by the Automobile Club to the manufacturers on November 9th. Among those at the speakers' table were Cornelius J. Field, Professor R. H. Thurston, General George Moore Smith, Albert C. Bostwick, George F. Chamberlin, Arthur J. Eddy, David H. Morris, Jefferson Seligman and E. E. Schwarzkopf. On November 10th, the last day of the exhibition, a meeting was held, at the Garden, of the automobile manufacturers in attendance, with the idea of forming an organization of the industry. John Brisben Walker was elected temporary chairman, and E. R. Estep of Chicago, temporary secretary. Not only the manufacturers, but members of the Automobile Club were invited to take part in the general discussion which followed. All were enthusiastic about the condition of the trade. It was proposed that all manufacturers should formally agree not to patronize automobile shows after a given date. The experience of bicycle makers shows that such exhibits, frequently recurring, threaten to prove ruinous to smaller firms. In lieu of such shows a plan was formulated to start a train of automobiles around the country next March. The train would visit all cities of consequence and remain from one to three or four days in each, in order that the natives might inspect the automobiles and have them explained to them. It would be a peripatetic show that should cover the whole country and it is thought, accomplish more with no greater expense than going into one show after another.

The Alpena and Western Railway company of Alpena, Mich., a corporation having a capital stock of $1,000,000, has been organized to build a railroad from Alpena to Frankfort. It will touch the towns of Hillman, Atlanta, Haylord and Mancelona, Mich.

Death of Henry Villard.

Henry Villard, railroad magnate and financier, died at his summer home, Thornwood Park, near Dobbs Ferry, N. Y., on the morning of November 12th. He had been ill some time and a cold contracted recently hastened his end. Mr. Villard was 65 years of age and was a native of Bavaria. He came to this country at the age of 18 and started his career as a newspaper reporter. For several years he engaged in newspaper work and later turned his attention to financial matters. He put the Northern Pacific Railroad company on its feet and was elected its president.

Mr. Villard was a daring financier, and he became interested in electrical undertakings at an early stage in their development. He was one of the original stockholders of the Edison Electric Light company which was formed to provide Mr. Edison with funds for his earliest experiments in the electric light. This connection of Mr. Villard with the Edison interests was made between 1876 and 1878. The deceased was also a pioneer in the financial development of electric traction. As far back as 1881 he advanced money for Mr. Edison's early experimental work in electric railways at Menlo Park.

In 1890, in connection with the Deutsche Bank, Siemens & Halske and the Allgemeine Elektricitäts Gesellschaft of Berlin and the Drexel-Morgan company of New York, Mr. Villard formed a syndicate

HENRY VILLARD.

which purchased the Edison Electric Light company (the company holding Mr. Edison's patents) of New York, the Edison Machine Works of Schenectady, the Edison Lamp company of East Newark, N. J., and the Bergmann company of New York. All of these companies, excepting the Edison Electric Light company, were purchased from Mr. Edison and his associates. Based on the properties mentioned, the Edison General Electric company was formed, with Mr. Villard as its president. Mr. J. H. Herrick was the first vice-president of the company and Mr. Samuel Insull was the second vice-president, in charge of the manufacturing and selling departments. At the time that the Edison General and the Thomson-Houston companies were combined to form the present General Electric company (1892), Mr. Villard retired from active connection with the electrical business.

At the time of his death Mr. Villard was a large stockholder in many electrical properties throughout the country. He was one of the largest and earliest investors in the first Edison electrical illuminating companies formed in the East, and from the start foresaw and predicted the great possibilities of the industry. He is given credit as being the first man to realize the advantage of the combination of electric-lighting and electric street-railway properties in large cities under one corporate management. His first efforts in this direction were in several cities in the far West, particularly on the Pacific coast. The most notable case of Mr. Villard's work in this direction was the uniting of the lighting and traction interests in Milwaukee. This combination was financiered by Mr. Villard, in conjunction with other capitalists.

Mr. Samuel Insull, president of the Chicago Edison company, who enjoyed an early and extended acquaintance with Mr. Villard, spoke as follows to a representative of the Western Electrician in relation to Mr. Villard's work: "Among financiers, the development of the electrical industry, starting with the installation of the first Edison central station, probably owes more to Mr. Villard, with his foresight and his courage in risking his money, than to any other one man. If to Edison as an inventor should be given the credit of foreseeing the great possibilities of electric lighting and electrical power transmission, then to Mr. Villard, as a financier, should be given a large share of the credit for the development of the electrical industry."

The accompanying portrait of Mr. Villard is a reproduction of a drawing made for the Chicago Tribune.

BOOK TABLE.

THE THEORY AND CALCULATION OF ALTERNATING-CURRENT PHENOMENA. By Charles Proteus Steinmetz. New York: Electrical World and Engineer. 1900. Pp., 525, six by nine inches, with 210 illustrations. (Third edition.) Price, $4.

The first edition of this work, which appeared in 1897, took rank at once as a standard in electrical literature, fully worthy of the reputation of its author among men of science. Perhaps no book has been written in any language dealing in so thorough and logical a method with the phenomena of alternating currents and their application to the design of machinery.

In the treatment of the subject in the first edition common algebra and trigonometry were for the most part used. In the present volume a number of new chapters have been added, such as those on vector representation of double-frequency quantities, such as power and torque, and on symbolic representation of general alternating waves. Many chapters have been in part rewritten and enlarged, as those on the topographical method, on frequency converters and induction machines, etc. The work now contains the latest knowledge relating to alternating-current phenomena as applied to engineering, much of which is original with the author, and appears for the first time in book form. While the book is necessarily of a rather abstruse character and a considerable part is necessarily devoted to the application of complex imaginary quantities, the graphical method receives a clear and simple treatment, and there is much in the book of profit for the less-advanced student of engineering.

DYNAMOMETERS AND THE MEASUREMENT OF POWER: A Treatise on the Construction and Application of Dynamometers. By John J. Flather. New York: John Wiley & Sons. 1900. Pp., x., 394, 7¼ by 5 inches, with 116 illustrations. (Second edition, revised and enlarged.) Price, $3.

Professor J. J. Flather is a recognized authority on power measurements and the use of dynamometers, and a work from his pen on this subject would naturally be expected to be one of standard merit. This is true of the book in question. The first edition, published in 1892, has been thoroughly revised and five new chapters have been added. As stated in the preface, the aim has been to present in convenient form, for the use of technical students and engineers, a description of the construction and principles of action of the various types of dynamometers employed in the measurement of power. That this aim has been accomplished, is shown by a perusal of the book.

In the first chapter the author treats in general terms of the determination of driving power, and then he proceeds to discuss friction brakes, absorption dynamometers and transmission dynamometers. The standard types of apparatus, including some of Professor Flather's own invention, are described and many of them are illustrated by diagrams and cuts. Chapter V., which is devoted to the measurement of waterpower, has been considerably enlarged by the addition of new material on the Venturi meter and meter testing.

The next five chapters are new ones, the first four treating of the measurement of electrical power. A general consideration of the subject is given, together with a discussion of electrical measuring instruments and methods in use for determining the power and efficiency of electric motors for both direct and alternating current. The testing of dynamos has not been taken up, as the author deems a general treatment of this subject beyond the scope and purpose of the work.

The new chapter on "Power Required to Drive Machinery" is one of the most valuable parts of the whole book and gives data that should be in the hands of every engineer, electrical as well as mechanical. Very extensive and valuable tables are given, which contain records compiled from tests of horsepower required to drive all ordinary machine-shop tools, cranes, elevators and wood-working machinery of various kinds and under different conditions. Most of the observations were obtained from machines driven either individually or collectively by electric motors. The last chapter gives an analysis of the power required to drive machine lathes. The entire book has been carefully edited and should prove valuable to the student as a text-book and to the engineer and general reader as a reference work.

The Austin Rapid Transit company took out a permit recently to build an $18,000 power house, to be built on West Sixth street, Austin, Texas.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

The Wisconsin Telephone company has moved its office at Marinette, Wis., to quarters in the Lewis block. New switchboards have been put in.

The Rock County Telephone company will construct a farmers' line to Emerald Grove, via Johnstown Center. Twenty farmers have signed contracts for service, to last five years.

F. A. Hall has leased the telephone line between Big Timber and Independence, Mont. He will improve it and continue the line to Livingston.

The Iowa Telephone company at Fort Dodge, Iowa, contemplates enlarging its office and rearranging the equipment.

President E. H. Martin of the Martin Telephone company, Webster City, Iowa, is having an automobile built for him. He proposes to use it in inspecting the lines of the company.

A line between Malcom and Sheridan, Iowa, is in operation.

The Iowa Telephone company has completed an extension to Morning Sun, Iowa.

A line has been completed from Central City to Troy Mills, Iowa.

The Waushara Telephone company of Berlin, Wis., has just completed an exchange for Wautoma, Wis.

A new switchboard will be put in at once for the exchange at Dunlap, Iowa.

The New State Telegraph and Telephone company has extended a line to Breda, Mount Carmel, Maple River Junction, Arcadia, Glidden, Carroll and Scranton.

The Northwestern Telephone Exchange company of St. Paul has sent a check for $25 to the firemen's relief fund.

The Northwestern Telephone Exchange company received a great many compliments on the expert way in which the election returns were handled in the Twin Cities. In Minneapolis, the company had over 60 extra employes on wires receiving and transmitting returns. Six hundred towns were furnished with the information. The St. Paul office had 65 extra employes at work, taking and tabulating returns. The management has worked hard to perfect the system of taking returns by telephone, and certainly scored a great success.

A local exchange has lately been established at Harrington, Wash.

The Cedar Valley Telephone company of Waterloo, Iowa, is receiving materials for the construction of its subway system.

The Blue Earth Valley Telephone Exchange company has been granted a franchise at Elmore, Minn., for a local exchange.

The Wisconsin Telephone company is constructing a long-distance line from La Crosse to Eau Claire.

James T. Quinlan, manager of the Wisconsin Telephone company's office at Madison, Wis., was cleaning a revolver, when the weapon was accidentally discharged. The bullet entered his side. His injuries are not serious.

The Wisconsin Telephone company will defer the erection of the proposed new building at Oshkosh, Wis., until another season.

Four men, employes of the Wisconsin Telephone company at Oshkosh, Wis., were recently arrested on a charge of grand larceny of 500 pounds of wire and lead pipe. The local management is inclined to refrain from prosecuting the men and believes them to be innocent of wrong intention. The wire was some that was secured when the company absorbed the Oshkosh Northwestern system. The wire laid in the basement in a pile of rubbish for some time, as useless. Finally the men sold it to a junk shop, and it was sent to Milwaukee, where the detectives got track of it and traced it back to the sellers. The officials of the company at Milwaukee felt inclined to make an example of the men, as the company has suffered greatly from the depredations of wire thieves. The local officials have sent an explanation of the case to the head office, and hope that the men will not be prosecuted.

The Wisconsin Telephone company has completed rebuilding its exchange at Bayfield, Wis.

The Nebraska Telephone company has extended its wires to Eagle, Neb. R.

Ohio Notes.

At a meeting of the stockholders of the Millersburg, Wooster and Orrville Telephone company, held some days ago, the following-named directors were chosen: George Adams, John E. Koch, M. M. Herron, all of Millersburg; L. P. Oliher and J. R. Zimmerman, Wooster; D. F. Griffith, Orrville; Frank L. Beam, Columbus; Dwight E. Sapp and John M. Ewalt, Mt. Vernon. The officers chosen are as follows: President, George Adams; vice-president, Frank L. Beam; secretary, B. C. Sill; treasurer, John E. Koch; general manager, M. M. Herron. The meeting was held at the office in Millersburg.

The Elyria Telephone company, Elyria, Ohio, has declared a dividend of 1½ per cent. on its stock. This company now has 724 instruments in use.

It is reported that Judge B. M. Critchfield is arranging to build a telephone system at Johnstown, Ohio, similar to the one he now has in operation at Sunbury.

The case of Frank Robecker against the Columbiana County Telephone company, brought in the courts at Lisbon, has been dismissed. The plaintiff asked $8,000 damages for an alleged injury, but it was shown that the company was not in existence at the time the man was hurt, the lines being the property of private individuals, who afterward transferred them to the company.

The war between the Bell Telephone company and the promoters of the Citizens' Telephone company continues at Canton. The Bell people gave an entertainment the last day of last month, when refreshments were served and a literary programme presented.

The Star Telephone company has been granted a franchise by the City Council of Mansfield, Ohio. This makes three companies to operate in that city, viz., the Bell, the United States and the Star.

The town council of Xenia, Ohio, has granted a 50-year franchise to the Citizens' Telephone company of that place.

W. D. Crawford, who has had the management of the Central Union Telephone company's office at Fostoria, has been transferred to a similar place at Ashtabula.

In Common Pleas Court, at Canton, Judge Taylor on Friday granted a temporary injunction against the Columbiana County Telephone company, restraining it from constructing a plant in Alliance, on the grounds that the ordinance giving the company a franchise had not been passed in the regular way. It is likely that a new ordinance will be prepared and placed before the council within a short time. The company had commenced the construction of the lines.

Miss Courtney McArter has been made manager of the office of the Columbiana County Telephone company at East Palestine. O. M. C.

Virginia and the Carolinas.

It is stated that the new Richmond (Va.) Telephone company will likely inspire the fight against the granting of a franchise to the Bell company. A member of the new company states that its franchise was obtained after the Bell had been ordered to vacate and that it was tacitly understood that the Bell company would not be granted a franchise. The Bell company will nevertheless ask for a franchise in Richmond.

The South Carolina Long-Distance Telephone company, with a capital of half a million, has been chartered at Columbia, S. C., by Samuel L. Miller of that city and others. It is said to be the purpose of the new company to control the Independent telephone lines of the state.

The Wilson (N. C.) and Carolina Telephone and Telegraph company is still extending its system. The company owns about 200 miles of toll lines at present. Howard F. Jones is general manager.

The Albemarle (N. C.) Telephone company will construct a telephone system at Albemarle. Supplies have already been purchased.

The East Tennessee Telephone company, with an exchange at Chattanooga, Tenn., will extend its lines into Georgia. The Cumberland Telephone company, which has purchased the above lines, will make the improvements and extensions. D. H. L.

Protective Measures in Kentucky.

The Independent telephone companies of Kentucky have come to see the urgent necessity of making some arrangements for a long-distance service that will reach all the larger cities and towns of the state and toward this end they are working now. When the Kentucky Telephone association was formed some time ago, it was thought that the matter had been gotten into such shape as to insure the success of the proposition, but a short time after this the Paris company sold out to the Bell people, thus breaking the chain of towns that had been formed. It will likely be necessary to establish another Independent company in that city before a satisfactory arrangement can now be made. To prevent another break of this kind, however, the members have been asked to sign an agreement that they will not sell to any other company and 23 of the local companies have agreed to this, as follows: Fayette of Lexington, Cynthiana, Frankfort, Georgetown, Winchester, Old Kentucky, Maysville, Crab Orchard, Lancaster, Somerset, Winchester and Lexington, Citizens' of Newport, Louisville Home, Lawrenceburg, Houstonville, Green River Valley, Nicholasville, Danville, Williamstown, Owenton, Lebanon, Louisville, and Lexington and Stanford. As soon as these towns are connected lines will be run into cities of other states and thus long-distance connections of importance will be established. It is probable that Cincinnati will be the first town outside of the state to be connected with this system.

It is announced from Rome that the Italian government has established telephone wires along the Italian Alps, with the object of connecting Rome with Paris. On the Italian Alps alone the supports for the line cost $150,000. Owing to the nature of the country, great difficulties have been encountered, but it is expected that the line will be in working order by next summer.

GENERAL TELEPHONE NEWS.

The Texas Telephone company of Brenham, Texas, will increase its capital from $5,000 to $10,000.

The Bell Telephone company of Wheeling, W. Va., will expend $50,000 in improvements.

The Tennessee River Telephone company has been organized at Birchwood, Tenn., with B. L. Tolley, president, and has commenced construction of its system. T. J. Tolley has the contract.

The linemen, inside men and cable men of the Southwestern Telegraph and Telephone company of Galveston, Texas, went on strike last week. They demand an increased scale of wages. Reconstruction of the telephone system has been suspended. Manager Snelling says the scale demanded is the same which has been paid there, with the exception of inside men, who have heretofore received $2.25 a day and who now demand $3.

A reduced scale of telephone charges is shortly to be introduced in London. Alternative methods of rating will be provided. In the one case a lump sum may be paid annually for the inclusive use of the whole metropolitan system. This rental will not be greater than £10, and may be rather less. Twenty pounds was formerly charged. The "toll service" will probably be the more popular plan. Under this method the subscriber pays an initial sum—about £3—and a penny for each call.

The Central Union Telephone company is to absorb the Iowa Telephone company. Stockholders of the latter corporation have agreed to exchange their holdings for stock in the Central Union company. The total outstanding capital stock of the Iowa company is $769,900; the majority of this is owned by the American Telephone and Telegraph company and the Central Union. The two companies were closely affiliated before, as both are controlled by the Bell interests. The Iowa company has $200,000 of bonds outstanding.

The proposition of the directors of the City and Suburban Telegraph association of Cincinnati, Ohio, to increase the capital stock of the company from $2,500,000 to $4,000,000, has been practically unanimously ratified by the stockholders. The larger proportion of the new stock will be issued as a stock dividend on the basis of two shares for every five held. This will require $990,000 worth of the new stock. The balance will be held in the treasury. It is stated that the rate of dividend will be reduced with the increase of capital.

It is reported that Budapest has a news telephone system which keeps its 6,000 subscribers supplied with the latest news. The service has a main wire 168 miles in length, and it is connected with private houses and various public resorts. From 7:30 in the morning until 9:30 in the evening 28 editions of news, it is said, are spoken into the transmitter by 10 men possessing loud, clear voices, working in shifts of two. The news is classified and given in accordance with a regular programme, and the service has been eminently successful.

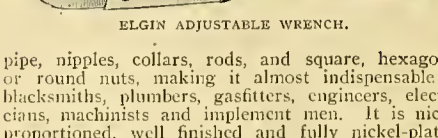
MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing company of Chicago has purchased property, 75 by 156 feet, in Clinton street, south of Jackson boulevard, from C. T. Yerkes. The amount named in the deed, dated October 15th, is $19,000.

The Western Telephone Construction company, Chicago, has secured the contract to furnish the Corsicana (Texas) Telephone company with a 1,200-capacity central-battery telephone equipment. The Western company claims to have sold more multiple, central-battery equipments during the last six months than any other manufacturer. Owing to greatly increased business this company has been obliged to increase its factory floor space 10,000 square feet.

Elgin Adjustable Wrench.

The Elgin adjustable wrench, handled by the Western Electric company of Chicago, is said to be one of the handiest wrenches ever put on the market. It is easily and accurately adjusted, and has an exceedingly wide range of usefulness. It will hold



ELGIN ADJUSTABLE WRENCH.

pipe, nipples, collars, rods, and square, hexagonal or round nuts, making it almost indispensable to blacksmiths, plumbers, gasfitters, engineers, electricians, machinists and implement men. It is nicely proportioned, well finished and fully nickel-plated, and is made of steel with hardened jaws. It is seven inches long and weighs 10 ounces. The accompanying illustration gives a good idea of the construction of the wrench.

Electrical Booth at Madison Street Fair.

During the recent carnival and street fair in Madison, Wis., the electrical booth was by far the most prominent building erected. The building, which is illustrated herewith, was occupied jointly by the Northern Electrical Manufacturing company, the Electrical Supply company and the Standard Telephone and Electric company, all of Madison. The Madison Democrat of October 20th referred to the electrical booth in particular as follows: "The electrical building will long be remembered for its beauty. It was built by the Standard Telephone and Electric company, which occupied the north wing, the Northern Electrical Manufacturing company, the center of the building, and the Electrical Supply company, the south wing. The Northern company furnished the motor that supplied power to a generator, from which was obtained current for lighting the 265 incandescent and the two arc lamps that were used for the booth."

ELECTRICAL BOOTH AT MADISON STREET FAIR.

Exhibit of Standard Telephone and Electric Company.

An accompanying illustration shows the exhibit of the Standard Telephone and Electric company. The apparatus exhibited included the company's new style of switchboard, its popular cabinet set, several different styles of wall and portable telephone instruments and a full line of general apparatus. The exhibit of the three companies, it is said, was more instructive and entertaining, because of its practical and electrical interests, than any other of the many fine exhibits made by the local merchants. The Standard company was awarded a bronze medal for its exhibit at the Paris Exposition.

Crown Rail Bond.

The accompanying illustration shows the Crown rail bond manufactured by the Washburn & Moen department of the American Steel and Wire company. Simplicity of application is one of the features accounting largely for the assertion made by the company that more Crown bonds are in use on electric roads than bonds of all other patterns combined. The adoption of this bond for electric railways is becoming widespread, as the economy effected on the score of labor alone for every single mile of bonding is an item of considerable importance, greatly reducing the actual cost of construction, as the work of applying the bond is all done on one side of the rail, only one man being required to handle and properly attach the bond. The company says that the copper of which these bonds are made is of standard conductivity. The bonds are furnished in every style, solid or flexible, for bonding over or under the fishplates, under the rails or for cross-bonding. The company will be glad to extend the services of its expert electrical engineer to facilitate by suggestions the settlement of all questions regarding bonding, line wire and feeders, whether aerial, underground or submarine, and for other electrical work for lighting and power plants. A booklet on Crown bonds will be forwarded upon application to the American Steel and Wire company, at either the Worcester, New York or Chicago office.

CROWN RAIL BOND.

In a letter to the street-railway commission recently G. E. Clark of South Chicago proposed the removal of street-railway tracks from the public thoroughfares. He suggests that the city lay broad, flat tracks, level with the surface of the street, which should be paved with asphalt or some better material, and that all vehicles for carrying passengers be licensed, the fees to be used to keep the streets in repair. Mr. Clark's plan would base the license on the weight and carrying capacity of the vehicle.

Systems and Apparatus for Light and Power Distribution.[1]

By C. P. Steinmetz.

Part II.

Where the main station is near the center of distribution and continuous current supplied therefrom, either a converter sub-station may be located in the main generating station, or all or a number of the generators built as double-current machines, that is, machines producing alternating, as well as continuous, current.

Double-current generators are limited to those sizes and speeds and number of poles, where simultaneously a good alternating and a good continuous-current generator can be designed. Thus, in most cases, they are not feasible for anything above 25 cycles.

They require step-up transformers.

As a rule, if not a very large part of the power is used immediately as continuous current, ordinary alternators are preferable.

The double-current generator is specially suited in a system of supply from a number of continuous-current stations, of which one predominates in size and economy of operation. By thus installing double-current generators in this station, they can be used during the peak of the load to supply continuous current, while during light load the smaller stations may be altogether shut down and power supplied to them from the double-current generators, thereby maintaining more constant load on the main station.

In such cases inverted converters can be used also to change the continuous-current power to alternating, for transmission.

When operating rotary converters inverted, that is, changing from continuous to alternating current, precautions have to be taken to keep them from racing. In the inverted converter, as in the continuous-current motor, the speed depends upon the field strength. Lagging current, however, demagnetizes the field, and thus, if in an inverted converter the current begins to lag (as, for instance, by starting a converter from it), its speed increases, and may increase so rapidly that it cannot be controlled by the field rheostat.

Obviously, when running in multiple with alternating-current generators, this danger does not exist, but the inverted converter speed is held by the generator, provided the latter is large enough not to be accelerated by the inverted converter.

While similar to the converters in their appearance, the double-current generators differ essentially therefrom in their internal constants. In the double-current generator alternating and continuous current flow in the same direction and the armature reaction and consequent field distortion are due to the sum of the two currents. Thus, the cross-section of the armature conductor must be large and the armature reaction moderate. In the converter the actual armature current is the difference between alternating and continuous current, and the armature reactions neutralize; thus a very small conductor section is used to secure best commutation and very high nominal armature reaction to secure high output and stability. A double-current generator used as converter is more liable to hunting and a converter as double-current generator to sparking and heating.

It is essential, for the efficiency and reliability of operation of such a system, to choose the simplest possible arrangement and the least number of transformations of power. Wherever, therefore, the substation can be reached with 6,000 or 10,000 volts, a direct generation of the transmission voltage is preferable to the use of the step-up transformers. The 6,000 or 10,000-volt generator is just as reliable and efficient as a low-voltage machine.

One important feature to be considered in the design of the generating station is, nowhere to bring the total power, or even a very large part of it, close together. Thus, the cables leading from the generators to the bus-bars and the feeders issuing from the bus-bars should be separated in a number of different conduits as far apart from each other as possible. We must consider that at the voltages and powers existing in such stations a short-circuit in a cable is liable to destroy or short-circuit any cable within 10 feet distance, or more. In a lesser degree the same applies to the sub-station.

The high-voltage conductors, bus-bars, etc., should preferably be kept away from the operating switchboard altogether, the instruments supplied by transformers, and all switches operated by relays, to secure safety to life.

A further important feature, in stations where the power is transmitted by cables, is the protection against excessive rise of voltage, as caused by resonance phenomena in making and breaking circuit, etc., the more as insufficient protection of the cable usually does not make itself felt immediately, but shows as a rapid deterioration of the cable, breakdowns beginning to occur after some months and then appearing with increasing frequency.

Where overhead lines and cables are used in the same system, lightning protection must be provided wherever a cable joins an overhead line, and every such place constitutes a weak point of the system.

In the consumer's circuits the power is used:

(A) As continuous-current, three-wire system with about 250 volts between the outside conductors, for the central part of the distribution.

(B) As alternating current for outlying districts and pioneer work.

(C) As constant current, either continuous or alternating, for series arc lighting.

(A) To change the three-phase power received from the generating station to 250-volt, constant-potential, continuous current, the rotary converter is the most suitable apparatus. It requires step-down transformers. In the chain of generator, transmission line, transformer and converter, the transformer is the weakest link regarding overload capacity, since at overloads the temperature of the transformer rises at a much faster rate than in the converter or the generator. In all these apparatus the losses consist of two parts—a constant loss, practically independent of the load, as hysteresis, friction, shunt-field excitation, and a loss increasing with the square of the load: I^2R in the main conductors and brushes. Obviously, where the latter loss is small and the main conductors so imbedded in the iron as to transfer their heat rapidly thereto, as in the converter, and to a somewhat lesser extent in the generator, the temperature rises quite slowly with the load, being rather proportional to the total loss in the apparatus. In the transformer, however, the conductors must, of necessity, be massed together and separated from the iron, so that the temperature of the coil is more independent of that of the iron. That means that at double load, where the loss in the conductor is four times as large, the temperature rise will be very much greater than in the converter for instance, where at double load the temperature rise may be increased only 50 per cent., or even less. Since, in emergencies, an overloading may not always be avoidable, especially in a system where the first consideration is to maintain the service under all conditions, it appears to me advisable to select the transformer capacity very liberally. For the same reason I prefer air-blast transformers for this class of work, since the air as expansive fluid reaches everywhere, and, therefore, the liability to local heating is small, while with oil as cooling medium, due to the sluggishness of the oil stream, pockets may be formed in which the oil does not properly circulate, and a destructive local rise of temperature is liable to occur.

It is desirable to give each converter unit a separate bank of transformers, since when operating several converters from the same transformers, a pulsating cross-current flows between them, if the position of the brushes is not very carefully adjusted, and causes sparking and heating.

The simplest, and thus the most reliable, arrangement, is to consider the converter and its transformers as one piece of apparatus, put in and out of service together, and connect converter and transformers permanently together on the low-potential side by conductors of the least possible length. With the heavy low-voltage alternating currents in these conductors, self-induction and mutual induction easily become formidable with any greater lengths of conductors. The only case where the possibility of transferring any converter to any transformer would be of advantage is, if one converter and a transformer of another converter are disabled simultaneously. It appears to me by far preferable, however, in this rather improbable case, to heavily overload the remaining units than to go to the excessive complication inherent to a transfer device.

The convertor unit can consist either of two machines of 125 volts, connected between neutral and outside conductors on the three-wire system or of one 250-volt machine. The former has the disadvantage to commutate the current twice, but the advantage to establish and maintain the neutral. It is usual in continuous-current generating stations, where face-commutator machines are used, since this type of machine lends itself best to 125-volt construction.

For the rotary converter, however, 250 volts is far preferable to 125 volts, since it requires to commutate only half as much current, and gives a better machine regarding commutation, efficiency, etc. Thus, 250-volt converters are preferable, and are more economical also regarding space.

In case of their use, the neutral can be fed:

(a) From a pair of 125-volt machines or an equalizer set, that is, two 125-volt machines on the same shaft, connected in series across the circuit.

(b) From the storage battery where used.

In either of these cases the voltages of the two sides of the system are independent of each other, that is, can be made unequal, if desired.

(c) From a pair of alternating compensators connected to a rotary converter. In this case the two voltages are necessarily equal, and thus to produce a difference, a booster is required in the neutral, which may be driven by the converter.

(d) A continuous-current converter. This is a 250-volt commutating machine, connected across the outside mains, but supplied with two pairs of collector rings, connected with equidistant points of the armature. Two compensators, or auto-transformers, are connected between these collector rings and joined with their common center to the neutral. Here the two voltages are equal also, and thus a booster desirable, which may be driven by the continuous-current converter.

The continuous-current converter, in some features, as the absence of armature reaction, the increased output, etc., shows a similarity with the synchronous rotary converter, except that the synchronous feature is absent.

The disadvantage of case (a) is that two 125-volt machines must always be maintained in operation. The disadvantage of (b) is that with any noticeable unbalancing of the system the two halves of storage battery are charged and discharged unequaliy. The disadvantage of (c) is that always at least one converter with compensator and booster must be maintained in operation. The disadvantage of (d) is the use of an additional machine. Thus which arrangement is chosen, depends rather on the conditions of the individual case.

Since with the change of load the bus-bar voltage of the sub-station is varied, the voltage on the converter commutator must be varied, by varying the alternating impressed voltage. This can be done either by varying the ratio of transformation of the step-down transformers, or by the insertion of potential regulators.

The ratio of transformation of the step-down transformers is varied by cutting out primary turns by a dial switch attached to the transformer. This arrangement, necessarily, is a step-by-step method, but sufficiently close for almost all purposes, except, perhaps, for slightly shifting the load from one converter to another. It has, however, the disadvantages that, when the converter voltage is high, a part of the transformer winding is unused. The potential regulator of the induction type consists of a three-phase transformer with movable secondary, the primary being connected in shunt, the secondary in series to the circuit. By the motion of the secondary, the phase relation of the secondary voltage is varied so as to change from additive to subtractive. The induction regulator gives a perfectly gradual variation of voltage and has the great advantage of affording, by its self-induction, a flexible connection between converter and generator. This is very desirable.

In a converter or synchronous-motor circuit, we have two independent electromotive forces, that of the generator and that of the converter, connected in parallel, and thus, if these electromotive forces are not exactly corresponding to each other, a cross-current flows between the two machines, which is limited only by the self-induction of the circuit. Thus, self-induction is necessary and essential in a synchronous motor or converter circuit. Step-down transformers and converter armature offer some self-induction, which, with proper care and control of the field excitation, may be sufficient, but the reliability of operation is greatly increased by the insertion of an additional self-induction, as that afforded by the induction regulator.

The induction regulator, however, is considerably more expensive than the step-by-step control of the dial transformer.

A storage battery may be used in the converter sub-station with the same advantage as in a continuous-current generating station. Since the storage battery must be able to discharge at the highest voltage required in the system, and the charging voltage is from 20 to 25 per cent. above the discharge voltage, it follows that, if the storage battery shall be charged directly from the converter, an additional margin of voltage of 25 per cent. must be provided in the latter. This is extremely undesirable, since it brings the range of voltage variation outside of that which conveniently can be covered by an induction regulator, requires the converters and transformers to be 25 per cent. larger, and, what is the most important feature, requires such changes in the constants of the converter, which make it in every way a less desirable machine, especially regarding hunting and efficiency. That is, a converter intended to operate anywhere between 220 and 320 volts cannot be made as good and reliable a machine as one intended to cover only the range from 220 to 270 volts, for instance.

Therefore, it is preferable to charge the battery through a series booster, which may be driven by the converter. In this case, however, the booster may also be used in the discharge of the battery, the end cells and the trouble and complications caused by them entirely avoided.

As the preferable way of installing the storage battery appears to me, to connect permanently in series as many cells as give the mean bus-bar voltage at open circuit, and connect it to the system through a series booster. In charging, the series booster adds to the station voltage the increase required to give the charging voltage. In discharging it adds to the battery voltage the amount required to bring it up to the bus-bar voltage. In either case the booster is generator.

(B) The second class of work done by a sub-station is alternating-current supply to outlying districts.

While in some places alternating supply will always remain preferable, in others the ultimate development is toward continuous current, by small transformers supplying individual customers, larger transformers on secondary circuits supplying several adjacent customers, a secondary network with large transformers, a system of three-wire mains, first fed by large transformers, then by feeders from a converter sub-station with continuous current.

The preferable alternating system thus is one permitting the operation of a three-wire system, that is, either a single-phase system or a quarter-phase system with common return. The unbalancing inherent to the latter is usually not objectionable, since long before the drop in the mains becomes serious, the change to continuous current occurs.

Where the frequency of the generating station is 60 cycles, step-down transformers are all that is required, changing from three phase to quarter phase, where the probability of a future change to continuous current exists. Otherwise, either a four-wire, three-phase distribution, or a system of three-wire, single-phase lighting, with three-phase power, is preferable, as simpler and more efficient.

With 25-cycle generation, motor-generators or frequency converters are needed.

With motor-generators, per one-kilowatt output, two kilowatts of machinery is required, with frequency converters only one kilowatt, of which a part, however, is of a more expensive type. In the latter case, just as in the rotary converter, the secondary voltage is proportional to the primary, so that, to vary the voltage, potential regulators are needed. Obviously, the frequency converter when changing from 25 to 62.5 cycles, for instance, at the same time can convert from three phase to quarter phase or single phase. An induction regulator in the primary controls the whole system, or individual secondary feeders are controlled by separate potential regulators, preferably of the magneto type.

(C) For series arc lighting either constant alternating or constant continuous current can be used. With the 60-cycle generating system, alternating arc lighting supplied by constant-current transformer, or equivalent apparatus, is decidedly preferable in simplicity and efficiency.

With a 25-cycle generating station, series arc lighting can be done:

(1) From arc machines driven by synchronous or induction motors. This arrangement has the advantage to require power and current only proportional to the load, but since the number of arcs which can be carried by one machine is limited in large stations, a considerable number of machines is needed, and the space economy of the arrangement is rather low.

(2) Constant-current transformers and rectifiers may be used. This arrangement is somewhat more efficient, but the light-load and even full-load power factor is low. At no load just as much current is required as at full load and the arrangement thus undesirable wherever the circuits cannot be operated always at fair load. Like in the first case, a considerable number of individual apparatus are required, which, however, take less space.

(3) The series arc lighting can be put on the alternating system, that is, the frequency converter or motor-generator, and operated by constant-current transformers. With the enclosed-arc lamp, the alternating arc lighting has become very satisfactory. The objections are the low power factor and apparent efficiency at light load.

(4) Series arc lighting can be done by alternating current from a special motor-driven, constant-current alternator. The advantage of using an alternating arc machine is that, instead of many smaller machines, one large machine unit can be used, feeding a number of arc-light circuits over series transformers. In this case, also, arc circuits of different voltage and different current can be operated from the same machine.

In this system low-voltage, indoor illumination can be provided by operating in series with transformers feeding high-voltage circuits of many lamps, other transformers feeding only one or a few lamps, at safe potential.

By using separate constant-current, alternating machines of large capacity, the objection to the low power factor of alternating arc lighting disappears, and a higher frequency can be chosen, which has some advantages for arc lighting.

[*The end.*]

Electric Railways in Connecticut.

Official statistics show that there are in the state of Connecticut, in operation, 27 street railways, of which, however, 18 are owned and controlled by four corporations. During the fiscal year ended June 30, 1900, mileage increased from 492 to 496 miles, as compared with the year before. Gross earnings for the year increased from $3,040,887 to $3,207,405; net earnings from $1,121,508 to $1,265,998, and dividends decreased from $471,470 to $322,800. Passengers carried increased from 59,084,702 to 64,109,818. The companies have stock outstanding for $12,143,448, and bonds outstanding for $10,592,800.

The following table shows the capitalization, earnings and travel on the electric roads of Connecticut for the fiscal year ended June 30th last, as compared with 1899:

	1900.	1899.
Miles operated	496	492
Stock issued	$12,143,448	$12,715,948
Bonds issued	10,592,800	10,608,800
Floating debt	841,909	1,341,431
Total debt per mile	47,570	55,730
Cost of construction	29,371,166	20,999,858
Cost of equipment	2,550,757	2,564,967
Gross earnings	3,297,405	3,040,887
Operating expenses	2,031,407	1,919,378
Net earnings	1,265,998	1,121,509
Dividends	322,800	471,470
Taxes	174,912	150,277
Traffic statistics:		
Car miles	15,964,168	14,603,905
Passengers carried	64,109,818	59,084,702
Passengers per car mile	4.02	4.00
Number of employes	2,100	2,465

Electricity and Steam on the New England Roads.

By George E. Walsh.

The rivalry between the electric railways and steam railroads is probably greater in New England than elsewhere, and the developments of the two systems of motive power have been unusually marked this year. Relations of transportation companies in Massachusetts are not only becoming decidedly complicated, but in many instances very strained, and the ultimate outcome of the question is one that is watched with concern by both parties. For instance, some of the electric railways of Massachusetts have applied for, and received, the right to carry baggage, merchandise, and even the United States mails. It is true that these roads do not, as a rule, parallel any steam road, and they run in a part of the country not touched by the latter, but they have succeeded in entering the wedge that the railroad corporations have steadily fought against.

On the other hand, the big steam railroads have entered the electrical field, and it may be only a question of time before they will apply for special charters to operate railways by electricity in the streets of towns and cities. Heretofore they have installed only their regular lines or branches and have not attempted to run in direct opposition to the electric railways. The New Haven road to-day operates more electric mileage than any other steam road in the country. Altogether, there are 45 miles of electric roads operated by this corporation, and preparations are being rapidly completed for increasing this mileage. The New Haven and Derby road, connecting these two points with Bridgeport, will be equipped with electricity and in operation within the coming year, and this will add many more miles to that now in operation. The company is building a large power plant, capable of producing 3,000 horsepower, at New Haven. The new road, which will be in operation by early spring, will be equipped with the third-rail system in preference to the overhead trolley, and the present steam locomotives will be taken off to make room for the motor cars.

This action is said to be due to the progressive policy of the different electric roads along the coast between these points, all of which have been combining into one. This renews the old question, whether there is any conflict between the steam roads and electric railways, or whether mutual interests will cause harmony to prevail between them. In Massachusetts and Rhode Island the New Haven road has conditions confronting it that are similar to those noted in Connecticut. A new electric line is now in the process of construction between Providence and Fall River, which will cause some renewed attempts to direct traffic away from the steam roads to the electric. The Boston and Albany railroad has for years been troubled by new electric lines starting up along its route, and it has been expected all along that the latter road would soon have to run its circuit line in Boston's suburbs by electricity. Now it is announced that the Boston and Albany will build an electric line from Concord to Nashua.

The remarkable growth of electric railways in New England in the last few years has completely revolutionized transportation conditions, and to-day it is a problem with railroad men whether the union of the transportation companies, electric and steam, will not be the ultimate solution of the whole matter. It is believed by many that the electric and steam-railroad interests are practically identical, and that they must combine in the end.

In the battle between the roads operated by steam and electricity, the latter have been the more progressive, and they have encroached upon the preserves of the former, until something had to be done to retaliate. This encroachment has been the most per-

sistent in New England. The electric roads have constantly petitioned for legislation to permit them to parallel the steam roads, and they are urgent in demanding the same rights as the steam roads in carrying passengers, baggage, freight, general merchandise and the mails. In Massachusetts the Legislature has repeatedly refused to grant these petitions to roads that would come into direct rivalry to steam roads. But the granting of the rights to many electric railways that run in parts of the country remote from the steam roads shows that the change has already progressed far. The last Legislature of Massachusetts granted important changes in this respect, and rights such as above were given to the Interstate Consolidated railway, the Plymouth and Sandwich, the Norton and Taunton, the Palmer and Monson, the Lowell, Acton and Maynard, and the Gardner, Westminister and Fitchburg railways. In all of these, except the Lowell, Acton and Maynard, which was incorporated with these privileges in its charter, the rights were granted to the companies through an additional clause in their charters. These roads, to all intents and purposes, enter into the full rights and operating powers of the steam railroads, and they practically pre-empt the field for all steam roads in their particular districts.

That the competition must continue until an acute stage is reached, is evident from the testimony of the Massachusetts railroad commissioners, who will report in their next returns from street railways a total mileage of 1,900 miles. When it is remembered that in 1894 there were only about 600 miles of electric roads in Massachusetts, the rapid growth and spread of this form of railway can be appreciated. So difficult and constant are the problems presented in that state between the conflicting roads that the commissioners have adopted as discriminating terms the words "railway" and "railroad." The former is always applied to electric roads and the latter to steam roads, and in this way there is no confounding of the two in a report.

The multitude of electric railways has also caused the appointment of a special inspector by the commissioners. The duties of this fourth inspector is to look solely after the railway bridges, roadbeds, curves and general system. Heretofore, there have been only four inspectors to look after the state's railroads, but now the special inspector has his duties mapped out for him in keeping a close watch on the electric lines.

Reports are current that the Standard Oil company is spending its money freely in buying up the electric railways along the New England coast, but whether this is true or not, there are plenty of signs manifest that capital is flowing their way freely. It probably matters little where this capital comes from, so long as it is being invested in railways, whose future must inevitably have a great effect upon the profits of the New Haven or other steam railroads running through the same territory. It is the opinion of Colonel N. H. Heft, chief of the electrical department of the New Haven road, that electricity can be used on the main through lines of the big roads as easily and as cheaply as steam, and that it is the economical and valuable motive power for these roads in the future. Colonel Heft further predicted at the International Railway Congress in Paris the use of electricity in greater and greater degree on all the main lines of the steam roads covering crowded districts.

Use of Electricity in Announcing Election Returns.

Elaborate arrangements were made in Chicago to publish the election returns broadcast to the public and to private parties. The American Telephone and Telegraph company, operating long-distance telephone lines throughout the country, centered its election returns in New York city, where they were edited and condensed into bulletins and sent out to the various cities.

The Chicago Telephone company received these bulletins at its main office, whence they were distributed to the different exchanges, and from there to more than 2,500 subscribers, who had requested the service. About 200 extra employes were put on to assist in the work. At each exchange were several readers, whose duty it was to give out the news as received. Twenty or more subscribers were put on the same circuit, the ordinary telephone service for which, except for emergency calls, was discontinued for the time. It was estimated that several thousand people were served in this manner. A number of private telephone parties were held, where the telephone bulletins were read to the guests. This service was given gratuitously by the telephone company, and was so well organized that bulletins were sent to hundred of clubs and houses within one minute after their receipt.

In New York city the telephone company followed the same plan, and similar arrangements were carried out by the Central Union Telephone company in the West, giving returns to such patrons throughout the country as had subscribed for the service, and displaying by stereopticon from the principal exchanges bulletins to the public.

Th two telegraph companies were well prepared for the rush of news. Many special wires were placed and returns posted in prominent places in the city. All the leading clubs, hotels and theaters were served by private wires. The Postal Telegraph company supplied news by wire in more than 200 stores, residences and offices. The Western Union company received less demand for its services than four years ago, due, probably, to the better telephone equipment. About 500 extra telegraph operators were employed in Chicago. All the Illinois reports were centered here, edited, and sent out. The number of points in the city at which returns were given out through the two telegraph companies and the Chicago Telephone company was 5,730.

The Chicago Record displayed the general result of the contest from the top of the Masonic Temple by a large projector searchlight, mounted for the purpose, under the direction of T. G. Crawford of the General Electric company. It had been announced that McKinley's election would be signaled by a steady horizontal sweep of light from left to right and right to left, while if Bryan were successful the beam was to be swung in a circle around the horizon, with a vertical up-and-down motion. As long as the result was in doubt the agreed signal was a steady, vertical ray. Many watchers throughout Cook County thus received their first news of the result.

CORRESPONDENCE.

London Letter.

London, October 30.—It cannot be said that the Metropolitan and District Railway companies have shown precipitation in deciding to substitute electricity for steam upon their systems. Experiments began many months ago on a section of the line at Kensington, and were fairly successful. Yet the reform has only advanced so far that firms are invited to submit tenders for the new installation by December 1st. There are some obvious difficulties in the way of instituting electric traction on the old underground railway; one is that several of the trunk lines have running powers over the system, and run a regular service. We can scarcely hope that the London and Northwestern, for example, will shut off its steam when it arrives at Willesden, and take to electricity and cleanliness. But even if only the majority of trains which travel around the circle of inner London are driven by electricity, that noisome sewer will be appreciably sweeter.

Some most interesting demonstrations of the various applications of the wonderful development of the means of illumination by electricity were given at the offices of the Electric Lighting Boards, on Wednesday of last week. The device provides a means by which electric glow lamps may be mounted in any desired position without the use of lamp sockets, etc. Ordinary incandescent lamps are used, but their terminals, instead of being of the usual form, consist of two sharp spikes about half an inch long and nearly the same distance apart. The "board" has a specially prepared surface, into which these spikes can easily be pushed. Below the surface a number of conductors, composed of bundles of fine copper wire, suitably insulated, are laid in such a way that when any adjacent pair of them are in contact with the spikes the circuit is completed, and the lamp illuminated. These conductors are so arranged that the lamps may practically be placed at any point of the board, the only precaution it is necessary to observe being to keep the spikes at right angles to the direction of the conductors. The boards can be made of any desired shape, from a large square to a narrow strip an inch or so wide, and they can be made flexible, if desired. But in every form, provided connection is made with a source of electric energy, a lamp lights immediately its spikes are pushed into the prepared surface. Various applications are suggested for the system. For instance, a theater provided with a large "board" can exhibit any desired notice in incandescent lamps and change the announcement at any time and as often as is wanted by merely putting in the lamps in new positions. Again, in ordinary houses, a strip of the prepared surface let in along a dado molding would enable connection to be made to standard or reading lamps in any part of the room, or the system might be effectively employed for the decoration of a dining room with small glow lamps. The makers say that the insulation of the arrangement is perfect, and that short-circuiting or internal arcing between the conductors within the board is not in the least to be feared.

The cry is, still more foreign plant for England. The Metropolitan Electric Supply company of London is about to erect what is said to be the largest installation of polyphase motor generators in the world, the estimated output being 9,000 horsepower. The plant and machinery for this installation are being made at Charleroi, in France. At the Canvery River, not far from the famous gold fields of Mysore, the first electrical power-transmission plant from natural waterpower in India will shortly be established. I hear the electrical plant will be supplied by the General Electric company of Schenectady, N. Y., the hydraulic plant by Escher, Wyss & Co. of Zurich. These are only a few instances where work is being executed by aliens. Yet many English manufacturers resent what they call "newspaper sermons" on their shortcomings; but how can they complain when the sermons are illustrated by texts like these?

The fifty-eighth half-yearly meeting of the Cuba Submarine Telegraph company was held last week. Mr. C. Parish presided, and stated that the traffic receipts for the first half of this year amounted to $65,885, and showed a falling off of nearly $25,000 as compared with the first six months of 1899. This serious reduction he had, at previous meetings, warned the shareholders to expect, as they were bound to lose the exceptional amount of business which the revolution and the war in Cuba gave rise to. Moreover, they had suffered from the low rates which competition had forced on them. The accounts showed that $40,870 for repairs to cables damaged during the Spanish-American war was still outstanding. He had no definite news to give regarding this claim, or of the company's concessions and general position in regard to the government of the United States. The negotiations which the British ambassador was carrying on, on the company's behalf, with the United States, were still proceeding. It was very hard that the company should not be paid the subsidy due for the coast cables, and the board would be much disappointed if this matter were not settled before long. The report was adopted, and the proposed dividends, at the rate of 10 per cent. on the preferred and of five per cent. on the ordinary stock, were sanctioned.

"The Limitations of Municipal Trading" was the subject set down for the consideration of the members of the National Liberal Club's political and economic circle, at the conclusion of its forty-first dinner. There was a good attendance, but, unfortunately, Lord Avebury, who was announced to preside, was confined within doors by an attack of la grippe. Mr. Henry Wilson, who occupied the chair in Lord Avebury's absence, remarked that his lordship's interest in the subject was so keen that he felt impelled to commit to writing the views to which he intended giving expression. The chairman accordingly read these typewritten "utterances." His lordship, in the first place, challenged the accuracy of statistical information, which attributed to municipal trading, as a whole, profits in favor of the ratepayers, and contended that local authorities had quite enough to do without embarking in commercial transactions. He objected, moreover, to municipal debts being increased by these enterprises, and to municipalities being involved in labor disputes. Another objection he offered was that unlimited municipal trading would be a serious check to progress and discoveries, and that, without the stimulus to economy and attention characteristic to private enterprises, there would be a possibility, not to say certainty, of municipal service costing more than private enterprise. Mr. Emile Garcké, member Institution of Electrical Engineers, in an exhaustive paper, argued that it was a delusion and a fraud to make ratepayers believe that municipal trading yielded them a profit.

W. H. B.

New York Notes.

New York, November 10.—Sufficient progress has now been made on the section of the Rapid Transit tunnel in Elm street, between Houston and Bleecker streets, to enable workmen to begin the construction of the pipe gallery on the east side. Laborers began laying the cement foundation for this gallery last week and it is expected that the gas and water pipes will be removed to it some time this month, thus opening the way for excavating the center of the roadway. Chief Engineer Parsons of the Rapid Transit subway has decided to station three inspectors at Egypt, Pa., during the continuance of Rapid Transit work here, to examine and certify to the quality of cement to be furnished by a concern there for tunnel work in this city. Six million half-pound bags of cement will be required for the subway in New York. To test cement thoroughly requires 28 days, and the plan to test before delivery will obviate the possibility of a large consignment being rejected after delivery and the danger of delay in the subway work. Large bins of cement will be kept on storage at Egypt, and consignments will be certified to by a lead monogram seal, specially made. Mr. Parsons has not yet decided to recommend that the subway route along Forty-second street, between Fourth avenue and Broadway, be changed. He said, however, that he had drafted provisional alternative plans for that section, as he had for other sections for which construction contracts had not yet been awarded.

At the last meeting of the Brooklyn Women's Health Protective association means were discussed for promoting the passage of a bill to compel the street-railway lines to provide vestibules for the protection of their motormen during the cold weather.

The Crocker-Wheeler Electric company recently desired a pulley which could run with a rim speed of 9,000 feet (or nearly two miles) a minute. This meant 750 revolutions a minute for a 46½-inch wheel. This pulley was built with a wooden rim, but with iron arms and hub. A duplicate wheel was run on a bursting test up to a rim speed of 28,800 feet, or about 5½ miles a minute. This is probably the highest speed at which a pulley of standard construction for ordinary service has ever been run.

An interesting paper on the "Taxation of Street-railroad Franchises" was read before the Municipal Club of Brooklyn last month by Mr. T. S. Williams, vice-president of the Brooklyn Rapid Transit com-

pany. That company, the paper states, paid to the city and state on an average $2,900 every day last year in taxes, or $1 for every $3.62 which went to stock and bondholders. This meant the carrying of 483,000 cash passengers daily to yield sufficient profit to pay the company's taxes. The Brooklyn Transit company is thus the largest taxpayer in the borough, and, with three or four exceptions, the largest taxpayer in Greater New York. The sum of $700,000 a year is paid in purely franchise taxes; for the privilege of carrying the people across the Brooklyn bridge without extra fare $170,000 was paid; for car licenses and percentages to the city over $30,000 was paid. Mr. Williams showed that, in addition to city revenues from direct taxation of the company, large receipts should also be credited by reason of the increased taxable valuations which have followed the railroad extensions, voluntary reduction of fare, distribution of millions of dollars for wages and supplies, etc. By the bridge service alone $2,700,000 is saved to the people each year. M. L. G.

From the Buckeye State.

Columbus, Ohio, November 10.—The Millcreek Valley Street Railway company of Cincinnati has awarded the contract for its new power house and car barn which are to be built at Hartwell. They will cost $25,000, and the machinery is to be in position by February 1st. The buildings will be of brick. The generators will be furnished by the General Electric company, and the boilers by McIntosh, Seymour & Co.

The engines and machinery for the power plant of the Dayton, Urbana and Springfield company's power plant at Glen Echo, to operate the Springfield and Urbana branch, have arrived and will be put in position shortly.

A new lime company which will build a factory at Rushsylvania, Logan County, has planned to have an electric railway built to carry the marl from where it is secured to the factory. Some of the interested parties are Andrew Amerine, Fostoria; James E. Roberts, Dayton, and Brugler Bros., Big Springs.

At a meeting held in Cleveland a few days ago the stockholders of the Western Ohio Electric Railway company chose the following-named officers: President, A. E. Akins, Cleveland; vice-president, A. R. Nutt, Akron; second vice-president, L. J. Wolfe, Cleveland; treasurer, M. J. Mendelbaum, Cleveland; secretary, Jacob Mayer, Cleveland. Will Christy of Akron is a member of the construction committee. The company is building a line from Lima to Wapakoneta, a distance of 32 miles.

The Salem Electric Railway company, Salem, Ohio, is repairing its tracks and putting them in good shape.

It is stated that Dr. L. E. Niles of Springfield has secured the necessary capital to form a large company for the manufacture of the telegraphic fire-alarm system invented by L. G. Wooley of Kenton. This system was tested on a line between Columbus and Springfield some time ago and proved a success.

Herbert A. Evans of Columbus has accepted a position as manager of a large electric-light plant at San Antonio, Texas, at a salary of $1,800 a year.

General Manager Fisher of the Columbus, London and Springfield Railroad company is in the East buying equipment for his line. The company will have the road in operation by the holidays, if possible.

At a meeting of Bowling Green men at Toledo a few days ago the plan of connecting several of the larger northern Ohio towns with an electric-railway system was discussed. The basis of the plan seems to be to build a line from Woodville to Bryan, crossing the Bowling Green line and connecting with the Toledo, Fremont and Norwalk line, and thus connect with both. Several other towns will also be connected up if this plan is carried out. L. C. Cole and Captain Black of Bowling Green and S. M. Heller of Napoleon were present at the meeting.

The Dayton and Maysville Electric Railway company has filed notice with the secretary of state of a change of name to the Cincinnati, Dayton and Maysville Electric Railway company. The purposes of the company, as stated in the first papers of corporation, were amended in such a manner that it will be allowed to build a line from a point in its original line in Warren County to Cincinnati.

The Columbus, London and Springfield Railway company has given notice to the secretary of state that it has increased its capital stock from $1,000,000 to $1,500,000. J. S. Harshman of Springfield is the president of the company, and Emmett Tompkins, just elected to Congress, from the Columbus district, is the secretary.

The track of the Ohio River electric line has been finished from Middleport, Ohio, to Racine, and it is reported that cars will be running over the line from Middleport to Syracuse within a few days.

The Columbus, Lima and Northwestern Railway company was incorporated recently, to build either a steam or electric road from Columbus to Lima. The capital stock is placed at $10,000.

A few days ago the commissioners of Franklin County revoked the franchise granted the Columbus and Lancaster Traction company some time back, because the promoters had not complied with the terms of the contract in beginning their work at the time agreed. A new company, known as the Columbus, Winchester and Lancaster Traction company, at once applied for a franchise over practically the same line. The old company fought the action of the commissioners and took the matter to Common Pleas Court, where an injunction was granted, preventing the commissioners from granting a franchise to any other company. Thomas Simonds and some other Columbus men have been watching this opportunity for some time in order to get a franchise for another road, but it seems rather doubtful whether they will get it now since the matter has been taken to court.

It is reported that the Cleveland and Eastern Railway company is making a determined effort to get control of the stock of the Chagrin Falls Electric Railway company in order to prevent competition from the Chagrin Falls and Eastern Railway company, which is building a line from Chagrin Falls to Middlefield, the terminus of the lines of the Cleveland and Eastern railroad. The majority of the stock of the new company is in the hands of the stockholders of the parent company and they assert that both lines are safe from schemes on the part of any other company and that there is no possibility of the road passing into the hands of competitors. The line from Chagrin Falls to Middlefield is almost completed.

A mortgage for $650,000, given to the Finance company of Philadelphia by the Cincinnati and Miami Valley Traction company, has been released. The lines of this company now belong to the Southern Ohio Traction company.

Judge Lamson has granted a perpetual injunction against the consummation of the contract between the city of Cleveland and the company which was to furnish the new police-signal system, on the ground that the investigation recently made there tended to show that the arrangement was made by corrupt methods.

The electric railroads in Lorain County have been valued as follows for the purpose of taxation: Lorain Street railway, $62,270; Cleveland, Berea and Elyria, $56,277.90; Lorain County railway, $26,080. The last two lines now compose a portion of the Cleveland, Elyria and Western system.

The commissioners of Pickaway County have granted a franchise to the Chillicothe, Mt. Sterling and Columbus Electric Railway company for two routes through the county. The Columbus and Southern Traction company has also asked for a franchise through the county.

The Tipp City Building company of Tippecanoe City has donated a tract of land near that place for the power station, car barns and shops of the Dayton and Troy Traction company. The right-of-way has nearly all been secured and work is progressing on the bridges and roadbed.

The power house of the Findlay, Fostoria and Toledo Electric Railway company will be located at Findlay, where a site has been secured. About one mile of the roadbed has been graded.

The Cincinnati, Lawrenceburg and Aurora Electric Railway company has placed a theater car in service on its lines to run on Tuesday, Thursday and Saturday evenings.

Corporation Counsel Hunt of Cincinnati has requested that an injunction suit be filed against the Cincinnati Edison Electric company to prevent the laying of underground conduits for which the board of public service issued a permit some time ago.

Lee D. Fisher, mechanical engineer of the Columbus, London and Springfield Railway company, and Miss Lillian Udell of St. Louis were married at the home of the bride, last Wednesday. Both are very prominent young people. The groom is the son of H. A. Fisher, general manager of the electric road.

The Columbus and Southern Electric Railway company has secured rights-of-way over most of the route from Chillicothe to Columbus. It is said the road will cost $1,500,000. A power house will be built either at Circleville or Ashville. Bids for the construction of the road will be received up to November 22d.

The Warren Electric and Specialty company, Warren, Ohio, has decided to increase the capital stock of the company from $100,000 to $200,000.

It is said that the town of Barberton, Ohio, will shortly make a new contract for lighting the streets. The Akron and Cuyahoga Falls Rapid Transit company has been furnishing the lights.

The offices of the Cincinnati Edison Electric company have been moved from the plant to the new building erected by the company on Government Square.

Hon. Randall Montgomery is to be the manager of the electrical interests at Youngstown which were recently acquired by New York and Chicago capitalists. It is said that negotiations for the Mahoning Valley Electric Railway company's property are off.

The Lorain Steel company has been given an order for the rails to be used by the Youngstown-Sharon Street Railway company on the line between Hubbard and Sharon. They are to be 94-pound girder rails. O. M. C.

Southern Developments.

Charlotte, N. C., November 10.—Judge J. L. Hauer of Cleveland, Ohio, is interested in a new electric line which may be constructed between Richmond and Petersburg, Va. It is understood that Judge Hauer has an option on the old Richmond and Petersburg Electric Railway company.

The lights of Berkley, Va., are now furnished by the Norfolk (Va.) Street Railway and Electric Light company. The old Berkley Electric plant has been abandoned. The Berkley Street Car company will begin running its electric cars to Maney Point on December 1st.

The disagreement between the city of Wilmington, N. C., and the Wilmington Gas Light company, relative to the electric lighting of the city, has about been settled. The suspended payments to the company have been ordered paid on the signing of the contract by the president of the company.

At the last meeting of the board of directors of the Roanoke (Va.) Street Railway company held October 31st, J. B. Fishburne was elected president and E. L. Stone, treasurer.

The Bristol Belt Line Railway company is tearing up its tracks in Bristol, Va., as a result of a refusal to pave the car lines on certain streets, according to the provisions of the franchise. The company has accordingly abandoned these streets.

Herman G. Smith of the Southern Electric Equipment company of Norfolk, Va., has filed a petition in bankruptcy. The failure is for $6,894.16. D. H. L.

Canadian Intelligence.

Ottawa, Ont., November 10.—W. T. Steward, electrical engineer, says in a communication to the mayor of Toronto, Ont., that if the Board of Control will postpone the letting of the street-lighting contracts for the city for the space of two weeks, he will engage to "bring in Americans representing several millions of dollars of capital who will make a proposition to light your streets at a saving of from $40,000 to $45,000 per annum over and above any proposition heretofore made to the city." The city of Vancouver, Mr. Steward states, is saving $12,000 annually in its street-lighting bill as the result of having acted upon his proposition, and he exhibits a recommendation from the mayor of Vancouver corroborating this statement.

The report is current in Toronto, Ont., that negotiations are nearing completion for the amalgamation of the Canada Cycle and Motor company and the National Cycle and Automobile company, the two companies recently formed by the amalgamation of several Canadian cycle and motor companies. Such an amalgamation as the one now projected would practically control the whole Canadian cycle business. The report is not denied by officials of the two companies concerned. The Canada Cycle and Motor company is capitalized at $2,500,000 and the National Cycle and Automobile company at $2,000,000.

James Ross, vice-president of the Montreal Electric Street Railway company, has just returned from a two months' visit to England. Seven years ago Mr. Ross, along with a number of other American and Canadian capitalists, became largely interested in the street-railway system in Birmingham, England. For years they have been endeavoring to induce the municipal authorities of Birmingham to allow them to introduce an electric trolley system in that city. It was only a few months ago that this permission was secured, and Mr. Ross states that the first part of the new electric line will be opened for traffic about the first of the coming year. The various cities in Great Britain, Mr. Ross says, are gradually adopting the electric-tramway system, though many of the most congested districts of London are not at all adapted to surface electric tramways. The new underground electric railway in London, known as the London Central, Mr. Ross declares to be an unqualified success under the management of Granville C. Cunningham, who is well known in Montreal in connection with the management of that city's street railway. A. V. W.

Northwestern Notations.

Minneapolis, November 10.—The Sioux City Traction company of Sioux City, Iowa, plans the erection of a large new car barn.

The Electric Light and Power company of Oshkosh, Wis., has applied for an extension of its franchise for 21 years.

The Electric, Water and Telephone company of Marshfield, Wis., has put in new machinery and will increase its lighting capacity 200 per cent.

The street-car system of Winona, Minn., will put a 10-minute service schedule in effect, beginning November 15th.

The electric-light system of Northfield, Minn., now operates all night.

Heavy floods caused the river at Sparta, Wis., to overflow and flooded the electric-light station. The town was without light for two days.

Fairbanks, Morse & Co. secured the contract to furnish and install a power and lighting plant for the county asylum at Eau Claire, Wis.

The local paper at Nicollet, Minn., urges that a dynamo be installed in the power house of the water station, and the streets lighted by electricity.

John Schneering secured a verdict at Dubuque, Iowa, against the Dubuque Street Railway company for damages incurred by one of the defendant's cars running into him. The judgment is for $1,270.

The Adel Mill company has completed the electric-light plant, and is now furnishing street lighting for Adel, Iowa.

The Street Railway company of St. Paul has agreed to give better service on the Grand Avenue line. Patrons of the line have been complaining and demanding better service for some time.

A council committee at Des Moines, Iowa, will look into the matter of the street-railway company's taxes, which have not been paid for three years.

A number of accidents have hindered the completion of the St. Paul Gas Light company's new

power plant at Somerset, Wis. After the flume had been repaired from the leaks, the bed of the river just below the dam began to wash out. The water had to be turned into the flume to prevent the dam being undermined. The full force of the water in the flume on the steel pipe leading to the power house was so great that the pipe burst. This compelled the shutting off of the power and closing down the machinery for repairs.

E. J. Cave has bought the franchise and plant of the electric-light company at Baldwin, Wis. He proposes to improve and extend the system.

The Missouri River Power company is a new company which has been formed to succeed the power company operating the plant at Canyon Ferry, near Helena, Mont. Additional capital has been secured, and new machinery will be put in to increase the power from 4,000 to 6,000 horsepower. A pole line is under construction to Butte, 66 miles, and power will be transmitted there, to the smelters and other industries.

The J. J. Bennett Power and Lighting company of Hastings, Neb., has secured the contract to install an electric-lighting system for Madison, Neb., at $5,100.

The Bluff City Electric and Gas company of Council Bluffs, Iowa, will secure power from Omaha until it can secure the new machinery necessary for lighting the streets of Council Bluffs. The Bluff City company is a new concern which has absorbed the old gas and electric company's wires and poles.

The La Crosse (Wis.) Street Railway company is having a home concern build a 32-foot car, as an experiment, to ascertain if the work can be done at home as cheaply as elsewhere. If it can be done, the company will have other cars built in La Crosse.

The Electric and Water company of Little Falls, Minn., has got the new incandescent-light machine in place and operating, and is again in position to furnish incandescent lighting.

Commissioner Montgomery of Fargo, N. D., has held that the evidence on which the Mexican government asked that Frank E. Carmody be held on a charge of embezzling from the General Electric company of the City of Mexico, is insufficient, and Carmody has been discharged from custody. He had been in jail for nearly two months.

The Benton Power and Traction company of St. Cloud, Minn., has transferred all its franchises and privileges to C. A. Wheelock. The power house has lately been deeded to Mr. Wheelock. The plant has been put in operation and the Benton company is now furnishing power for its own cars, instead of securing it from the gas and electric company. The latter has been carrying a heavy load in furnishing street-railway power and also furnishing commercial power. It is understood the new owners of the Benton company have plenty of capital behind them and will be able to extend and improve the system.

The voters of Council Bluffs, Iowa, have ratified the award of a franchise to the Bluff City Electric Light and Gas company, by a vote of 680 for the proposition and 509 against it. But little interest was taken in the matter and there was but a fifth of the normal vote out.

John S. McGroarty of Philadelphia and James P. Gleason of Seattle have applied to the council of Port Angeles, Wash., for a franchise for an electric-light, telephone and waterworks system.

The Big Fork Electric company is surveying a new route for the proposed pole line into Kalispell, Mont.

O. C. F. Sorenson is an applicant for a franchise to install an electric-light plant for Kasson, Minn.

The Electric Light company of Muscatine, Iowa, is erecting a new brick power station.

The Edison Electric Light company of Des Moines, Iowa, has started work on a subway system for its wires

The members of the Electric Light and Power Commission of Marquette, Mich., feel very much pleased over the fact that the Lake Shore Iron Works of that city has replaced its steam engine with two large electric motors, which will hereafter furnish power.

The Twin City Rapid Transit company has informed the city officials of Stillwater, Minn., that the company has no desire to antagonize the Stillwater people by fighting the proceedings to annul the company's franchise. The company says the line to South Stillwater cannot be built until spring.

The Edison Light company of Des Moines, Iowa, has absorbed the plants of the Capital City and Thomson-Houston Electric Light companies, and the light will hereafter be furnished from the station of the former. New and improved machinery will be put in to meet the increased demand, and it is said that rates will be reduced about 20 per cent. Owing to the extensive changes necessary to effect the centralization of the power plants, it will take until about May 1st to have a single power plant for the consolidated system.

The city of Billings, Mont., has contracted with the Billings Water Power company for 50 arc lights at $80 per annum each. At present the city pays $2,400 per annum for 20 lights.

J. M. Frink, W. H. White, George F. Meacham and E. F. Tremper were granted a franchise last February for a street-car line to City Park, in Seattle, Wash. They announce that they will build the line at once.

The Triumph Electric company secured the contract to furnish an electric-light plant for Thief River Falls, Minn., at $3,175.

The Ripon, Dartford and Green Lake Traction and Light company has filed articles to operate a street railway between the towns in the corporate name, and also to operate a light plant. The capital stock is $100,000.

The Seattle Electric company will extend its line in Ballard, Wash., beyond the City Hall, and will establish a freight depot there, as there is a large amount of traffic between Seattle and Ballard. The line has been changed and improved in a number of ways between Seattle and Ballard.

The employes of the Butte Street Railway company, Butte, Mont., have received an advance of 16 2-3 per cent. in their wages.

A. K. Ware has become the principal stockholder of the Light, Heat and Power company of Northfield, Minn., and will hereafter be the manager of the plant.

Mr. Dixon has bought the electric-light plant at Coon Rapids, Iowa, and will put it in first-class condition.

James McNaught, formerly general counsel for the Northern Pacific railroad, State Treasurer T. E. Collins of Montana and J. R. Havens are the projectors of an electric railroad through a rich mining country between Great Falls and Billings, Mont., 200 miles. Articles of incorporation have been prepared, placing the capital stock at $4,000,000, and the New York Trust company of New York is said to have guaranteed the placing of the bonds. Preliminary field work has been begun. Electric power houses will be constructed on the Missouri and Yellowstone rivers.

The mayor of Neepawa, Man., has issued a statement showing the cost of the municipal light plant, $23,000, and its earnings, $3,680. The revenues cover operating expenses, but do not cover the interest and depreciation.

The Fox River Valley Electric Railway company has absorbed the local street-railway and lighting systems at Appleton, Wis. Steps will be taken at once to erect a temporary power house in Appleton to furnish city lighting and to operate the street-car system and furnish power for the interurban line. In the spring a large power house will be built to furnish power for the Appleton-Neenah line, the Kaukauna extension, the local car and lighting system.

The electric-lighting system at Albert Lea, Minn., is to be rebuilt throughout at a cost of $20,000. Evans, Almirall & Co. of Chicago have the contract for the work.

Charles A. Cahill, chief engineer of the Sioux City (Iowa) Traction company, has resigned, to take a position with the General Electric company of Milwaukee. The Sioux City branch of the National Association of Stationary Engineers presented Mr. Cahill a handsome gold watch.

Pewaukee, Wis., contemplates putting in a municipal lighting plant. R.

PERSONAL.

Marcus Daly, the Montana "copper king," died on November 12th at the Hotel Netherlands, in New York city.

P. A. B. Widener of Philadelphia, who is well known for his large holdings in electrical securities, is expected to be a candidate for United States senator in Pennsylvania.

Frederick H. Tubbs, district superintendent of the Western Union Telegraph company in Chicago, who has been ill with a severe five-week attack of pneumonia, is recovering.

G. O. Perkins, at one time manager of the United Press at Chicago, Ill., and of late manager of the Postal Telegraph-cable company at El Paso, Texas, has been appointed superintendent of telegraph of the Mexican Central railroad, with headquarters at the City of Mexico, Mexico.

William R. Holligan, who has been connected with the Western Union Telegraph company as chief operator for the last 15 years, is about to assume the management of the Chicago offices of the Postal Telegraph-cable company, taking the place of F. H. Houston, who has been acting manager since June 1st.

The New York correspondent of the Chicago Times-Herald is authority for the statement that Frank Jarvis Patten, "inventor of the multiplex-telegraph system, which was purchased by the Western Union Telegraph company, and of the gyroscope, used on ocean vessels for giving the position of the ship in midocean," died suddenly in that city on November 12th.

Thomas A. Edison, an old-time telegrapher, as everybody knows, assisted in receiving election returns at the Orange Club in Prospect street, East Orange, N. J., last week, just to keep his hand in, as he remarked. He not only took messages as they came over the Western Union wire, but also sent a message at the same time that he was transcribing one that was being received.

L. B. Stillwell, formerly electrical director of the Niagara Falls Power company, and now in charge of the electrical installation work of the Manhattan Railway company, has been appointed electrical director of the Rapid Transit Subway Construction company of New York. He will have charge of everything pertaining to the electrical equipment and construction of the Rapid Transit railroad, and has already entered upon his duties.

ELECTRIC LIGHTING.

Weston, Ore., is to have an electric-light plant with a capacity of 600 16-candlepower incandescent lamps.

An electric-light plant will soon be erected at Monroeville, Ind., and bids for its construction are now being received.

The electric-light plant of Cottage Grove, Ore., owned by A. Nelson, was destroyed by fire recently. The loss was $3,000.

The Lawrence Heat, Light and Power company of Newcastle, Pa., has been incorporated, with a capital stock of $10,000.

The Board of Public Works of St. Paul, Minn., favors the erection and equipment of a municipal lighting plant for that city.

J. E. Wooten and M. B. Johnson have been granted a franchise for the construction of an electric-light plant in Danville, Ark.

T. T. Huey, mayor of Bessemer, Ala., wants estimates on the approximate cost of an electric-light plant for a city of 10,000 inhabitants.

The Canadian General Electric company is putting in a 500-light plant for the village of Sunderland, Ont., and a 2,000-light plant at Southampton, Ont.

The Kilbourn (Wis.) Machine company has been granted a franchise for electric lights, and within a short time Kilbourn will be lighted by electricity.

The contract for erecting and establishing an electric-light plant for Madison, Neb., has been let to the J. J. Bennett Power and Lighting company of Hastings, Neb.

The Briar Cliff Manor Light and Power company of Ossining, Westchester County, N. Y., has been incorporated for $25,000, by J. D. Baldwin, F. A. Hill and others.

The Mt. Gilead (Ohio) Water, Light, Heat and Power company has been incorporated by E. Mansfield, J. C. Fish, W. H. Myers and B. F. Long. The capital stock is $60,000.

The Turtle Creek Electric Light, Heat and Power company of Turtle Creek, Pa., has been incorporated, with $500 capital stock, by R. W. Williams, C. B. Wilson, W. F. Kimmick and J. W. Johnson.

The Merchants' Electric Light, Heat and Power company of York, Pa., has been formed, with $750,000 capital stock, and an electric-light plant will soon be built. Charles H. Bear is at the head of the movement.

The Southern Electric Light company will build a plant at Navasota, Texas, to operate 25 1,000-candlepower arc and 2,000 16-candlepower incandescent lights. W. H. Freeman of Rosebud, Texas, should be addressed.

The Lexington (Ky.) Railway company will make improvements at its power house, including the installation of an engine and dynamo, with a capacity of 3,000 lights. E. C. Hathaway is the general manager of the company.

The plant of the Citizens' Electric Light and Power company of Houston, Texas, will shortly undergo considerable improvement. An order has been issued by Judge D. E. Bryant, authorizing the receiver of the company to purchase $60,000 worth of equipment.

An extension of the lighting stations of Chicago will be asked for by City Electrician Ellicott in his estimate for the 1901 appropriation for his department. He will also ask for sufficient money to extend the fire-alarm and police-signal system. His estimates for 1901 show an increase of $351,724.66 over last year. The total amount asked is $1,422,415, as against $1,070,689.34 for last year.

The eighth half-yearly report of the Brisbane Electric Supply company of Queensland, Australia, has recently been issued over the signature of E. J. Holmes, chairman. The report states that the position of the company has considerably improved during the half year and that the business is still expanding. A new station has reduced the cost of operation nearly one-half. The output for the half year was 125,000 kilowatt-hours, the revenue for the same period from all sources being £2,933.

The Westchester Lighting company was incorporated in Albany, N. Y., on November 5th, with a capital of $2,500,000, to furnish gas and electricity for lighting purposes in New York city, Yonkers, New Rochelle and Mount Vernon, and in the towns and villages of Westchester County. The principal office of the company will be in Port Chester, N. Y. The directors are Charles W. Squires, Charles H. Werner, Richard F. McKiniry, Nathan D. Daball, M. J. Warner and Reginald H. Giles of New York, Louis B. Grant, Charles M. Heminway and Henry A. Kenworthy of Brooklyn.

In the thickly populated districts of Poplar, Bromley and Bow of East London, gas lights are rapidly being supplanted by large arc lamps. The light is to be supplied to the inhabitants at such a low price that it will be cheaper for the working classes to use electricity for lighting purposes. The light is to be installed in the dwellings free of cost to the residents. The tariff for light consumption will be six cents, eight cents and 10 cents per unit, while for motive power electricity will be supplied at the

purely nominal costs of three cents and six cents per unit. The present cost of the gas is 68 cents per 1,000 feet, and as about five units of electricity is equivalent to 1,000 feet of gas, there is a considerable difference between the cost of the gas and the electricity. When the installation has been completed, 65 miles of streets will be lighted by the electric lamps, and the houses corresponding to the same area of streets will be in a position to avail themselves of the electric light. The installation has cost about $500,000.

ELECTRIC RAILWAYS.

The Grand Rapids (Mich.) Railway company has commenced the erection of a brick power house to cost $46,000.

The work of rebuilding the Valley street railway of Sharon, Pa., has been commenced. The improvements will cost $100,000.

A strike among the street-car employes of Pensacola, Fla., was called recently because the company refused to allow motormen to use stools.

The Syracuse and Oneida Lake Electric Railway company has broken ground for its proposed trolley line between Syracuse and South Bay, on Oneida Lake, N. Y.

The Chattanooga (Tenn.) Rapid Transit company is negotiating for the right-of-way of the old broad-gauge railway up Lookout Mountain for the purpose of building an electric railway thereon.

The Western Ohio Electric Railway company has recently been incorporated with $1,000,000 capital stock. The company will soon begin to build a line from Lima to Wapakoneta and St. Marys.

The Lexington Railway company has decided to build a branch of its system to a park, which is to be established in the suburbs of Lexington, Ky. R. L. Williams of Richmond is president of the company.

A charter has been granted to the East Bangor (Maine) and Portland Street Railway company, with a capital stock of $12,000. The company will build a street railway between Bangor and Portland, a distance of 10 miles.

The Hamilton (Ont.) Grimsby and Beamsville Electric Railway company is making plans to extend its line to St. Catharines, Niagara and Niagara-on-the-Lake, and to issue bonds not exceeding $10,000 per mile of the whole line.

Messrs. P. M. O'Brien, T. F. Deegan and Captain Higgins, capitalists of Elkton, Md., have subscribed for the whole of the capital stock of the Cherry Hill, Elkton and Chesapeake City Electric railway, and construction of the road will soon begin.

The Chicago Union Traction company has placed in service on its West Side trolley lines 55 large vestibuled cars. They are 30 feet in length with one-third of the room set apart for smokers. Thirty more cars of similar design will be added as rapidly as they can be built.

A Newark (N. J.) trolley car carrying several tons of sand collided with a South Tenth street car on November 8th. The passenger car was turned completely around and thrown into the gutter. Both motormen were injured, one fatally. No passengers were on the cars.

The Lackawanna and Wyoming Valley Rapid Transit company was lately incorporated at Trenton, N. J., with $2,850,000 capital stock. The company is authorized to equip and operate railroads. The incorporators are F. H. Hansell, G. H. Martin and [illegible]dell, all of Camden, N. J.

The borough of Metuchen, N. J., has, after long delay, granted to the Raritan Traction company of Perth Amboy, N. J., permission to run through its territory. The line is to be built along the New Brunswick turnpike, from the Raritan township line. The fare from Perth Amboy is to be 10 cents.

At the recent annual meeting of the stockholders of the Concord (N. H.) and Montreal Railroad company it was voted to authorize the building of a branch from Concord to Hudson, to be operated by electricity, and to issue bonds for the construction to an amount not to exceed $1,000,000.

The ordinance committee of the City Council of Newport News, Va., will recommend favorable action on the request of the Hampton Roads Railway and Electric company for a franchise. A 10-cent fare to Old Point Comfort is asked for by the council, which the new company declares impossible.

The Concord and Clinton Street Railway company has been incorporated in Massachusetts with $60,000 capital stock. The line is to commence near the postoffice in Maynard, and extend through Maynard, Acton and Concord, to a point near Monument square in the latter town, a distance of 6½ miles.

The Cuba company has been organized in Philadelphia, with a capital stock of $20,000,000, to secure options on and operate all horse and trolley lines in Cuba, as well as the sugar plantations in the island. The promoters of the company are: Sir William and R. B. Van Horne of Montreal, Canada, William L. Elkins and Thomas Dolan of Philadelphia, R. A. C. Smith, president of the Cuba Mail Steamship company, Percival Farquhar of New York, and Dr. T. W. Shephard and M. L. Evans of Montreal.

The Jackson (Mich.) street railway was sold at auction recently to W. A. Boland, representing the Michigan Traction company. J. D. Hawks, president of the Detroit and Ann Arbor Electric Railway company, C. D. Beebe of Syracuse, N. Y., and others, were among the bidders. The price paid was $153,500.

The roof of a street car in Evanston, Ill., caught fire one night recently, from defective wiring, and caused a panic among the passengers. Fortunately no one was seriously hurt, although several were trampled upon. One woman fainted in the excitement. The flames were easily extinguished by a bucket brigade.

The Indiana and Ohio Traction company has been incorporated at Indianapolis, Ind., with $750,000 capital stock, to build an electric road to connect the cities of Marion, Huntington and Fort Wayne in Indiana, and Hicksville in Ohio. The directors are J. H. Simonson, P. R. Smith, J. D. Olds and J. W. White.

The Toledo Interurban Railway company of Toledo, Ohio, has been incorporated, with $100,000 capital stock, by G. Williams, C. L. Reynolds, S. D. Carr and G. D. Palmer. The company will build a road running from Toledo northwest, through Lucas, Fulton and Williams counties, crossing the state line in Williams County.

The Charlottesville and University of Virginia Electric Light and Gas company, the Consolidated Ice and Electric company, the Charlottesville City and Suburban Railway company and the Jefferson Park Hotel company have consolidated and now compose the Charlottesville City and Suburban Railway company of Charlottesville, Va.

The Junction City Electric Railway, Light and Ice company of Junction City, Kan., has been incorporated, with $100,000. The company intends to construct an electric railway from Junction City to Fort Riley, and also to operate an electric-light plant. The directors are S. W. Pierce, W. W. Cook, J. K. Wright, F. E. Tyler, C. K. Raber and J. Humphrey.

Articles of incorporation were issued at Charleston, W. Va., recently, to the Wheeling Traction company, having a capital stock of $10,000. The incorporators are A. M. Snyder, F. A. Henry and A. R. Manning, all of Cleveland, Ohio. The company proposes to construct a street railway from Wheeling to Bridgeport, Bellaire and other towns in Ohio.

The Chicago City Railway company is about to do away with trailer cars, substituting for them 50 new closed motor cars and adopting a new schedule of running time. The change does away with the switching of trailers from the Wentworth avenue line at Washington street, and saves considerable time. It is expected thus to give a more satisfactory service to residents on the South Side.

The car sheds and electric plant of the Norfolk Railway and Lighting company, in Huntersville, a suburb of Norfolk, Va., were destroyed by fire on November 10th. Fifty-two cars and the electrical machinery were destroyed. The loss is estimated at $150,000, covered by insurance. The street-car system was badly crippled. A fuse from a car in the barn is supposed to have started the fire.

The local stock exchange of Washington, D. C., has listed the bonds of the Washington Traction and Electric company. The brokers have for some time desired to deal in these bonds, but it was locally understood that the traction company did not desire to have them listed. The amount of the issue is $13,000,000. Sixty-five was bid and 66 asked on the first day the bonds were listed.

The Oklahoma Telephone and Railway company has been incorporated to build an electric railway from Tecumseh, Okla., to the town of Coalgate, I. T., passing through the towns of Pauls Valley, Roff and Stonewall. The estimated length is 125 miles, and the cost will be $500,000. The electric plant for this road will furnish light for the towns on its lines. The capital stock is $1,000,000.

The Richmond (Va.) Passenger Railway and Power company recently reduced the fare on one of its lines to three cents and the reduction was profitable to the company. It is expected that the fares will be reduced soon on the Main street line to three tickets for 10 cents. It is thought probable that the Richmond Traction company will meet the cut and put its lines on the three-cent basis.

A Grand avenue motor car of St. Louis was entirely consumed by fire on November 10th, and several women and children who were passengers in the car had narrow escapes from death. Many were injured as they sought to escape the fire, which spread with great speed. The car was reduced to ashes before the firemen could reach it. The fire originated, apparently, from the blowing of a fuse under the front platform.

Articles of organization have been filed with the secretary of state by W. C. Lawrence and C. C. Pierce of Chicago and A. L. Hutchinson, W. H. Weed and E. H. Jones of Weyauwega, Wis., for forming a corporation to be known as the Wisconsin Midland Railway company. The present capital stock is $25,000, and the object of the company is to build an electric-railway line from Berlin to New London, Wis., via Weyauwega, and from Poysippi to Wautoma, via Pine River.

A company by the name of the Athens (Ohio), Nelsonville and Hocking Valley Traction company has been incorporated, under the laws of Ohio, with a capital of $100,000. This company has been organized for the purpose of constructing an electric road from Athens to Nelsonville, then to Murray City, the terminus of the road. The line will be 35 miles in length. The incorporators are Harley H. Haning, Henry W. Kaiser, Elmer C. Biddison, Robert E. Kling, T. A. Selz, S. R. Pine and H. C. Haning. The estimated cost of the line will be $600,000.

The third-rail system of the New York, New Haven and Hartford railroad, between Hartford and Bristol, has proved so successful that the line is to be extended to Waterbury in a few months. President J. M. Hall says that eventually some system of the third rail may be adopted for the main line of the consolidated road. Within a month the Warren and Bristol division of the New Haven road will be run by the trolley system for passenger traffic. The third-rail system was not deemed practical for this division, owing to the many shore towns along the route, and to the fact that the third rail might prove dangerous to persons crossing the tracks.

A bill for an accounting of the finances of the Seattle Traction company has been filed in the Superior Court of Chicago. The Seattle Electric Railway and Power company was organized in 1890, giving the Illinois Trust and Savings Bank a trust deed, which was supposed to cover all the real and personal property of the company. Later a reorganization was effected, the name changed and a trust deed given to the Central Trust company of New York, to guarantee another issue of bonds. The defendant in the suit is the reorganization committee. The chief complainant, L. H. Griffith, claims to be one of the largest holders of stock and bonds in the company. He wishes to find out how the reorganization committee has disposed of the capital raised by the issuance of the last bonds.

AUTOMOBILES.

The automobile fête at the Paris Exposition on November 8th attracted vast crowds, though five tickets were charged for admission. It was announced that all those who paid this price between the hours of one o'clock and three o'clock would receive tombola tickets for prizes which included automobiles. The tombola tickets were exhausted at 2:30 o'clock, whereupon the crowd became indignant. The lucky street sellers saw their opportunity, and quickly demanded 18 sous for tickets which had previously been selling for three.

Judge J. Coxe of the United States Circuit Court, Southern District of New York, has overruled the demurrer filed by the defendants in the case of the Electric Vehicle company and George B. Selden against the Winton Motor Carriage company, Percy Owen and A. W. Chamberlain. The suit involves letters patent No. 549,160, granted November 5, 1895, to George B. Selden, for a road vehicle, the motor being a liquid hydrocarbon gas engine of the compression type. The demurrer, which is now overruled, was based upon the broad proposition that the patent, on its face, was void for lack of patentability.

TELEGRAPH.

The business of the Western Telegraph company, Limited, of Brazil, has increased to such an extent that a third cable between Rio de Janeiro and Pernambuco has become indispensable. This is expected to be laid forthwith.

It is said that in Tacoma, Wash., girl messengers will deliver telegrams in future, as the truant officers have crippled the service of the District Messenger company by forcing the boys to attend school. For the present the girls will not be permitted to run errands or deliver parcels.

F. W. Inden, the manager of the Western Union's office on the Board of Trade in Duluth, Minn., is the inventor of an instrument for telegraphers' use whereby no one but the receiving operator can hear the incoming messages. The sounder is enclosed in a box, and from it projects a tube resembling a megaphone. The operator can hear with great clearness, but the sound cannot be heard a foot away from the mouth of the tube.

According to the report of the United States consul, E. N. Gunsaulus, at Pernambuco, Brazil, that city now takes first rank as a cable station in South America, and has lately made material improvements in its submarine telegraphic service. It has no less than 10 cable lines to various parts of the world. There were formerly three cable companies there, but recently two of them were consolidated. The present companies are the Western Telegraph company, Limited (English), and the South American Cable company.

At a conference held recently between the poles and wires committee of the City Council of Springfield, Mass., and the supervisors a petition of the Western Union and Postal Telegraph companies was considered for permission to place wires underground in certain streets which are paved. It was decided to give the companies permission to place

their wires in streets which are not paved with asphalt, the filling of the excavations and the relaying of the pavement to be done by the city at the expense of the companies.

News has been received in San Francisco direct from St. Michaels that the government cable has been laid between St. Michaels and Nome, and that the first message went over the wire on October 20th. When the Orixaba, which contained the cable, was wrecked near St. Michaels, it was reported that the cable could not be laid before next spring. The Alaska Commercial company, however, bought the wreck of the Orizaba for $1,250 and took out the cable. They loaded it on their steamer, the Sadie, and quickly laid it to Nome. The distance from Nome to St. Michaels is 120 miles.

The Cuba Submarine Telegraph company, an English corporation, seeks from the United States government compensation for damages done to its property during the late war. It claims $41,000 for injuries done to its cables cut by the American blockading fleet; in addition the United States is asked to induce the Cuban authorities to recognize as an American claim the subsidy of $10,000 a year granted the company by the Spanish government, $15,000 of which is now in arrears. The British company operates under a concession granted by Spain in 1868, which will expire in 1908. The company's system extends across the island from Havana to Cienfuegos, touching the southern coast towns of Casilda, Tunas, Jucaro, Santa Cruz, Manzanillo and Santiago.

PUBLICATIONS.

The Bullock Electric Manufacturing company, Cincinnati, Ohio, issues an attractive calendar card for November which contains a design typical of the month.

The American Electric company of St. Paul has prepared for the benefit of its customers an order book made in duplicate, which it will be pleased to send to anybody desiring such a book.

SOCIETIES AND SCHOOLS.

The students in the electrical courses of the University of Syracuse, N. Y., have organized an electrical engineer association. There are 24 charter members of the organization. A committee will consult with the chancellor and endeavor to arrange to take charge of the ceremony at the breaking of ground for the new engineering building. The society will hold monthly meetings, at which lectures will be given by members of the faculty.

Secretary H. E. Chubbuck of the Illinois State Electric association is sending to the members of the association a letter asking for assistance in obtaining new members and urging all to help make the coming meeting at Champaign, on November 27th, a successful one. A complete revised list of the members of the association is also being sent with the letter. Mr. Chubbuck's address is Quincy, Ill., and he will be glad to hear from any electric-lighting companies in the state that are not now members of the association.

ELECTRICAL SECURITIES.

The Brooklyn (N. Y.) Rapid Transit company reports $390,769 net earnings for September, an increase of $80,207 over the corresponding month last year, and $1,264,916 net since July 1st, an increase of $366,793 over the corresponding period last year.

A Chicago daily paper says that the Chicago City Railway company will probably retire its bonds which expire next July by putting out a new issue of stock. The bonds are 4½ per cent., and the amount outstanding is $4,619,500. The new stock will be offered at par to holders of the old shares and the proceeds of the sale will take up the bonds.

It is announced that the earnings of the Chicago Union Traction company in the month of October were $45,997 less than earnings in the corresponding month last year. The toal for the month was $633,043, which is less by $7,000 than the earnings in the month of September. It has recently been decided not to continue publication of the monthly returns of earnings. The decrease in October makes the total decrease for the four months of the present fiscal year, since July 1st, $50,662.

MISCELLANEOUS.

At a recent meeting of the city council of South Omaha, Neb., the ordinance concerning the underground electric conduit was voted down.

The Committee on City Property of Baltimore, Md., has reported favorably on the ordinance approving the scale of rentals to be charged by the electrical commission for space in the city conduits.

The Acme Harvester company of Pekin, Ill., is completing an electric-power plant, which will comprise 500 horsepower in generators and motors. Electricity is the sole power to be used in this plant, each machine being driven by an electric motor.

A Russian physician holds that the electric light is the least injurious to the eyes, and that candle light is the most harmful. He states that the oftener the lids are closed the greater the fatigue and consequent injury. As a result of his experiments was compiled the following table showing the number of times a minute the lids were closed with different illuminations: Candle light, 6.8; gas, 2.8; sun, 2.2; electric, 1.8.

During a recent rainstorm in Newark, N. J., a pedestrian carrying an umbrella brought the steel shaft in contact with the frame of an arc lamp. A hole was burned clear through the hand which held the umbrella, and the shock hurled the man several feet, leaving him in a half-conscious condition. When he recovered he found that the current had torn the shoe almost off his right foot, although it had done no other apparent damage except to his hand.

Recent advices from Paraguay state that American enterprise is making itself felt in Asuncion. An American syndicate has obtained concessions from the government, on very favorable terms, for the installation of an electric plant for lighting the city of Asuncion, and also for a line of electric cars for the same city. It is said that Asuncion is peculiarly well adapted for electric lighting, owing to the fact that coal cannot be imported there except at a price that renders the manufacture of gas impossible.

A new development in electrometallurgy comes from Switzerland. On account of the scarcity of coal, a concession has been obtained for the working of a bed of hematite ores in the Bernese Oberland, near Meiningen, in an electric smelter. An aerial ropeway will transport the ore to the village of Innert Kirchen, below the mountain ledges on which it is found. The waterpower of the River Aar, in the immediate vicinity, will be used for the generation of the current for the smelting, the concession allowing the development of 60,000 horsepower.

Electricity is to be used on a large ranch in Lower California this winter for a variety of purposes. A unique feature, it is said, will be the placing of several searchlights on the mountains overlooking the ranch, thus replacing the old system of night riding to prevent thieving. The tender of each light will be provided with a signal code, by which he can flash information to the other light tenders and anyone who may be out among the cattle. Each light tender will also have at hand a telephone connected with the main ranch. All parts of the ranch will be provided with telephone stations, and an electric-light plant will be installed at the ranch, all of the buildings being illuminated with electricity.

A new electrical heater is said to utilize for resistance thin films of precious metals, such as gold and platinum, deposited on an insulating base of mica, enamel or other suitable material. In this heater the preliminary waste of heat in the insulating bodies is made negligible. It is stated that resistances of 25,000 ohms can easily be obtained. Small-sized radiators are said to be sufficient for heating rooms of 700 to 900 cubic feet. A cheerful appearance is given to the heater when in operation by a ruby-tinted lamp which, arranged behind the mica strips, shines through and between them. Modifications of this stove are made to serve for the drying of ladies' hair, for foot-warmers, for the heating of plates in the dining room and many other purposes.

At a recent gathering in Boston one of the speakers made the following statement, as quoted in The Age of Steel: "The century received from its predecessors the horse, we bequeath the bicycle, the locomotive and automobile. We received the goose quill, and bequeath the typewriter; we received the scythe, we bequeath the mowing machine; we received the sickle, we bequeath the harvester; we received the hand printing press, we bequeath the Hoe cylinder press; * * * we received gunpowder, we bequeath notro-glycerin; we received the tallow-dip, we bequeath the arc light; we received the galvanic battery, we bequeath the dynamo; we received the flint-lock, we bequeath automatic firing Maxim guns; we received the sailing ship, we bequeath the steamship, the greyhound of the sea; we received the frigate Constitution, we bequeath the battleship Oregon; we received the beacon signal fire, we bequeath the telephone and wireless telegraphy; we received wood and stone for structures, we bequeath 20-storied skyscrapers of steel. Such are a few of the bequests of the nineteenth century to the twentieth."

The Revue Universelle des Mines has published an article by Mr. Léon Demaret of Mons, Belgium, a well-known expert, relative to the location of the different "gisements," or beds of copper ore, throughout the world. He sums the production of copper as follows: United States, 2,725,600 tons; Chili, Bolivia and Peru, 1,870,600 tons; Spain and Portugal, 1,189,000 tons, and England, 855,800 tons. The permanency or duration of the great "gisements," some of which have been worked for whole centuries, is remarkable. It is estimated that one-third of the world's production during this century has been furnished by mines opened before 1800. In 1898 four mines—the Anaconda, the Calumet, the Hecla and the Rio Tinto—extracted 28 per cent. of the total production of the globe, and eight mines have given 50 per cent. of that production.

TRADE NEWS.

The Magnetic Electric Brake company, Limited, has been incorporated at Toronto, Ont., to manufacture, sell and deal in magnetic-electric brakes. The capital stock is $500,000.

Electrical workers in Cleveland, Ohio, report trade excellent. In that city there are not enough electrical men to handle the work as fast as ordered, and men from outside are constantly coming in.

The Hirsch & Voth Manufacturing company of Milwaukee claims to have a 50-light dynamo which weighs only 214 pounds, including both pulley and base, or about half the weight of an ordinary 50-light machine. The greatest saving in weight lies in the method of winding.

The Treasury Department has awarded to the D'Olier Engineering company of Philadelphia, Pa., the contract for erecting a switchboard in the United States immigrant station at Ellis Island, New York harbor. The contract price is $3,293, and the work is to be completed within 40 days.

Ambitious mechanics who desire to obtain better positions and higher wages are asked to investigate the free-scholarship offer made by the American School of Correspondence, Boston, Mass. Situated in a large city which is a recognized educational and industrial center, this well-known correspondence school has many natural advantages in teaching the theory of the trades and engineering professions. It should be the ambition of every man to advance in his trade or profession. A mechanic with practical experimence, supplemented by theoretical education, can command a better position than a man without such an education. The result of long experience in teaching by mail shows that no other method so fully meets the requirements of men who have but little time for study.

BUSINESS.

The Electric Appliance company, Chicago, makes the claim that the Adams-Bagnall is the only arc lamp made especially to work on street-railway circuits. The lamps burn five in series on 500 volts, each lamp working independently of any other.

The American Electric company of St. Paul, Minn., reports a constantly increasing business in Sunbeam incandescent lamps. The fact that an exceedingly large stock of these lamps is carried in St. Paul is partly responsible for this business; the main reason, however, says the American company, is the exceptionally good quality of the new type Sunbeam lamps.

Hon. Emmett Tompkins, secretary of the Columbus, London and Springfield Railway company, was the successful candidate for Congress from the Columbus, Ohio, district. Mr. Tompkins served two terms in the state Legislature from Athens County, after having held a number of county offices, and when his time expired he opened a law office in Columbus. He has been successful as a professional and business man, and is well and favorably known throughout the state.

Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, report business very good. They are receiving many orders for their Gardner grinders, for finishing flat surfaces, a number of these machines being sent to manufacturers of electric motors for finishing brass parts. Many contracts have been closed on their Bonanza oil cups and celebrated Helmet oil, for use on agricultural machinery. They are very busy in the tap and die department at their factory, Beloit, Wis., and regard the outlook for future business as very bright. Their new 300-page illustrated catalogue is now ready for distribution, and will be sent free to any address.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 6, 1900.

661,049. Controlling End Play of Rotary Machines. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 31, 1900.

For producing end play of a rubbing surface with relation to a shaft, means are provided in this invention for periodically shifting one of the engaging parts at intervals corresponding to its period of natural oscillation. Means are also supplied for adjusting the periods of shifting action to maintain the part in oscillation, thereby effecting uniform wear.

661,085. Process of Making Accumulator Plates. Zdzislaw Stanecki, Lemberg, Austria-Hungary. Application filed November 9, 1899.

The process for the production of very hard and porous accumulator plates consists in forming a paste of lead oxides with distilled water, then shaping the paste into a slab, then slowly desiccating with repeated moistening with water, and after complete desiccation and incrustation with hydrate of lead, immersing the hardened slab in dilute sulphuric acid.

661,107. Carbon Pencil or Electrode for Electric Lights. John F. Sanders, Chicago, Ill., as-

signor to Harry Brown, Chicago, Ill. Application filed September 25, 1899.

A pair of carbon pencils or electrodes for electric lights vertically positioned, and each having a predetermined point of fusion, and each provided with an axial longitudinal hole, carries a non-fusible resistance separator of cylindrical form interposed between the carbon pencils or electrodes, both of the ends of which are beveled or pointed to enter the axial hole. This separator is properly centered longitudinally with the pencils and has a length coincident with the required spacing between the points of the carbon pencils, or electrodes, for producing a resistance proportionate to the point of fusion.

661,125. Electric Arc Lamp. John A. Heany, Philadelphia, Pa., assignor to the Teter-Heany Developing company, Philadelphia, Pa., and Charleston, W. Va. Application filed February 27, 1900.

In an electric arc lamp, an air-tight receptacle having walls of insulating material is supplied and a solenoid core inclosed in the receptacle. Means are shown for connecting the core directly with the source of electric energy. An upper carbon is inclosed in the receptacle and surrounded by the core and in electrical contact therewith. Mechanism is carried by the core for feeding the carbon, and a solenoid coil is located outside the walls of the receptacle and adapted to magnetically actuate the core during the feeding of the carbon.

661,126. Electric Arc Lamp. John A. Heany, Philadelphia, Pa., assignor to the Teter-Heany Developing company, Philadelphia, Pa., and Charleston, W. Va. Application filed February 27, 1900.

In an electric arc lamp is a cap to which the carbon is secured with a contact brush carried by the cap, and a stationary metallic tube connected with one pole of the source of electric energy. The carbon and its cap are adapted to slide freely in the tube, and the brush is adapted to make contact with the tube, while a solenoid core is shown surrounding the tube and adapted to slide up and down thereon. This core is adapted to operate the upper carbon in the tube.

661,127. Electrical Measuring Instrument. Frederick A. LaRoche, New York, N. Y. Application filed August 22, 1900.

An electrical measuring instrument is described comprising a magnetic field composed of a sectional permanent magnet having a yoke and permanent magnets secured to the yoke, pole pieces for the permanent magnet having opposing concave surfaces, and a spherical armature core therefor. A circular armature is adapted to rotate over the surface of the core between the pole pieces and the armature core, while the terminal conductors for the armature are differentially coiled about the shaft of the armature so as to neutralize the effects of the mutual and self induction of the currents carried by the terminal conductors.

661,196. Rheostat and Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing company of New Jersey. Application filed September 28, 1899.

In combination with an electromagnetic circuit-breaker and a resistance-controlling switch are shown means for short-circuiting a portion of the actuating coil during a prescribed movement of the resistance-controlling switch. A shunt to the actuating coil of the circuit-breaker is adapted to be brought into or out of circuit by the movement of the resistance-controlling switch.

661,222. Method of Governing Prime Movers. Ralph D. Mershon, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing company of New Jersey. Application filed November 6, 1899.

The method described is for regulating for constancy, or approximate constancy, the speed of an electric generator carrying a variable load whose variations are due to variations in electromotive force or current or both. It consists in causing the electromotive force and current to produce a magnetic resultant, which resultant and its variations are proportional to the power and variations of the power delivered by the generator, causing variations in such magnetic resultant to produce corresponding variations in the driving power applied to the generator, thereby producing an approximately constant speed on the part of the generator regardless of variations in the load.

661,224. Telephone Arm. Hugh McDonald, Williamsport, Pa. Application filed December 13, 1899.

The invention relates to a pivotally mounted arm for the support of the transmitter of a telephone consisting of a shell or casing having spindle holes and an elongated opening in the arm.

661,227. Commutator Collector. Henry G. Reist and Edward L. Aiken, Schenectady, N. Y., assignors to the General Electric company of New York. Application filed June 25, 1898.

The commutator described comprises a number of supporting rings, each ring being united integrally by a series of spokes, each of which spokes occupies a different radial position from any one of all the series, with a flange cast in one piece and divided by transverse cuts into a series of commutating segments which form a periphery of substantially uniform width of face. A method of manufacturing commutators is also described which consists in mounting supporting rings upon an arbor, covering the rings with insulating material, and then shrinking on contact rings over the insulation. (See cut.)

661,250. Process of Manufacturing Thin Homogeneous Plates. Luigi Lombardi, Turin, Italy. Application filed May 18, 1900.

The process described may be applied to the preparing of dielectric plates for high-tension condensers. It consists in spreading a fused insulating material upon a liquid bath, cooling until the fused insulating material is hardened and finally removing the hardened layer.

661,260. Transmitter. Richard H. Ferguson, Baltimore, Md. Application filed August 15, 1900.

This telephone transmitter comprises a casing having a screw-threaded lug projecting inwardly therefrom, and a chamber containing granules of carbon having one end flexibly closed and the opposite end screw-threaded upon its inner surface and screwed upon the lug. A block of carbon is fitted within the chamber and impinging against the lug, while a sound diaphragm is secured to the front end of the chamber, having its periphery clamped between the casing and front cap and insulated therefrom. A cap is fitted over and secured to the casing, and a mouthpiece secured to the cap.

661,292. Dynamo-electric Machine. John F. Kelly, Pittsfield, Mass. Application filed May 11, 1900.

A dynamo-electric machine is described having in combination a set of coils, carried by a magnetic body having a continuous polar surface of revolution of one polarity, at which both limbs of the coils are located. An inductor is mounted so as to be rotatable within the coils and to form magnetic paths from the polar surface, while means are provided for magnetizing the magnetic body so as to produce the polar surface, but not embracing the axis of the inductor.

661,306. Dynamo-electric Machine. Cummings C. Chesney, Pittsfield, Mass. Application filed May 11, 1900.

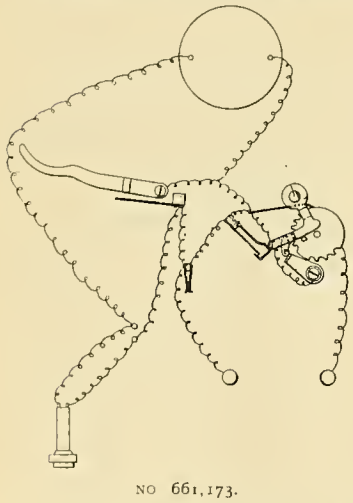
In this dynamo-electric machine are a magnetic body having a continuous surface of revolution and an inclosing shell, energizing coils giving the entire surface one definite polarity, with their axes substantially radial to the axis of revolution. The energizing coils are located between the shell and the magnetic body, while armature coils are shown having both limbs located at the continuous surface, and an inductor mounted so as to rotate before the coils.

665,335. Electromechanical Clutch. Russell E. Cryder, Chicago, Ill., assignor to Charles F. Chapman, Chicago, Ill. Application filed March 30, 1900.

This electro-mechanical clutch comprises a driving member, a driven member, an engaging device on one or the other of the members, and means on either of the members for mechanically moving the engaging device into position for engagement. An electromagnet for retaining the device in the engaging position is included in the device.

661,456. Electric Candlestick. Lawrence F. Lewis, New York, N. Y., assignor of one-half to Charles G. Till, New York, N. Y. Application filed January 25, 1900.

The invention relates to an electric candlestick in which are comprised a foot or base provided with a carrying ring, a cylindrical casing attached thereto, a dry primary battery within the casing, and an electric lamp mounted upon the top of the casing. Concealed conductors pass to the lamp and to contacts beneath the cylinder, and a concealed switch is provided with an operating extension projecting from beneath the cylinder.



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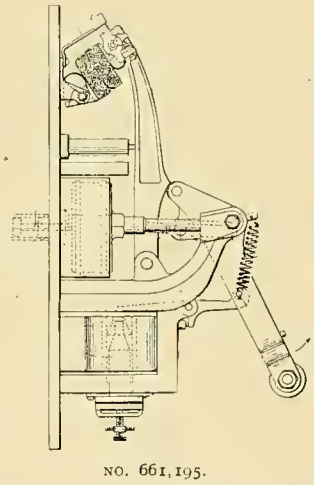

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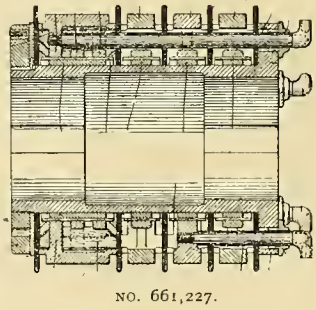

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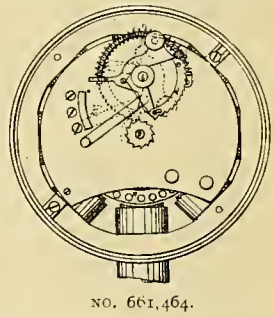

NO. 661,464.

661,165. Protecting Underground Metallic Structures from Effects of Electrolysis. Lucien I. Blake, Lawrence, Kan. Application filed August 9, 1900.

As a means for protecting an underground metallic structure from corrosion resulting from electrolytic action, a conducting coating is applied thereto, which is unaffected by electrolytic action and impervious to the products of such action. With the underground metallic structure is also described an electrically conducting medium surrounding the same, which is unaffected by electrolytic action and impervious to the products of such action. Or a coating composed of a non-ionizable conductor and a binding material impervious to fluids may be applied.

661,173. Electric Call or Signal Box. George G. Glenn and William S. Sullivan, Philadelphia, Pa. Application filed April 20, 1900.

In a call or signal box are combined a circuit interrupting wheel and a spring-actuated clockwork to rotate it a number of times. A stop is provided for normally preventing the circuit-interrupting wheel from making more than one revolution, and held in place by fusible solder, whereby under the application of excessive heat it will fall away, and the circuit-interrupting wheel may make a series of revolutions. An electric circuit including the circuit-interrupting wheel for transmitting signals to a distant place is included. (See cut.)

661,195. Automatic Magnetic Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing company of New Jersey. Application filed July 22, 1899.

An automatic magnetic circuit-breaker is described embracing the combination of a main switch, a hand lever for operating the movable contact of the same, a supplemental switch in shunt with the main switch, and a pivoted arm carrying the movable contact of the shunt switch. The hand lever is adapted to act upon the pivoted arm by cam engagement to close the shunt switch the hand lever being connected to the movable contact of the main switch with a certain amount of play in order to secure the closing of the shunt switch before that of the main switch, and the opening of the main switch before that of the shunt switch. (See cut.)

661,228. Adjusting Brush Holders. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed March 22, 1900.

The means for adjusting the brush-holders of electric machines comprise a split tubular support adapted to receive the brush-holder, and means for clamping the split portions together about the holder.

661,241. Thermal Cut-out or Fuse. Otto Feuerlein, Charlottenburg, Germany, assignor to the Siemens & Halske Electric company, Chicago, Ill. Application filed September 9, 1899.

The inventor describes main and supplemental fuses and a casing forming the walls of a hollow structure, and having a partition dividing its interior into two chambers, the main fuse being contained in one chamber and the supplemental fuse in the other, the fuses being included in parallel relation with each other in the circuit. The chamber for the supplemental device is constructed so as to permit the latter to be seen.

661,243. Lamp Guard. Emil Gahlau, Detroit, Mich., assignor to William C. Clark, Detroit, Mich. Application filed February 19, 1900.

The lamp guard comprises a body and arms hinged thereto adapted to extend upon opposite sides of the lamp socket, each of the arms consisting of a wire loop having longitudinal bearing portions and a connecting segmental portion. Semicircular locking segments are hinged to the longitudinal portions at one side of each arm, having hooks at their free ends adapted to engage with the corresponding longitudinal portions of the opposite arms, and to clamp over the intermediate longitudinal portions.

661,244. Electric Cable. William M. Habirshaw, New York, N. Y. Application filed September 26, 1900.

The subject of this patent is an insulated cable composed of a plurality of electric conductors, each inclosed in a coating of paper laid together with a jute filling, and a coating or layer of vulcanizable rubber surrounding the jute filling, the whole being taped and braided.

661,458. Current Distributer for Electric Railways. Heinrich Schramm, Nuremberg, Germany, assignor to Otto Herrmann, New York, N. Y. Application filed May 9, 1900.

A current distributer for electric railways is described, by which a current can be taken from the contact button by sliding contact as long as the carriage is above the distributer in question. The device is characterized by a horizontal indicator lever, provided with a contact piece at one end, engaging loosely with two vertical pivoted arms and actuated by two electromagnets located on the carriage, in such manner that through one of the electromagnets the circuit to the contact piece of the horizontal lever is closed, and through the second one, interrupted.

661,464. Alternating-current Motor. Wales Aldrich and Henry E. Borger, Dayton, Ohio, assignors to D. L. Bates & Brother, Dayton, Ohio. Application filed April 30, 1900.

With an alternating-current electric motor are combined a mechanical starting device, consisting of a ratchet wheel geared to the armature shaft, a pivotal frame mounted adjacent to the armature shaft, and a segmental ratchet yieldingly mounted on the pivotal frame and adapted to gear with the ratchet wheel on the armature shaft. (See cut.)

661,465. Electrical Switch. Nathan Bassett, Philadelphia, Pa., assignor to the Globe Telephone Manufacturing company, Philadelphia, Pa. Application filed February 8, 1900.

An electrical switch of the character described has a sliding or movable circuit-closer arranged in a circuit, and provided with a series of contact lugs. A lever is shown for actuating or moving the circuit-closer and adapted to be weighted at one end and a spring contact. This contact is normally movable in line with the contact lugs, and connected up in circuit with the circuit-closer, and adapted to spring or snap past the contact lugs, and operatively engage the lugs upon its return or recoil movement. Means are also provided to engage the spring contact with the contact lugs.

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Electrical Installation of the Milwaukee Harvester Company.

Electrical power-transmission systems for the operation of factories from a central power plant are by no means uncommon nowadays. The use of direct current for such installations is perhaps the more prevalent, especially where the distances of transmission are not long and where variable-speed motors are required, but there is a growing tendency to use alternating-current systems for factory operation, not only because the motors are more simple in construction and lack the commutator, but also on account of the saving in copper in carrying the circuits to distant buildings and distribution points. A good example of an alternating-current installation is that recently installed by the Milwaukee Harvester company at its works in Milwaukee. The question of operating its factory by electricity came up when it was decided to enlarge the plant a few months ago, and with the recent completion of the new buildings there was also finished a new central power house. The choice between a three-phase and a two-phase alternating-current system was decided in favor of the latter, because the company already had on hand a two-phase generator and a few two-phase motors. The alternating-current system was preferred because the dust in the wood shops necessitated the use of sparkless motors.

The plant of the Milwaukee Harvester company is situated on Park street in the western part of the city, and the grounds cover 20 acres. The new brick buildings recently constructed include a two-story foundry, 400 feet long and 100 feet wide, a general machine and wood-shop building, five stories in height and 212 by 80 feet in ground dimensions, and the power station. The first two of the buildings named and the stack of the power house are shown in Fig. 4, on page 330. Other buildings on the grounds are several brick factory buildings, a blacksmith shop, the old foundry, warehouses, etc. An elaborate plan is being worked out by the company for the rebuilding of most of the old buildings and the erection of many new ones, and the structures recently finished are a part of the general scheme. In the buildings now erected there is an aggregate of about 10 acres in floor space.

The Milwaukee Harvester company manufactures grain and grass-cutting machinery of every description, the principal types being self-binders, harvesters, mowers and reapers. As the company does no outside work, all the processes of manufacture are specialized for particular lines of work, and naturally the buildings are constructed and the machinery installed so as to minimize the labor and increase the output of the works. The plant is now about to start for its working season, which usually lasts from 10 to 10½ months, and during this time 1,400 men will be employed by the company. With its recent improvements, the works will have a capacity for turning out about 80,000 machines in a season.

Power Plant.

The power plant of the harvester works is located centrally with respect to the distribution of the load on the electrical and steam-transmission lines, and consists of two separate brick buildings, with the stack between. The larger of these buildings is 65 by 120 feet on the ground, and is occupied solely as an engine room. The boilers are located in the other building, which is 120 feet long by 50 feet in width. A good view of the engine room is given in Fig. 1. The electrical generating machinery consists of two belted units and one direct-connected unit. The two large engines are of the simple Corliss type, with cylinders 26 by 48 inches, and were manufactured by the Nordberg Manufacturing company of Milwaukee. Each engine is belted to a 250-kilowatt, two-phase, Westinghouse alternator, operated at a speed of 450 revolutions a minute and delivering current at 440 volts. The 125-volt exciters for the alternators are belted from the main generator shafts. The third unit consists of a 75-kilowatt, two-phase alternator, directly driven by a Ball & Wood simple engine. The reason that belted machines were used for the two large units was because the company already had on hand the two Corliss engines. Provision is made in the engine room for the addition of a large 1,000-horsepower, compound-condensing, direct-connected unit when it is needed. The engines are designed for operation on 125 pounds of steam pressure, although at present the pressure is but 80 pounds. In the summer the plant will

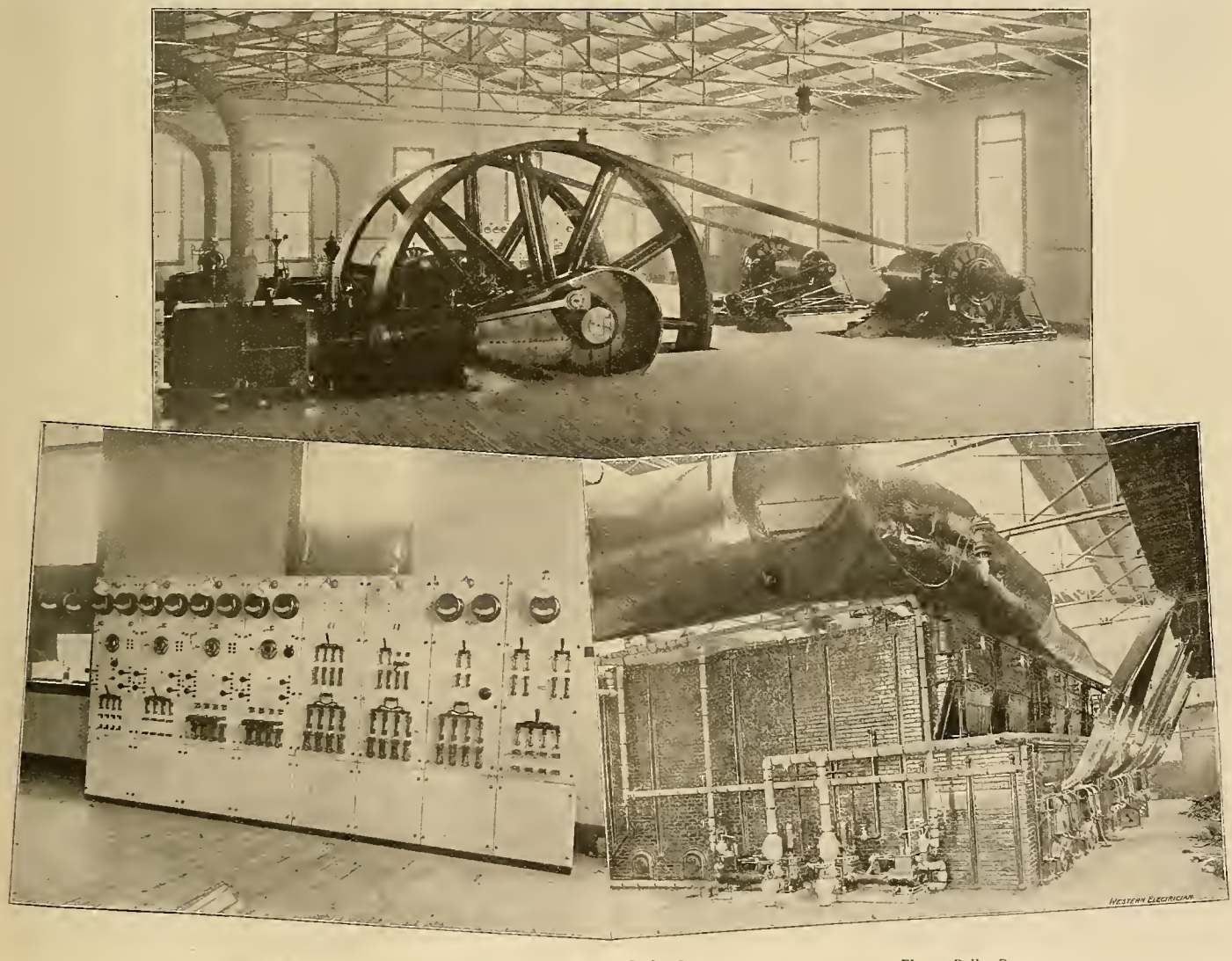

Fig. 2. Main Switchboard. Fig. 1. Engine Room. Fig. 3. Boiler Room.

ELECTRICAL INSTALLATION OF THE MILWAUKEE HARVESTER COMPANY.

be run condensing, but will be operated non-condensing in cold weather, so that the exhaust steam can be utilized for heating the different buildings.

Fig. 3 shows the six 100-horsepower boilers installed in the boiler room. These are of the fire-tubular type and are equipped with extension furnaces, manufactured by the Butman Boiler Furnace company of Chicago. The coal (washed screenings) is fed to the boilers by pendulum chutes from overhead steel bins. There is space in the boiler room for the addition of nearly as much boiler capacity as is already installed and the piping, headers and breeching are already in place for these boilers. The brick stack is 235 feet high, and has a flue 84 inches in diameter. A Cookson open feed-water heater is installed in the boiler room. The steam piping, which was installed by S. J. McLeod of Chicago, is well designed and carefully erected, with long bends to allow for expansion and contraction. It is all covered with magnesia sectional coverings, made by the Keasbey & Mattison company, and is such as is used on ships of the United States navy.

Stilwell-Bierce & Smith-Vaile condensers are used in the plant, and the condensing water is taken from one of the city's flushing tunnels, being returned to the tunnel at a distance of 200 feet downstream. In the engine room are two fire pumps, one of which is kept in operation constantly to supply the water service on the grounds. These pumps draw their water from a large cistern near the foundry, which is fed from the city water supply. Two air compressors in the engine room supply a compressed-air system, extending to all the larger buildings, for the operation of pneumatic hoists. A Siegrist oil-pumping apparatus, shown in Fig. 5, supplies the engines with oil. There are in this system two small steam pumps, one pumping cylinder oil and one engine or lubricating oil, and they force the oil through pipes under the floor to the bearings on the engines. Special lubricators distribute the oil, which (except the cylinder oil) is then collected, drained into the basement, filtered and is ready for use again. The oiling system was installed by the Siegrist Lubricator company of St. Louis.

The switchboard (Fig. 2) consists of eight panels of white marble. The four panels on the left are generator panels, one being reserved for the additional unit to be installed. On the left side of the switchboard, hung on a swinging frame, are two voltmeters to record the voltages of the two phases. The board is equipped with two integrating wattmeters, and all the circuits are provided with enclosed fuses. Three feeder circuits lead from the board to the foundry, machinery building and old factory building, respectively. Westinghouse instruments are used throughout on the board.

Wiring and Lighting

A brick tunnel, constructed in a horseshoe shape, about six feet in height and five feet wide at the widest part, runs east and west from the power house, ending at the foundry on the west and the old factory building on the east. The total length of the tunnel is about 425 feet. The wires leading from the switchboard are carried through this tunnel and also exhaust-steam pipes for heating, return steam pipes, pipes for live steam, compressed air, water and gas, and telephone and fire-signal wires. Branches lead from the tunnel to the different buildings and carry the necessary pipes and wires.

The four-wire, two-phase system is used, the frequency of the current being 60 cycles a second. The motors are operated on the two phases at 440 volts, while the incandescent lights are operated single phase after the current is transformed down to 110 volts. There are seven transformers in different parts of the ground, ranging in capacity from 10 to 50 kilowatts. They are supported on the outside of the buildings, the leads being placed in iron-armored conduit. There are three different systems of arc lighting used about the plant. In the foundry room there are 50 arcs operated directly on the 440-volt circuit, five lamps being placed in series. Each of these lamps is provided with a compensating device, so one or more lamps can be cut out when necessary. For the outdoor illumination there are scattered over the grounds 22 arc lamps on a 25-lamp series circuit. A 20-kilowatt step-up transformer and regulator for this service are placed in the power house. The third system comprises about 100 arc lamps in the different buildings, operated in parallel from the 110-volt transformer circuits. These arc lamps are of the type manufactured by the General Incandescent Arc Light company. About 700 110-volt incandescent lamps are installed in the buildings.

Machine Operation and Motor Service.

The motor equipment comprises two-phase induction motors, ranging in size from five to 75 horsepower and aggregating about 800 horsepower. Most of the motors are belted to line shafting in the different departments of the plant. A 75-horsepower motor operates a Root blower for the cupolas in the annex to the foundry. This foundry building, shown at the left in Fig. 4, is of unusual design and merits a short description. As mentioned above, the building is 400 feet long and 100 feet wide. The first or ground floor is divided up into a number of different rooms for cleaning, filing, grinding and chipping the castings, for storage bins for stock, for pattern storage, and various other purposes. One room contains 24 rattlers, arranged in four rows of six each, which are used to clean the castings. A partial view of this room and of the two 50-horsepower motors driving the rattlers may be seen in Fig. 6. A motor-driven fan operates an air-blast system, which collects the dust from the rattlers and forces the air through a filter and into the atmosphere outside the building.

The main, or second, floor of the foundry is entirely devoted to one large room, with a truss roof. It has a heavy wooden floor, covered with two feet of dry sand, upon which the molding and casting is done. Three steel trolley tracks run the entire length of the building and on to the elevator and over to the cupolas. By means of these tracks, which were designed by the superintendent of the company, H. F. Crandall, the heavy crane ladles holding the molten iron can be quickly and easily transported from the cupolas to the molds, and the castings can be carried to the elevators. Interlocking switching devices are provided, which prevent the trolley wheels from running off at junction points and switches. At the south end of the room on each side of the main aisle are 12 pneumatic hoists for handling the heavy patterns and castings. Each of these hoists has a longitudinal and a transverse motion, thus making them traveling cranes.

An annex to the foundry adjoins the building on the west. It is 50 by 100 feet in size and three stories high. Two 60-inch cupolas, made by the Whiting Foundry Equipment company of Harvey, Ill., are on the second floor of this wing, the charging floor being in the third story. The core ovens, which were designed by the Milwaukee Harvester company, are provided with special trolley arrangements for drawing out the core shelves or slides. These ovens and the core room are on the second floor. In the first story are to be fitted shower baths for the molders. It is the intention of the company eventually to extend the foundry 200 feet, thus making one great room 600 feet long, with the cupolas in the center.

More than half of the new machinery building is given up to woodworking machinery. The machines include the ordinary saws, planers, shapers, etc., for woodworking, and also some special apparatus, such as multiple-boring machines. In the east end of the building are machine and tool rooms, equipped with drills, planers, lathes, milling machines, etc., designed for doing a lot of duplicate work. On the fifth floor are the pattern shop, drafting room and the company's private photograph gallery, where photographs are taken for catalogue work. The machines are all belted to shafts, which in turn are driven by motors. A 75-horsepower motor operates a shaving and dust collector that carries the refuse from the wood shops to the boiler room. All the motors, which are of the Westinghouse manufacture, are equipped with pilot lights, four in series, on the 440-volt circuits, which serve the double purpose of lighting up the

FIG. 4. ELECTRICAL INSTALLATION OF THE MILWAUKEE HARVESTER COMPANY.—FOUNDRY AND MACHINERY BUILDINGS.

Fig. 6. Motors Driving Rattlers.

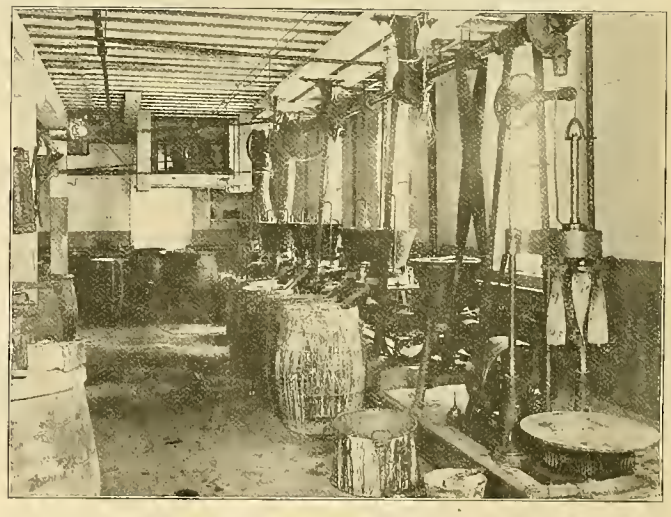

Fig. 8. Motor Driving Paint Mills.

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motors and surroundings and of notifying the motor tender when the current is on.

The most interesting use to which the induction motors are put is to drive pumps for hydraulic elevators. There are five of these elevators, one in the new machinery building, one in a warehouse and three in the foundry. The first two are driven by 20 and 15-horsepower motors, respectively, while the foundry elevators are operated from one 20-horsepower motor, shown in Fig. 7. The motor is direct-connected to a Quinby rotary pump, which takes water from the open tank on the right and

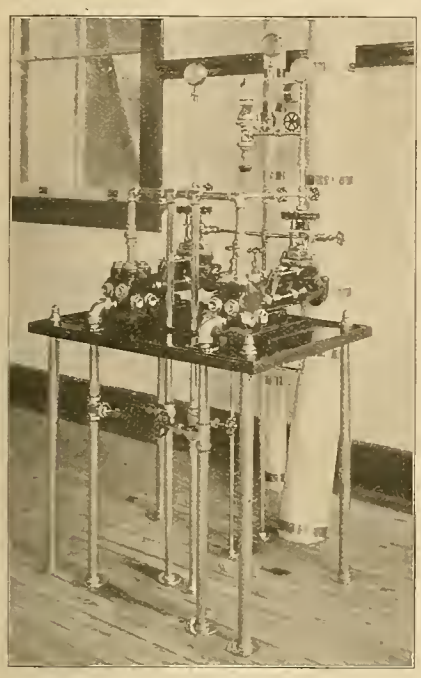


FIG. 5. ELECTRICAL INSTALLATION OF THE MILWAUKEE HARVESTER COMPANY.—LUBRICATING APPARATUS.

forces it into the compression tank on the left. The elevators, which were installed by the A. Kieckhefer Elevator company of Milwaukee, are of the direct-lift, hydraulic-ram type, and are operated by water from the compression tank under about 100 pounds' pressure. They have a capacity of 4,000 pounds each, and will travel 170 feet a minute under average load and 125 feet a minute under full load. The foundry elevators serve the cupolas and the casting floor. The elevator in the machinery building runs to the fifth floor and has a lift of 55 feet.

Of the other motors installed, there are five in the blacksmith shop and one in the paint mill, shown in Fig. 8. This latter motor is of 12 horse-

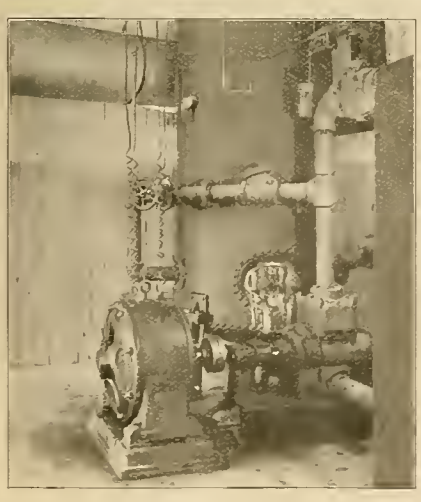


FIG. 7. ELECTRICAL INSTALLATION OF THE MILWAUKEE HARVESTER COMPANY.—ELECTRO-HYDRAULIC ELEVATOR MECHANISM.

power and drives nine paint mills and a mixer, as shown in the illustration, and some large paint mixers on the floor above.

Other Details.

All of the buildings on the grounds are heated from the central power house, the pipes running through the tunnels as far as they extend. The two new buildings are heated by the blast system, exhaust steam being used for heating the coils. The heating system was designed with liberal sizes for the pipes, so that the entire plant is heated with not to exceed one pound back pressure, no vacuum system being used.

A complete telephone system, with 35 instruments, connects the different departments and buildings and also the residences of some of the officers of the company with the main office, where a 50-drop desk switchboard is located. The system was installed by the Stromberg-Carlson Telephone Manufacturing company of Chicago. The works are also connected with the Milwaukee public telephone lines. An independent fire-alarm system is provided on the grounds. There are 100 boxes or stations, and they are all connected to the annunciator board in the power house. The Western Electric company installed the system. Special attention was given in the erection of the new buildings to cut down the fire risk, and consequently the electric wiring has been carefully installed. To provide additional safety, an automatic sprinkler system has been placed in all the buildings.

G. H. Schulte, vice-president and general manager of the Milwaukee Harvester company, has given his personal supervision to the erection of this fine power plant, which was designed by Charles G. Armstrong of Chicago, the consulting engineer of the company. The motors, generators and switchboard were furnished by the Westinghouse Electric and Manufacturing company, while the wiring contract was executed by George Rohn of Milwaukee.

Incandescent "Lighting Board."

The London correspondent of the Western Electrician, in a letter dated October 30th and published last week, spoke of the recent exhibition in London of "lighting boards," by which incandescent lamps can be placed and operated in any position on the "board," which is, of course, especially prepared for the purpose. The invention is an interesting one and may be used for theater or show-case lighting, for sign work or for other purposes, if it prove durable and safe in practice and not prohibitive in expense. The accompanying illustrations, which

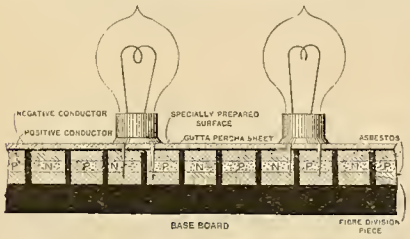


Fig. 1. Section.

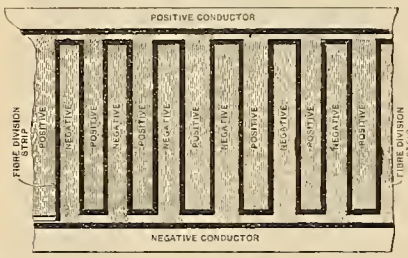


Fig. 2. Plan.

INCANDESCENT "LIGHTING BOARD."

originally appeared in The Engineer of London, are therefore reproduced.

Speaking generally, the system consists in employing surfaces under which positive and negative conductors, composed of a large number of fine wires, are interlaced, while being insulated from one another. Incandescent lamps with their terminals consisting of spikes are thrust into these surfaces, and the spikes, penetrating through to the conductors, allow current to pass to the filaments of the lamps. The cuts show a part section and part plan of one of the lighting boards. They are only sketches, not drawn to scale, but they show quite plainly the construction of the boards. On a base-board are fastened strips of specially prepared vulcanized fiber placed on edge. These are about one-sixteenth inch thick, and, as will be seen, vulcanized-fiber pieces are fitted to alternate ends of the channels formed by the strip, the result being that a long zigzag of fiber is formed. This construction is easily understood from Fig. 2, which shows a plan of the board during construction. At the bottom of each channel, and along the spaces at each end which are to be occupied by the positive and negative main conductors, is laid sheet asbestos. The conductors are laid on the top of the asbestos. They consist of a large number of fine copper wires bunched together, and connections are led from these down the channels marked positive and negative, respectively. The bunching is so arranged that the cross-section of the conductor is diminished by just the amount of wire which is taken down each channel. The result is that the main conductors gradually taper toward their ends in exact proportion to the amount of current likely to be taken from them. Fig. 2 shows part of the board in course of construction. When all the wires have been laid properly flat and fill up the channels from side to side, further strips of asbestos are placed over them and rammed down hard, the resulting construction being shown in cross-section in Fig. 1. The whole board is then carefully dried and varnished with special india-rubber solution, the surface being then covered with a sheet of guttapercha. Further, india-rubber solution is then applied, and the surface composition then put on. This consists of powdered cork, special india-rubber solution and other ingredients, and it is pressed down, making a fine dark-brown surface, which can be readily pierced. The resultant board is a network of positive and negative conductors, separated only by thin strips of insulating material, so that a lamp provided with spikes for terminals can hardly be pressed into the surface at any point without making a contact through itself between a positive and a negative conductor. If, by any chance, a lamp spike should, in being pushed into the board, encounter one of the upright division pieces, it is only necessary to move it one-sixteenth inch or so, and the division piece is avoided and the lamp can be pushed home. By this means any point of a board can be illuminated by the simple expedient of sticking in a lamp.

In places where there is vibration or where the lamps are to hang downward, special clips provided with flanges are used, which grip the lamp caps and have their flanges turned into grooves at the edges of the strips. A further modification, specially adapted for temporary lighting and decoration, is by means of twin flexible cable and special clips. The company exploiting the device hopes soon to be able to put on the market this flexible cable with lamps so clipped on to it that the whole can be inserted in water.

"Two questions naturally arose in connection with the use of this system," says The Engineer. "They were these—how long would the surfaces last, and how does the insulation vary with use? We were informed as regards the first question that, taking a shop showcase where continual changes were always being made, for an example, it was estimated that the surface would last for some two years, and would cost a very small sum for being renewed. The length of time would necessarily depend on the amount of use. As to insulation, we were told that the holes formed by the lamp spikes apparently closed up, and the insulation did not become appreciably reduced. For instance, a certain board with an insulation resistance between positive and negative of eight megohms, and in which a lamp had been pressed 200 times in different places, had been exposed to the weather on a roof for months. At the end of this length of time the insulation resistance had remained unchanged. As regards the contact obtained, we were shown a board into which two staples had been driven and a 100-ampere fuse connected between them. The fuse had been blown, and there was no indication at the points where the staples had made contact with the conductors that any current had passed. There was no sign of sparking or fusing. We may mention that the carrying capacity of the conductors in the boards is calculated with reference to the largest number of lamps which can possibly be stuck into them."

Board of Trade Quotations

Negotiations for a settlement of the differences existing between the Chicago Board of Trade and the Postal and Western Union Telegraph companies have received a setback. Until last week the outlook for a satisfactory agreement concerning the delivery to the telegraph companies of the board's stock quotations was bright. E. J. Nally, acting for the Postal, and Col. R. C. Clowry, representing the Western Union, had outlined a basis of settlement, and this was agreed to by the officers of the companies in New York. It was determined, however, not to abandon the local field to the Cleveland Telegraph company, and it was on this vital point that agreement could not be reached with the Board of Trade. The Cleveland Telegraph company now affords the only ticker service over which Board of Trade quotations are distributed in Chicago, and its policy is controlled by the Board of Trade.

In the conference held last week in New York, with President W. S. Warren of the Board of Trade, the telegraph companies demanded the right to enter the local ticker field in Chicago. As this field, according to the view of the board, is not large enough to maintain two ticker companies, it would mean the extinction of the Cleveland Telegraph company and the loss of the position of independence which its position gives the Board of Trade. The latest offer of the old telegraph companies concedes all that the exchange demanded when the quotation war broke out, as to withholding quotations from bucket shops, but refuses to distribute them at all unless given an equal right in the Chicago district. Apropos of this question, it is reported that the Minneapolis Chamber of Commerce has decided to reject the proposition to ally itself with the Exchange Telegraph company, which is projected by the Chicago Board of Trade. The vote was 55 for, to 169 against, the proposition.

Manufacture of Rubber in the Philippines.

By G. D. Rice.

There has been, as is well known to electrical men, indication of shortage in the rubber and guttapercha supply for the last few years, owing to the increased demand for this material in the electrical field and by makers of pneumatic and solid tires for vehicles and manufacturers of rubber boots and shoes. The fact that shortages have existed in this direction has led to the experimenting with substitutes of all kinds, and to-day we have in the field several classes of artificial rubber and guttapercha. This artificial material has been so well made in some instances that it has answered the purpose well for covering wires and for the formation of many of the parts and articles used in electrical appliances. In most instances there is a proportion of the genuine article used in combination with products of other kinds. In the Philippines there is an abundance of the genuine article, but as many of the rubber works handle the product, other articles than guttapercha are employed. One of the rubber works visited by your correspondent had an outfit for the making of rubber.

The guttapercha trees grow in large numbers on the islands of the archipelago, and one might suppose that it would be best to manufacture only the genuine article, but it has been found that the guttapercha is improved from several points of view by the addition to it of gum ammoniac, glue and gelatine, all of which products are found on the islands in large quantities. The process of melting

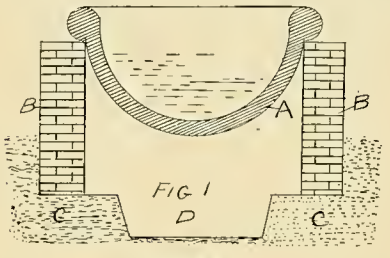
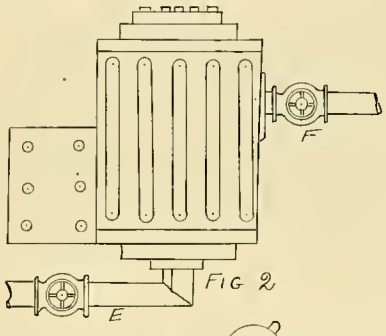


FIG 1



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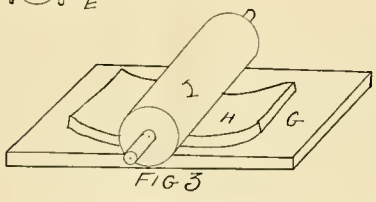
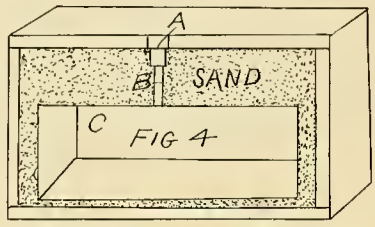


FIG 3

Devices Used by the Natives.



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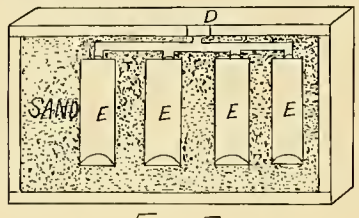

FIG 5

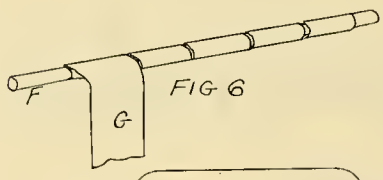

FIG 6

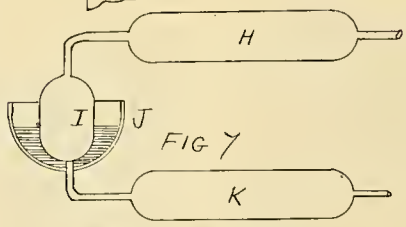

FIG 7

Molds and Testing Apparatus.

MANUFACTURE OF RUBBER IN THE PHILIPPINES.

the compositions is by means of large kettles, usually the old boiling kettles formerly employed in the sugar mills. In fact, nearly all of the machinery of the rubber works of these islands appears to have been taken out of old-time sugar mills, and one recognizes the engines, tanks, vats, compressors, kettles, boilers and plant in general, besides the pumps.

These pumps are constructed of wood, and are arranged to raise the liquids to the proper level for conveying them to other points through bamboo pipes, a very interesting sample of the ingenuity of native carpenters, for they make the pipes so as to be practically watertight and serviceable. India-rubber is made in several ways. At some places they use considerable of the genuine article, in combination with white lead, glycerine, glue, tallow and gelatine, while in others the natives employ compositions of another description.

The process of manufacture, however, seems to be nearly alike in most places. The equipment seen in the majority of works was very like that shown in the accompanying illustrations. In the first place, they have the reducing and melting kettle (A) fixed up in masonry, as shown in Fig. 1. In this kettle they boil the various ingredients that enter into the manufacture of guttapercha or india-rubber. In some places which I inspected they seemed to have only one kettle, and the work was necessarily slow. In other works they had several of the kettles, and all of them were in use at the same time, so as to melt the glue, for example, in one kettle while the other ingredients were in process of melting in other kettles.

The glue used on these islands does not look much like glue in its raw condition. The natives manufacture it from the hoofs of the caribao mainly. There is not much of the desirable glutinous portion in these hoofs, but by hard work the natives manage to get a sort of a glue in this manner.

The drawing of the kettle shown is typical of the majority of those used, although in some of them the cavity for the fireplace is smaller. The cavity for the fuel to be burned is at (D), and here the wood or coal used for heating the contents of the kettle is put and ignited. The earth at (C), (C) forms sides for the fireplace. The walls (B), (B) are well laid up and make good sides.

At one of the works where the natives seemed to be more advanced than at others, I noticed that they had quite an ingenious contrivance for melting the ingredients. This is shown in Fig. 2. It consists of a cylinder taken from one of the engines of a sugar mill, the other portions of the engine having gotten out of gear. The cylinder was opened at the top by means of inserting a new head for the purpose of cleaning out. The ingredients to be treated are let in through the pipe (F) and drawn out through the head. The steam for the purpose of heating and boiling the contents of the cylinder is admitted through pipe (E), circulating the casing of the cylinder. The native workmen seemed to get good results by using this type of device.

After the contents of the kettles or cylinders are removed they are permitted to stand for a time in vats, during which interval they are mixed as desired and compounded in accordance with the needs of the combination. Then the partly hardened stock is rolled out on a stone tablet, as in Fig. 3. The sheet of material is cut into a convenient form of a slab (H), and is repeatedly rolled by the hardwood roller (I). Considerable pressure is applied, and often the strongest of the men about the works are employed in this work. They can roll the products of a good-sized factory in a small proportion of the time consumed in the making of the stock.

After the process of rolling is finished, the material is again melted for the purpose of casting it into the desired forms. The same kettles are used for the melting, and when in a proper state for running into molds the rubber is admitted into the casting devices, one of which is shown in Fig. 4. This mold is made with sand, pretty much after the plan of the regular mold employed in the casting of iron or other metals. The box is made of wood and set up in a frame for convenience, while the sand is put in and molded according to the kind of form wanted. The sand has to be very fine, and in some cases the sand itself is covered with a surfacing, which fills all pores and makes the facing as smooth as glass.

When the molds are ready, and in some places they use as many as 100 of the molds, the molten material is poured in through the opening (A) to the leader (B), whence it passes down into the mold (C). The stock is permitted to remain in the mold for about six hours, after which it is removed in cube form, and in this shape is shipped to Spain, China and other countries. Americans who have been here during the last year or two have been looking into this rubber-working idea of the natives, and think that by introducing American machinery and American methods that the works can be made to be quite profitable.

Some of the orders for the rubber or guttapercha stock call for the pieces to be furnished in cylindrical shape, in which case the mold is constructed on the plan of that shown in Fig. 5, in which a series of chambers are used. In this mold the box portion is made of boards like the first, and instead of one large cube being arranged for the contents of the mold, is divided into a series of cylindrical shapes, as represented by (E), (E), (E), (E). The portions are connected by means of a runner, just as the feed for molten metal is arranged for in metal molds. The molten material is run into the opening at (D), and this opening leads into the runner, from whence the liquid is distributed throughout the set of molds.

The operations of rubber manufacture in the Philippines are not of recent origin, as some of the works visited by the writer indicated long years of service. But the work of rubber-making has never been carried on to any great extent. The demand for rubber in the islands has amounted to but very little each year, as there are no rubber-boot and shoe factories or other works to consume rubber. There always have been, however, a number of boot and shoe makers in all of the cities and towns, and these men have used considerable rubber in the making of rubbers, which they sew up. They use a wood or rawhide or leather sole, and the sides of the boot or shoe are of the native sheet rubber. The rubber makers have found a good market for the rubber products from the boot and shoe makers, and then Japan has taken large amounts of the rubber. The rubber works of Japan melt the rubber over again and combine it with that secured from other sources.

Spain has always taken considerable of the rubber products of the Philippines. Since the Americans arrived on the islands and have begun to establish electric lights, trolley roads, and, in fact, everything that one may find in an up-to-date country, the demand for rubber locally has been quite an item. The military signal corps wants considerable rubber in its work, and purchases that of local manufacture, if it is suitable. There are a number of electric-light lines in full operation and using rubber, while within a few months the proposed trolley lines for Manila and vicinity and Iloilo and surrounding country will be in operation, and rubber will be needed by them. In Fig. 6 is shown the way that the natives wind the wires with rubber in this country. The wire itself is marked (F), and the rubber is wound over and over, spirally, like (G). They do not seem to have any means for casting the insulation or for drawing the insulation on the wire.

The native rubber workers are very poorly equipped with the necessary devices for carrying on the work of rubber manufacture, and for that reason the grade of rubber produced is not up to the standard, so far as the finish is concerned. It lacks elasticity and the general desirable features required in rubber for electrical purposes, or, in fact, for vehicle tires. But the trouble is wholly due to the way the natives carry on the work, and with an American foreman the trouble could be averted and the products of the Philippine shops made useful for electrical concerns in any part of the world.

The device shown in Fig. 7 is one for testing rubber products, the glass cylinders (H) and (K) receiving the melted products before and after application. The central globe (I) is surrounded by hot water in a dish (J), and the heat from this water dissolves the rubber or other material desired to be tested. The melting point of the rubber is secured by the maintaining of the water at various temperatures.

Death of F. W. Royce.

Frederick W. Royce, well known as an inventor, all-around electrical man and veteran telegraph operator, was stricken with apoplexy in front of the city postoffice in Washington, D. C., on November 16th, and shortly after died as the result of the stroke. Mr. Royce was 61 years of age and a native of Delaware. He was one of the first to send a message by the old printing-telegraph instruments, and he was famous for having attained the speed of 60 words a minute while sending out press telegrams. Experts with Morse instruments at that time made about half that speed. After working as a telegraph operator in several New York cities, he came to Washington in 1858 and was in the employment of several telegraph companies till 1890. After severing his connection with the Western Union Telegraph company, he engaged in the electrical contracting business as a member of the firm of Royce & Marean.

Indianapolis Strike Settled.

The strike of electrical workers which began some weeks ago in Indianapolis, Ind., has been settled. As a result of the strike the shops of four leading electrical concerns of the city have been "unionized." At a conference between the executive committee of the Electrical Workers' union and representatives of the Indianapolis District Telegraph company, the Sanborn Electric company, the Advance Electric company and C. W. Meikel, a contract was signed which is to run until January 1, 1902. This contract provides for a uniform scale of 28 cents an hour, time and one-half for overtime and double time for all legal holidays and Sundays, and full recognition of the union. The union men made several concessions.

Electric Railway and Lighting Business in Ohio.

[From the Columbus (Ohio) correspondent of the Western Electrician.]

The reports of the various electric-railway companies and electric-light companies filed with the state auditor of Ohio, for the purpose of computing the taxes due the state, contain some very interesting figures, inasmuch as they give the gross earnings for the year ended April 30, 1900. There are at the present time 65 electric-railway lines or systems in operation, as shown by the books in the auditor's office, and the gross receipts range all the way from a few thousand dollars to nearly three million dollars, the Cincinnati Street Railway company taking the lead in this respect. The total gross receipts of all the roads for the last fiscal year were $11,533,350, and they will pay taxes to the state to the amount of $57,666.75, which is one-half of one per cent. of the gross earnings. Last year 63 roads earned a total of $9,971,939 and paid $49,859.67 taxes. There are now 81 steam roads operating in the state, and their income, for the year ended June 30th, was $86,182,911. There has been a large increase in the business of both classes of roads. It would seem from the figures that there are about the same number of electric roads operating in the state this year as last, and that there had been no increase in the number, but the combinations and the merging of several roads into systems are responsible for this. The secretary of state's report shows that there have been 35 electric-railway companies incorporated within the last year. It is true, however, that not many of the new ones are now in operation, and as a consequence have not been reported for taxation. Following are the gross receipts of a few of the largest roads in the state:

Cincinnati Street Railway company	$2,968,575
Cleveland Electric Railway company	1,522,307
Cleveland City Railway company	1,479,546
Columbus Railway company	867,121
Toledo Traction company	678,125
Northern Ohio Traction company	376,302
Southern Ohio Traction company	260,764
Lorain Street Railway company	101,266

All of the roads named here have made an increase over last year, with one exception, and it is expected that the increase over the last year's receipts shown in the next report will be even greater.

The books at the state auditor's office show that there are 123 electric-light companies operating plants in the state. Their gross earnings for the year ending on April 30th were $2,735,553, and their taxes will amount to $13,677.76. The gross income of the light plants in the state last year was $2,560,493, and they paid taxes to the amount of $12,802.46. So there has also been an increase in business here.

The annual report of the secretary of state for the year ended November 15th will show that during the year there have been 35 street and electric-railway companies and consolidations incorporated in the state, with a capitalization of $10,352,000 for new companies with $4,000,000 for consolidations, and that various companies have increased their capital stock $8,160,000 in the aggregate. Fourteen electric-light and power companies have been incorporated, with an aggregate capital stock of $930,500, and other companies have increased the capital stock $254,000. Thirteen steam-railroad companies, with a capital stock of $2,755,000, were incorporated, and railroad companies already in existence increased their capital stock $215,000 showing that the electric roads are making vastly greater strides in the state than the steam roads. In all, 417 manufacturing concerns were incorporated and 38 banks were chartered. There were 1,527 charters issued altogether, with an aggregate capitalization of $77,593,199, and the total increase of capital stock of various companies already in existence amounts to $35,446,900.

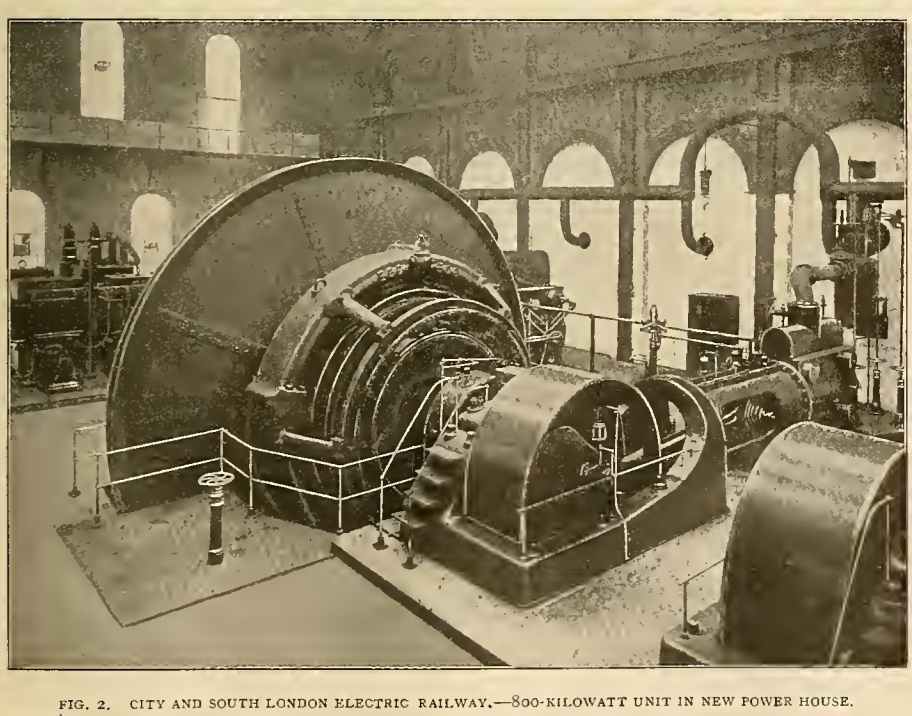

FIG. 2. CITY AND SOUTH LONDON ELECTRIC RAILWAY.—800-KILOWATT UNIT IN NEW POWER HOUSE.

City and South London Electric Railway.

Nearly 10 years ago the pioneer underground electric railway of London—that of the City and South London company—was constructed under the supervision of the late Mr. Greathead. The late Dr. John Hopkinson and his brother Edward had control of its electrical equipment, and the system

FIG. 1. CITY AND SOUTH LONDON ELECTRIC RAILWAY.—BOILERS AND MECHANICAL STOKERS.

received much attention and interest from English and foreign electrical and railway authorities.

The total length of the system was 3½ miles until this year, when the two extensions were opened, increasing the length to 4¾ miles. It had long been apparent that a new station and new generating apparatus were needed for the modern demands of electric-railway traffic. The old generating plant has been sold and is being dismantled. The old buildings will be utilized for tool and repair shops, while a new generating station and additional car sheds have been erected, adjoining the old station at Stockwell.

With the opening of the extensions of the line the ordinary two-wire system of feeders was no longer suitable on account of losses in the rail return and in the feeders. The three-wire system, with equalizers, was adopted, and has thus far justified the choice of the directors.

All the machinery and equipment in the new station are of British manufacture. Boiler and engine houses are practically under the same roof. Coal is stored over the boilers on a steel and concrete floor, in iron bunkers having a capacity of 1,000 tons. An elevating and conveying plant is attached. From the bunkers the coal is delivered by measuring chutes to the hoppers of the Vicar mechanical stokers below, as may be seen by referring to Fig. 1. The steam-generating plant consists of a battery of nine Davey-Paxman boilers, capable of evaporating 8,000 pounds of water an hour each, the working pressure being 160 pounds.

The generators, which are of various sizes, are all direct-coupled, with the exception of the original Siemens-Willans set of 125 kilowatts removed from the old power house; all the generators are of the Electric Construction company's make, and consist of one 125-kilowatt generator, coupled to a high-speed Willans engine, and two 300-kilowatt, also coupled to Willans engines. The remaining two 800-kilowatt generators, of the type shown in Fig. 2, are direct-coupled to two Corliss compound engines, built by Cole, Marchent & Morley. The engines are fitted with unusually heavy plate flywheels, and extremely good governing is obtained. The generators are all compound-wound, to maintain a constant potential of 500 volts.

The main engines condense into a surface condensing plant, shown in the illustration (Fig. 3). The cooling water is passed over two Klein cooling towers by two centrifugal pumps.

The electrical distribution is on the three-wire system, using the track as the neutral conductor, and the conducting wire in each of the two tunnels as the outers. The working conductor in each tunnel is fed at three points, at one of which, Kensington, the feeder is coupled through a booster. At London Bridge the battery sub-station and reducers maintain a constant pressure. This battery consists of 556 Tudor accumulators, of 450 ampere-hours, when discharging at 150 amperes, or of 350 ampere-hours, when discharging at 350 amperes. At three other sub-stations equalizing dynamos are located, each machine capable of handling 160 to 200 amperes.

The contract for the complete electrical equipment was let to the Electric Construction company.

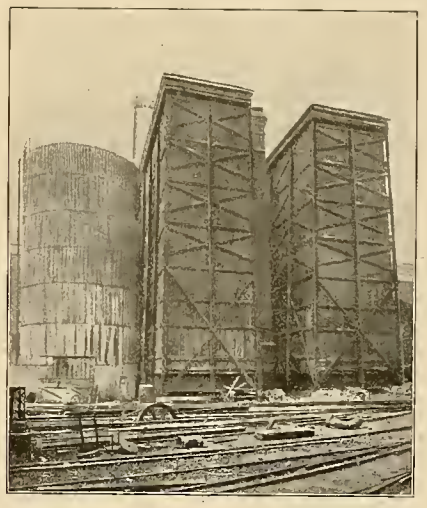

FIG. 3: CITY AND SOUTH LONDON ELECTRIC RAILWAY.—COOLING TOWERS.

Mr. P. V. McMahon, the company's engineer, had supervision of the entire work.

The City and South London railway has had a struggle from the first, says the London Electrical Review, from which the foregoing facts are taken. The present extensions to Clapham and Margate street will doubtless add to its commercial success, but from the Islington extension, to be finished next year, the greatest aid is expected. Other extensions at both ends of the line are under consideration.

Chicago Street-railway Projects.

The Chicago Street Railway Commission discussed its estimates for next year's appropriation at a meeting last week. The commission will ask for $5,000, in addition to the unused $2,000 of this year's appropriation. In its estimates the commission asks for money to employ an expert on motive power. It is the purpose of the commission to get expert information on the relative value of overhead and underground trolleys, compressed-air and other motors. At the meeting Mayor Harrison said that he would consent to the use of the underground-trolley system in any streets in which the traction companies already have tracks, but that there would be a fight on the mention of overhead trolleys in the downtown district. City Electrician Ellicott was of the opinion that of all the plans suggested for replacing the cable loops in the downtown districts, the underground trolley was the most feasible. He thought the change could be accomplished without great expense, and to the satisfaction of all concerned. His idea would be to put the underground trolley in the downtown district, use motor cars on it, haul the other cars around the loop, and switch them over on the other side of the river, or where the change is made, to the overhead trolley. This would not necessitate the expenditure of a great sum. He expected that the street-railway companies would object that the drainage of the city would not permit of an underground trolley, but said that he had proved that argument to be worthless, for the sewers are nine feet below the street.

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In choosing as the theme of his inaugural address the electrical features of the Paris Exposition, President Hering of the American Institute of Electrical Engineers has made a timely and interesting selection. Mr. Hering has had experience at several international exhibitions and congresses, and his observations and comparisons are therefore of value. The inaugural address is rather long, but it will be printed in full in the Western Electrician, the first portion appearing in this issue.

Treasury Department statistics show that the exports of the United States last month broke all records for a similar period, reaching a total of $163,093,597. The highest preceding record was made in March of this year, when the value of the exports was $134,157,225. Reports up to October 31st last give assurance that the calendar year of 1900 will show the largest exports in the history of our foreign commerce and the largest preponderance of exports over imports. This result is, of course, highly pleasing, and it is gratifying to know that the greatest increase is in manufactures, in which electrical apparatus plays a part of constantly augmenting importance.

In the press of other duties at the coming session of Congress senators and representatives should not forget the bill to create a National Standardizing Bureau as advocated by the Treasury Department and cordially indorsed by the electrical and other scientific and technical interests of the country. The bill passed the committee stage in the House at the last session, but, owing to early adjournment, was not acted upon. Should no action be taken at the session beginning next month, the project would be postponed for at least another year, which would be a misfortune, as the United States has already delayed too long in establishing a bureau to test and verify its units and standards. We can conceive no valid objection to the passage of this bill, which, on the other hand, will only make for the scientific and industrial advance of the nation. The bill has been explained and recommended in the Western Electrician heretofore, and we now repeat the recommendation and urge all readers of this journal to use their influence with their respective representatives in Congress to the end that this excellent measure may become a law.

Mr. Holland, the submarine-boat designer, is credited with the statement that vessels of his latest type are capable of taking long voyages, even to the extent of crossing the Atlantic. Testing trips of from one to two thousand miles on the deep sea are quite confidently discussed. The submarine boat has been regarded hitherto as possibly useful as a torpedo boat in warfare and in wrecking and dredging operations in commerce, but in either naval or industrial use it was to make short trips, remaining near a secure base of supplies. The machinery of the earlier types was evidently designed with that end in view. For long cruises both the steam (or gas) and electric plant would have to be considerably modified and the weight and bulk increased. Arrangements would undoubtedly be made for re-charging the accumulators on board, and in every way the mechanical equipment would have to be more elaborate, to say nothing of the added room needed for fuel and stores. A submarine vessel fitted to cross the Atlantic "under its own steam" and ready to dive at a moment's notice would be a very different craft from a boat designed to make a five or 10-mile dash out of a harbor and then to return to a friendly shelter.

It is interesting to observe that some of our eastern contemporaries have at last come to the conclusion that the Independent telephone movement has attained an importance worthy of their attention. On the expiration of the first of the fundamental Bell patents the Western Electrician foresaw that a great development of the telephone field was impending, and so, with no intention of discriminating against the older companies, it welcomed the active and energetic newcomers. Time has proved the accuracy of this forecast. The Independents have given a wonderful impetus to the telephone business of this country. Not only have they brought the telephone within the reach of hundreds of thousands who would not have had the benefits of this modern adjunct of civilization without their existence, but their vigorous competition forced the pre-existing companies to give lower rates and better service and to make improvements in every direction. Thus all telephone users have been benefited and a veritable revolution is being wrought, in which the more wide-awake of the Bell companies have themselves profited by being awakened to the possibilities of the business. The Western Electrician has fully chronicled this movement from the start, believing in a fair and healthy competition in the telephone as in any other business, and it looks back with some satisfaction at its efforts in securing for the Independents the fair hearing which they asked. Now that telephone monopoly is virtually a thing of the past and the Independents have waxed numerous and powerful, our contemporaries have seen a great light in the West, where the opposition telephone movement was nourished into strength, and are giving the anti-monopolists belated consideration. Well, it is never too late to mend, perhaps, but if the eastern journals had followed the example of the Western Electrician some years before they did, they would have rendered a real service to the competitive telephone interests at a time when they were weak and struggling and needed it. It will be recalled that Dr. Johnson, in a celebrated letter to a nobleman who sought to pose as a patron of letters, spurned belated patronage where early assistance had been denied. Possibly the Independents entertain a similar feeling to those who tender assistance when it is no longer necessary.

Complaint has been made on more than one occasion and in more than one city against the noise and vibration of electric power houses. Of course the tendency of modern practice in electric-current supply is in the direction of placing generating stations at points apart from crowded centers of population; electrical companies wish to do this for their own protection, for the expense of real estate is usually a serious consideration; but in earlier days it was thought to be essential to place steam-driven, low-tension plants at or near the center of distribution. Nearby residents have been known to contend that such plants were not pleasant neighbors. In the case of Mrs. Sarah Bly against the Edison Electric Illuminating company of New York, for instance, witnesses testified that the vibration of the building was a continuous annoyance, and that, owing to it, it was difficult to sleep; that it caused clocks to stop and pictures to become deranged; that the ceiling cracked and fell, and the windows constantly rattled. William Hallock, a professor of physics at Columbia University, testified among other things that upon leaning against the partition wall of the house he could feel the vibration very perceptibly, and by means of a delicate instrument he found that the partition wall vibrated one one-hundredth of an inch continuously and in consonance with the revolutions of the company's engines. Mrs. Bly conducted a boarding-house at 33 West Twenty-sixth street, and it was the company's power house at 45 West Twenty-sixth street, put in operation prior to 1890, that was the source of complaint. A judgment at a Special Term of the Supreme Court of the state of New York, awarding Mrs. Bly an injunction and $4,000 damages, was modified by the Appellate Division last week, by reducing the award to six cents. The court holds, in an opinion by Justice O'Brien, that damages not being recoverable for a greater period than six years, and during such period Mrs. Bly being in possession under a lease or leases which were subsequent in date to the construction and operation of the company's power house, she, having taken a lease with knowledge of the existing condition, was entitled to only nominal damages. The damages resulting from loss of business caused by vibration, smoke and cinders from the power house were, in effect, damages to the rental value of the premises, and could not be recovered by the plaintiff as lessee. Had she proceeded promptly, the court says, she would have been entitled to an injunction restraining the company from prosecuting its business in a way that would inflict damages upon her or destroy her comfort or health.

This case is of importance. The plaintiff failed in the court of last resort, but the judges make it clear that had she proceeded promptly to make her complaint the result might have been different. There is no doubt that some of the complaints against the older central stations were well founded, and the attitude of the New York court will furnish another incentive to reconstruct on modern lines some of the plants where improvements are needed.

Operations of the Signal Corps.

An interesting account of the work done by the United States Signal Corps in the Philippines, China, Alaska, Cuba and Porta Rico is contained in the annual report of General A. W. Greely, chief signal officer of the army, made public last week. The services of the signal department with the Pekin relief expedition are first spoken of. This small body of men, under command of First Lieutenant Henry W. Stamford, signal officer of volunteers, got through the first military telegraph line to Pekin under circumstances that were very discouraging. The first reliable news that came out of Pekin was sent by Lieutenant Stamford At Matow the wire gave out, and although obliged to wait two days for more, Lieutenant Stamford, "by the most extraordinary exertions, succeeded in covering the ground lost by two days' marches and brought Chaffee's command again in communication with Tientsin." Of the work of this undaunted little band of American telegraph operators, General Greely says:

"Through the labors of Lieutenant Stamford's men the American army carried the first telegraphic wire into Pekin, where the first telegraph office was installed in the house of Minister Conger. Fortunately, this action permitted General Chaffee, in Pekin, to extend courtesies, in the way of transmitting telegrams, to officials of the British, Russian, French, German, Italian, and even Chinese governments, and likewise to the press."

In Cuba many important lines have been laid and efficiency and cheapness in telegraphic communication provided. The commercial rate from Washington to all points in Cuba beyond Havana ranged from 44 to 94 cents a word prior to the Spanish-American war. Any point on the island beyond Havana can now be reached over the military-telegraph line by commercial messages at rates ranging from 22 cents a word to 26 cents a word maximum. The aggregate of commercial business done amounted to $212,470.

In Porto Rico the military-telegraph system has been maintained, operated, repaired and reconstructed without drawing a dollar from the treasury of Porto Rico. The expenses have been defrayed either from the appropriations for the support of the army or from the line receipts. All money received for commercial messages since May 1, 1900, when the island was transferred to the civil authorities, has been turned into the United States treasury, as is required by law in the case of commercial receipts of military-telegraph lines in the United States.

In the Philippines considerable important work has been accomplished. A comprehensive telegraph and cable system is being constructed, which will cover all the important islands in the Philippine group and extend over more than 1,000 miles of latitude from Seno de Bangui of northern Luzon to the southerly island of Jolo. On June 30, 1900, there was in operation 3,007 miles of telegraph lines and cables, with 400 telegraph and telephone offices, of which no less than 301 were connected directly with the headquarters of the commanding general at Manila.

General Greely relates this incident of field telegraph work: "In connection with General Lawton's famous march through untraveled eastern Luzon, when Major Thompson performed the remarkable feat, deemed impossible of accomplishment, of keeping Lawton in daily communication with the commanding general at Manila, there were about 100 miles of line constructed, of which fully 75 miles were necessarily abandoned and the rest recovered by Captain Russel and his efficient command."

Of the work done in Alaska, the report mentions the telegraph line with iron poles, 25 miles in length, which now extends from Nome City through Port Davis eastward to Safety Harbor, where ultimately it will connect with the cable at St. Michael. General Greely recommends that a telegraph cable be laid by the government from Skagway to Juneau. "This," he says, "would not only connect the military post at Skagway with Juneau, the capital of Alaska, but would enable the territorial authorities to reach, via Skagway and Dawson, the points in the Yukon Valley now so remote that, as a rule, not more than two or three letters upon any subject can be exchanged in the course of a year. A cable from Skagway to Valdez would be about 650 miles in length, and could be laid for about $300,000. A cable from Skagway to Seattle, passing outside of Vancouver and Queen Charlotte Islands, so as to avoid any international complications, would be about 1,150 miles long, and could probably be laid for about $500,000."

Attention is called to the desirability of having the whole subject of the rights, privileges and immunities of submarine-cable properties in time of war considered by an international cable conference in connection with the proposed American-Pacific cable, which General Greely says is a military and commercial necessity if our colonial possessions are to be retained, or if American interests are to be safeguarded in Asiatic countries.

The French minister of marine has just ordered that eight more submarine boats for the navy be put on the stocks. After January 1st France will own four completed submarine boats and 10 now nearing completion, not counting the two offered to the government by the newspaper Matin, which are the largest of all.

DOINGS OF SOCIETIES.

American Electrotherapeutic Association.

At the tenth annual meeting of the American Electrotherapeutic association held in New York city September 25th to 27th it was decided to hold the next annual meeting of the association in Buffalo, N. Y., beginning the first Tuesday in next September. This date has since been changed, so that the meeting now will be held on September 24, 25 and 26, 1901. At the recent meeting the following-named officers were elected for the ensuing year: President, Dr. Ernest Wende, Buffalo, N Y.; first vice-president, Dr. Frederic H. Morse, Melrose, Mass.; second vice-president, Dr. D. R. Brower, Chicago, Ill.; secretary, Dr. George E. Bill, 255 North street, Harrisburg, Pa.; treasurer, Dr. R. J. Nunn, 119½ York street, Savannah, Ga.; executive council, Dr. Robert Newman, New York city; Dr. G. Betton Massey, Philadelphia, Pa.; Dr. Charles R. Dickson, Toronto, Can.; Dr. Frederic Schavoir, Stamford, Conn.; Dr. F. B. Bishop, Washington, D. C.; Dr. W. H. White, Boston, Mass. The chairmen of the different committees appointed by the president are as follows: Induction coils and alternators, Dr. Margaret A. Cleaves, New York city; electrodes, Dr. Charles R. Dickson, Toronto, Ont.; meters, Dr. Emil Henel, New York city; static machines and condensers, Dr. William J. Morton, New York city; electric-light apparatus for diagnosis and therapy and the Roentgen X-ray, Dr. C. O. Files, Portland, Me.; cataphoresis, John J. Carty, New York city; constant-current generators and controllers, Dr. William J. Herdman, Ann Arbor, Mich.; arrangements, Dr. Henry R. Hopkins, Buffalo, N. Y.; ordinary fellows, Dr. W. S. Whitwell, New York city; resignations, Dr. Frederick Peterson, New York city; necrology, Dr. G. Apostoli.

Automobile Manufacturers Organize.

At the meeting of motor-vehicle builders held on November 14th, at the Hoffman House, New York, the National Association of Automobile Manufacturers was formally launched by the committee selected to form an organization at a convention of makers in Madison Square Garden the week previous.

John Brisben Walker presided, A. S. Winslow acted as secretary, and others present were S. T. Davis, Jr., A. L. Riker, C. E. Miller, E. P. Wells, C. E. Duryea, J. M. Hill and C. J. Field. It was decided to perfect the organization and to incorporate as soon as possible. The active members will comprise manufacturers of automobiles, and the associate members, makers of accessories and parts. Twenty-three active members and 15 associate members were enrolled. Three sub-committees were appointed, as follows: To perfect organization and incorporate, S. T. Davis, Jr., J. M. Hill and C. J. Field; to prepare constitution and by-laws, A. L. Riker, C. E. Duryea, C. E. Miller, A. S. Winslow and E. P. Wells; legislative committee, A. L. Barber, John H. Flagler, S. T. Davis, Jr., and A. A. Pope. The last-named committee was instructed to look up the law bearing on gasoline automobiles on ferryboats.

The automobile exhibition at the Grand Central Palace, although following closely that at Madison Square Garden, has been well attended. Eleven firms not exhibiting at the first show had displays at the Palace. A liquid-air automobile was perhaps the most interesting machine. The track at the Palace was not banked, and no speeding contests could be held.

Mr. Steinmetz on Alternating Currents.

The New York Electrical society held its two-hundred-and-ninth meeting at the College of the City of New York, on November 16th, when, before a large and most appreciative audience, Mr. C. P. Steinmetz delivered a lecture on "Alternating-current Engineering." It may be said that no more valuable or interesting lecture has ever been delivered before the society. In the course of about an hour and a half, supplemented by replies to suggestions, Mr. Steinmetz treated of the development of the alternating current for power and lighting purposes, its application for long-distance work, its relation to continuous-current local supply, questions of railway work, frequency, voltage, regulation, etc. While treating the subject broadly, Mr. Steinmetz presented a number of new facts and cleared up many obscurities in regard to the nature and use of alternating currents. At the close of the lecture and of the discussion, in which Messrs. Dunn, Henshaw, Burnett and Williams participated, Mr. Steinmetz, in response to a unanimous request, promised to put the lecture into written form, so that it may be published by the society.

Chicago Electrical Association.

At the regular meeting of the Chicago Electrical association held at 1741 Monadnock block, Chicago, on the evening of November 16th, W. B. Hale of the laboratory department of the Western Electric company read a paper on "Incandescent Lamp Photometry." Mr. Hale gave an interesting resumé of the subject, treating it mainly from a commercial point of view. He used several drawings, sets of curves and "shotgun" diagrams to illustrate the paper. A brief discussion was participated in by several members of the society, including Albert Scheible, Harold Almert, W. A. Harding, R. F. Schuchardt, A. M. Blumenthal and others. At the next meeting of the association on December 7th, Charles Wirt of the Wirt Electric company, Philadelphia, will present a paper on "Development of the Theater Dimmer."

Roentgen Society.

The Roentgen society of the United States has issued a final notice to manufacturers of X-ray apparatus inviting them to exhibit at the coming meeting of the society. A floor space of 2,000 square feet has been engaged for exhibition purposes and a 230-volt, direct-current power circuit will be available for the exhibitors. To secure larger facilities the place of meeting has been changed from the Academy of Medicine to the Hotel Victoria, New York. The meeting will be held on December 13th. S. H. Monell, chairman of the committee on arrangements, 47 West Twenty-seventh street, New York, says that all indications point to a most successful meeting.

Electrical Booth for Charleston Exposition.

Among the many and attractive features at the coming South Carolina Interstate and West Indian Exposition, to open in Charleston, S. C., on December 1, 1901, and extend into the middle of the following year, will be the electrical display, exhibits and equipment. It is the intention to add to the natural beauty of the landscape in every way possible, and in order to aid in this matter electricity will play no inconsiderable part. Among other features, an artificial lake will be constructed, and in this lake will be the "electrical island," upon which will be erected the palace of electricity.

One of the buildings has been completed. It is in the form of an octagonal booth the framework composed of light malleable-iron, the exposed surfaces inside and outside of the building being filled in with beautifully inlaid mosaics of rare marbles, onyx and glass. The dome of the booth is of leaded glass, representing in colors the globe of the western hemisphere, Charleston being indicated by a blazing point of light. Below this dome is a frieze of jeweled glass, containing typical motifs in swags and arabesques, which, like the dome, is lighted from within by electricity, the whole being supported upon eight graceful columns and arches of inlaid mosaic. Above the capitals of these columns are beautifully molded swans with extended wings. The shining globe, with its dividing lines of longitude and latitude, and these winged creatures, together inevitably suggest a floating and moving spirit, the entire structure being symbolic of Light, Motion and Progress. Viewed from within or without, this little building is equally radiant and transparent. Between the glass sides of the columns and the frieze, as well as in the dome, are many concealed electric lights, throwing out a prismatic halo, while, still further to enhance the beauty of the effect, sprays of water play around the dome and the frieze, columns and arches, affording a constant kaleidoscopic change of color and form.

Within this booth a fountain of onyx and glass rises from a strong substantial base, the figures on the pedestal representing the triumph of Electricity over Waterpower. A cylindrical shaft copies, in conventional lines, the trunk of the palmetto, and at the top of this column a beautiful statue of Columbia stands upon a large mosaic ball amid a cluster of palm leaves. This statue is supposed to be typical of the New South. In one hand the figure holds a distaff, outlined in incandescent electric light and suggesting the cotton industry, while in the other hand she bears an arc lamp, which typifies the light of Progress. Below the water line of the fountain and the sprays of water, which are cast up from the grotesque projections like the gargoyles of medieval architecture, are mirrors and lights which duplicate the radiant coloring and graceful lines of the dome and columns. Both the booth and the electric fountain are so constructed that they can be taken to pieces and shipped from one place to another.

Massachusetts Electric Companies.

The Massachusetts railroad commissioners have authorized the lease of the Nashua street railway to the Lowell and Suburban Street Railway company. There will be no increase of capitalization. The commissioners have sanctioned the consolidation of the Lowell and Suburban Street Railway company by the Lowell, Lawrence and Haverhill Street Railway company, and authorized the latter road to issue $1,200,000 additional stock for the purpose of purchasing the Lowell and Suburban on a basis of share for share. The commissioners also authorize the Brockton Street Railway company to issue $363,600 additional stock for funding its floating indebtedness incurred in the construction of its railway and for the purchase of real and personal property. The new shares are to be offered proportionately to stockholders at $110 a share. The petitioners asked for $400,000 additional stock. The above-named lines are parts of the Massachusetts Electric Companies' properties, and progress toward consolidation of them all is rapidly making on the plan above indicated.

DEVELOPMENT OF THE TELEPHONE FIELD.

Ohio Notes.

To gain some idea of the development of the telephone interests in Ohio the last year, it is only necessary to refer to the facts that the annual report of the secretary of state for the year ended November 15th will contain. While the telegraph and telephone companies are grouped together in the figures here to be presented, it is well known to those interestd in the matter that nearly all of them are telephone companies, since few have essayed to break into the telegraph business because of the extensive construction of lines that would be required and the sharp competition that a new concern would have in the two old companies, the Western Union and the Postal. The number of companies incorporated during the year is 69, and the combined capital stock to be invested is $1,388,999. These new companies, many of which have not yet completed their plants, and some have not even commenced construction, are not confined to any section of the state, but have been formed in small towns, as well as the cities. The capital stocks range from $1,000 to $100,000 or more, and the lines in some instances are to be confined to certain towns and cities, and in others are to be interurban affairs, all eventually to form a part of one great system by being connected with the lines of the United States Telephone company, which is now very active in the construction of its long-distance plant in this and other states. The increase in the capital of telephone and telegraph companies has been greater, that put into the new companies being $4,442,000, as shown by the report. This fact shows that the business of the older companies is growing and that they have been compelled to make additions to their investments from time to time. This, of course, is mainly for enlarging plants, making improvements and perfecting their service.

The New Washington Telephone company, New Washington, Crawford County, Ohio, has been incorporated, with a capital stock of $5,000, to build a local plant in that place. The incorporators are C. R. Callahan, Frank A. Knapp, John H. Sheetz, Jacob Sheetz and M. J. Callahan.

The National District Telephone company of Cincinnati was incorporated last week, with a capital stock of $1,000. The object is to build and operate telephone and telegraph lines in Cincinnati, and connecting with Covington, Newport and Ludlow, Ky. The incorporators are John T. Colling, R. E. Daly, Edwin Heil, Thomas Kelley and John M. Hiatt.

The Central Union Telephone company has a petition prepared to present to the Village Council of Lorain asking for a franchise to build a plant in that city. The Black River Telephone company has 500 telephones already in use there, and it is said will oppose the admission of the Central Union.

The ordinance granting the Stark County Telephone company a franchise in the city of Canton has reached its second reading, and from all appearances will be passed at the next meeting of the council. The vote stood eight to five in favor. The Bell people presented a number of remonstrances, but they were all referred to a committee of the whole, to be considered at the call of the president. Several amendments were also proposed, which would have interfered with the passage of the act for some time, but they were all voted down.

The Citizens' Telephone company of Xenia, Ohio, has been incorporated, with a capital stock of $125,000, for the purpose of building and operating an exchange in Xenia and line in Green County. The incorporators are J. C. Conwell, W. L. Marshall, Marcus Shoup, L. E. St. John and H. H. Davenport. The company was granted a franchise last week to erect a plant in Xenia.

The Central Union Telephone company of this city has advertised residence telephones for five cents a day, which means $1.50 a month, or $18 a year. It seems that the company will have to fight its battles alone, however, as the Citizens' has made no move to reduce prices, and the management has announced that there will be nothing of the kind, as they feel that they will have the support of their patrons in the stand they take. O. M. C.

Telephone News from the Northwest.

The sheriff has attached property in Minneapolis of the Mississippi Valley Telephone company to secure a claim of $10,000 in favor of the Farmers and Mechanics' Savings Bank of Minneapolis. A. B. Jackson has sued for $1,000 for legal advice. J. C. Hubinger, the president and manager of the company, has filed a mortgage for $750,000 to the Royal Trust company of Chicago. He says that the money thus raised is for the purpose of building up the concern and extending the lines. Mr. Jackson, in his suit, alleges that the company is about to assign or dispose of its property with intent to delay the creditors. Hubinger claims that the company will meet all claims, and says these suits will have a tendency to injure the company.

Dr. H. Igarashi, the imperial director of the telephone service of Japan, has been in the Twin Cities to inspect the local telephone plants. The government owns the telephone systems of his country, and he is in search of improvements. He professed himself greatly pleased with the local exchanges, and thought well of the nickel-in the-slot machines which have been reviled so by citizens of the Twin Cities. He was amazed at the complete electrical street-railway system of Minneapolis and St. Paul.

The Spencer Telephone company is extending a line from Greenville, Iowa, to the new towns of Davis and Royal.

The Johnson County Telephone company of Iowa City, Iowa, will extend a toll line to connect with the system of the Mississippi Valley Telephone company of Muscatine, Iowa.

The Inland Telephone company proposes to build 200 miles of wire before the first of January, in the vicinity of Spokane, Wash. Among the lines will be those from Spokane to Newport, Dayton to Starbuck, Endicott to Winona, Wenatchee to Leavenworth, Chelan to Brewster, Medical Lake to Edwall, Ritzville to Lind.

The council of Avoca, Iowa, has granted a franchise for a local system to the Harlan and Avoca Telephone company, conditional on the voters ratifying the action in the spring. If they refuse, the company is to remove its wires from the streets. Work will be started on the exchange at once.

The Mississippi Valley Telephone company is renewing its wires in Burlington, Iowa, and replacing those which have become rusty.

The Hutchinson (Minn.) Telephone company is extending a toll line to Acoma, Cedar Mills and Greenleaf. At Greenleaf connection will be made with the line to Litchfield.

The Zenith City Telephone company of Duluth, Minn., has made application to the council of Duluth, to assign its franchise to the People's Telephone company of West Superior. The stockholders of both companies are the same, and it is proposed to make one large corporation to handle both systems.

The Minnesota Central Telephone company contemplates establishing a local exchange for Buffalo, Minn.

The Southern Electric Telephone company will shortly begin work on an exchange for Lamberton, Minn.

John G. Crow of Frendale, Iowa, is pushing the telephone line from Windham to Cosgrove. It is proposed to connect from Cosgrove to Iowa City.

Suit has been begun at Des Moines, Iowa, on behalf of F. M. Hubbell and C. E. Campbell, as taxpayers, to oust the Iowa (Bell) Telephone company from the streets of Des Moines, on the ground that its franchise has expired and the wires and poles encumber the streets. The company will resist, on the ground that the council has repeatedly recognized its existence since the franchise expired, and also on the ground of vested rights, having more than $100,000 invested in its plant.

The Cedar Valley Telephone company has closed its exchange in Shell Rock, Iowa, and has taken out all instruments except the toll station. The company says that the system did not pay.

E. D. Hooey of Kaukanna, Wis., has become manager of the Wisconsin Telephone company's office at Ashland. R.

Activity in Carlinville.

The Macoupin Telephone and Telegraph company of Carlinville, Ill., which has been fought by the Bell lessee in the City Council for over a year, has at last brought things to pass, with a corporation composed of 34 of the leading men of the city, 30 of whom are business men there. It has installed a Stromberg-Carlson central-energy system, with a capacity for 200 subscribers. The construction, which is said to rank with the best in the state, comprises full-metallic circuits, large poles and the best of material. The company has 100 instruments now installed, and applications are on hand for 50 more. The outlook is said to be bright and the company is proud of its investment. Secretary and Manager J. A. Fletcher and his company are receiving the support of the citizens in general, and next year new toll lines will be built to the different towns in the county. The Macoupin company is capitalized at $10,000, and J. B. Liston is president and C. G. Heinz, treasurer.

Wireless Telephony in Minnesota.

An experiment in wireless telephony was tried at Powderhorn Lake, Minn., last Sunday. J. C. Kelsey, who is in charge of the switchboard at the Northwestern Telephone Exchange company's building in Minneapolis, conducted the trial. The method used was virtually the same as that of Sir William Preece. On either side of the lake was strung a wire 100 feet in length, the two being parallel and fastened with grounding pins to insure better induction. An ordinary local telephone transmitter and receiver were attached to either wire. The results were said to have been satisfactory, and the experimenters are of the opinion that the system will allow conversations to be carried on over a distance of 20 miles.

The strike of the linemen of the Colorado Telephone company at Colorado Springs has not yet been settled. The men asked for an increase in wages from $2.85 to $3 a day, and for a decrease in hours from 11 to 10. The demand was refused and work stopped. It is stated that the company will not be inconvenienced, as workmen to continue the construction in progress can be secured.

Erie System to Be Extended.

The Erie Telegraph and Telephone company, which has headquarters in Lowell and Boston, and already controls extensive telephone systems in the city of Cleveland and in Michigan, Wisconsin, Minnesota, North and South Dakota, Arkansas and Texas, is believed to be on the point of absorbing the Maryland Telephone company of Baltimore, the Pittsburg and Allegheny Telephone and Telegraph company of Pittsburg and the Delmarvia Telephone company of Wilmington, Del., all Independent companies. The Erie company is in its turn controlled by the Telephone, Telegraph and Cable company, or, rather, by the National Telephone and Telegraph company, which was incorporated last July to succeed the "T. T. C." company, and which is not a Bell company, at least as far as is known. The Erie company already possesses the largest system of telephone exchanges in the country under one management.

News of the proposed absorption comes from Baltimore, Md., where the deal, it is understood, is being arranged by Alexander Brown & Sons and George R. Webb, president of the Maryland Telephone and Telegraph company. The Maryland company is capitalized at $1,000,000, with $1,000,000 of five per cent. bonds. The Pittsburg and Allegheny company has $1,500,000 of stock and $1,200,000 of five per cent. bonds. With all of the companies business is said to be increasing at a rapid rate.

Trouble in Texas.

The strike of the employes of the Southwestern Telegraph and Telephone company at San Antonio, Texas, promises to spread throughout Texas and Arkansas. The San Antonio company refused to accede to the demands of its employes, and sympathy strikes have been started in Galveston, Waco and Houston, and notice has been given by the employes at Dallas of their intention to strike. Committees of union men are working trying to get the employes of the company at Austin, Fort Worth and all other towns in Texas and Arkansas to join in the strike. The business men of San Antonio, to the number of 900, have discontinued the service of the Southwestern Telegraph and Telephone company, it is reported, and have asked the Independent telephone company, which is promoted by Ohio capitalists, to concede to the demands of the striking linemen and receive their orders for over 900 telephones. The new company has declined the proposition, it is said.

At San Antonio the long-distance wires have been cut. The South Western Telephone company is now filling the places of the strikers with non-union men as rapidly as possible.

New Work in Central Wisconsin.

A. D. Hutchinson of the Wolf River Telephone company, Weyauwega, Wis., recently closed two important deals for his company. One was in securing H. G. Slater of St. Peter, Minn., to construct an exchange in the city of Waupaca. The other was the formation of the Fox River Valley Telephone company to build exchanges in Kankauna, Appleton, Neenah and Menasha, to be connected with the Wolf River system. The incorporators are J. S. Van Nortwick, John McNaughton and John M. Baer of Appleton and A. D. Hutchinson of Weyauwega. Mr. Hutchinson is secretary of the company. The headquarters of the company are at Appleton, but Mr. Hnitchinson will handle all correspondence from Weyauwega.

Bell Telephone Output.

The American Telephone and Telegraph company's instrument statement for the month ended October 20th is as follows:

	1900.	1899.	1898.
Gross output	67,198	50,861	33,639
Returned	30,737	18,044	11,823
Net output	36,461	32,817	21,816
Since December 20th:			
Gross output	524,362	539,598	278,363
Returned	220,698	163,271	120,082
Net output	303,664	376,327	158,281
Total outstanding	1,884,169	1,501,577	1,077,402

MANUFACTURERS AND DEALERS.

The contract for a 1,500-line multiple switchboard for the Johnstown Telephone company of Johnstown, Pa., has been awarded to the Kellogg Switchboard and Supply company of Chicago. This switchboard will be equipped with self-restoring drop-line signals and the lamp double supervisory system, and will operate on the central-battery system. Among other smaller contracts recently secured by the Kellogg company are those at Elmore, Ohio, 100 lines; Woodville, Ohio, 100 lines; Huron, Ohio, 100 lines; Waupaca, Wis., 150 lines; Thomas, W. Va., 50 lines, and Sapulpa, I. T., 100 lines; These exchanges will use the Kellogg express 150-line switchboard. Bloomfield, Ind., will be equipped with a special Universal switchboard having a capacity of 400 lines.

The Paris Exposition of 1900.[1]

By Carl Hering

Part I.

A large international exhibition, like the one about to close, may be judged from two standpoints. For commercial reasons a necessary feature is its general attractiveness, that is, its beauty, architecturally as well as in the arrangement of the grounds and in the decorations, its proper combination of instruction and entertainment and its purely entertaining features. On the other hand, such an exhibition should be a representation of what is called the state of the art in the various industries, and, to a certain extent, at least, show the relative importance of competing industries.

From the first of these standpoints this exhibition may be said to have been a great success. It certainly was very beautiful and attractive, and in this respect it was typically French, for to the Frenchman such an exhibition would be a failure if it were not beautiful. While there were undoubtedly a few architectural features that might be criticized unfavorably, yet in general the buildings and arrangement of the grounds left little to be desired, although the absence of straight lines in the architectural decorations of the main buildings might not meet with the approval of every American, for in this respect they differed typically from those in the Chicago exhibition. The arrangements and decorations of the characteristically unsightly interiors of long exhibition buildings were also very tasteful and effective, although the avoidance of a regular system of aisles made a systematic study of the exhibition an almost hopeless task. In some of the attractions, such as the Optical Palace, the underground mines, etc., instruction and entertainment were combined, but, as a rule, the too-numerous "side shows" were for amusement only, and were typically French.

From the other standpoint, that of showing the state of the arts, the exhibition may have been, and undoubtedly was, a success in many departments, but that claim can hardly be made for the electrical industry. For France, Germany, Switzerland and a number of the other continental countries, the electrical exhibits doubtless represented the true state of the art and the best general practice as far as these countries were concerned; but the absence of a proper representation from the United States proportionate to the enormous development made the exhibition an incomplete representation of the present state of this important industry. Anyone judging its development in the respective countries by their exhibits would have obtained a very wrong impression of its progress in the United States, or of the general practice here. We sent over a few excellent electrical exhibits, and they were greatly admired, but there was general disappointment that a country in which the electrical industry is known to be so largely developed was so inadequately represented. This is all the more unfortunate at the present time, when our export trade of manufactured articles is growing so rapidly, and when our electrical practice, in certain directions at least, is thought so well of by foreigners that many of them come over here to study it.

The fact that several of our largest manufacturers have ceded their rights in foreign countries to local companies and therefore claimed to have no interests there may explain in part the absence of some of the important American electrical exhibits. But, unfortunately, these local companies do not always follow our practice, and do not manufacture the goods on the same scale and in the same way, so that their exhibits were not as a rule representative of our products.

England was also very inadequately represented in the electrical classes. The English claimed that they were tired of exhibitions, but another reason is no doubt the unfortunate political relation with France. England's exhibits in other groups also seemed to fail to represent the proper magnitude of the respective industries in that country.

Of all of those foreign to France, Germany, its former bitter enemy, had by far the finest exhibits in most of the groups, including the electrical. Another feature of interest, politically, is that Hungary had in many respects better exhibits than its stepmother country, Austria, and was represented as an independent nation; it bids fair to become one of the greater industrial countries of the East.

The question is frequently asked how the Paris Exposition compared with the one in Chicago in 1893. As both were very large and creditable, a comparison becomes difficult, and in order to give an opinion of any value one ought to have studied both equally thoroughly and under equally favorable conditions. It is also largely a matter of individual taste, and depends on the nationality of the one giving it, as also on the extent of his knowledge of French. The area of the Paris exhibition was 336 acres, which, together with the annex, made it about half as large in area as the fair in Chicago, which had about 1,000 acres. The average number of paid admissions seems to have been about double in Paris, due to the fact that it was so managed financially that the average admission was about seven to 10 cents, as compared with somewhat less than 50 cents at Chicago. Americans seem to have obtained their unfavorable views from antagonistic English papers.

1. Inaugural address by the president at the meeting of the American Institute of Electrical Engineers, New York, October 24, 1900.

It is thought safe to say that the Paris exhibition, taken as a whole, was more generally beautiful in details, but that it contained no single group as magnificent as the famous Court of Honor, nor were the illumination effects as fine as at Chicago, where they were electrical, while in Paris gas was largely used, the whole of the largest open area, the Champ de Mars, being a brilliant mass of incandescent-gas lamps. Neither had as finely illuminated fountains as the exhibition of 1889 in Paris, although the background to the poorly illuminated fountains in the present exhibition, forming the famous Chateau d'Eau or Water Castle, was very attractive and beautiful.

The means of getting to and from the exhibition were very poor, as Paris has unquestionably the worst-managed tramway and 'bus system of any large city in the world; its cab system, the best and cheapest of any large city, except perhaps London, was, of course, entirely inadequate and too expensive for the exhibition traffic. The exhibition, however, had the great advantage of being practically in the city itself, and in one which is admitted to be the most beautiful in the world, offering many attractions to visitors, and containing treasures which made it in itself an exhibition worth going to see. The Paris exhibition was decidedly more truly international than the one in Chicago, and the social intercourse of those officially connected with it was for this as well as for other reasons, including the generous hospitality of the French, more interesting.

The electrical exhibit was greater in Chicago, where it filled a large separate building, while in Paris it was confined to a moderately small part of one of the buildings.

Among the classes of exhibits of well-developed industries, there were three in particular which may be mentioned here specifically, as each marks a distinct and important direction of development, and was exhibited for the first time very prominently at a large international exhibition. They are the automobile, the incandescent-gas lamp (known here as the Welshach) and the three-phase-generators, motors and systems. The automobile exhibit was very large, but unfortunately for the electrical industry, it seems that the gasoline vehicle is gaining very fast in the race with the electric. In Paris, where automobiles are being used quite extensively, the quiet but heavy electric vehicle is seen only occasionally, while the light but noisy and malodorous one using gasoline is heard and smelt very frequently. The incandescent-gas lamp was used in large numbers on the Champ de Mars, the only large open area in the exhibition, where arc lights would otherwise have been installed. Even the friends of the electric light must admit that the illumination produced by it was very effective, brilliant and white without being dazzling. This lamp is getting to be a very serious competitor to the electric light, and some of the European central stations, particularly in the home of its birth, Austria-Hungary, are having serious difficulty in competing with it. The third of these prominent classes of exhibits, the three-phase machinery, will be referred to below.

Another feature of indirect interest to the electricians is that most of the acetylene illumination was relegated by the authorities to two small strips of land unoccupied by any buildings, along the banks of the river, which seems to indicate that acetylene illumination is limited to a narrow field of its own.

Much else might be said about the exhibition in general, but we, as electrical engineers, are more interested in the electrical exhibits. As was already mentioned above, these were representative of the state of the art only as far as the continental countries were concerned, as those from the United States and England were very deficient in scope. It was also stated above that it was less of an electrical exhibition than the one at Chicago. There were, moreover, no quite novel, epoch-making electrical inventions shown, although a few quite interesting ones that were already known to readers of the electrical journals were exhibited there for the first time. Detailed descriptions of all the important apparatus have doubtless been or will be given in the electrical journals, where they more properly belong, and where they can be read at one's leisure, and therefore no attempt will be made here to give such descriptions, even if time permitted, the intention being merely to mention some of the chief features and to make some general observations.

One of the striking features was the great prominence of three-phase generators, and their size. One obtains the impression that the three-phase current has triumphed over all the others, including the continuous current, when large amounts of power are concerned, and that it would be poor practice now to install large units of any but the three-phase system, unless one is forced to use another. There was shown a decided tendency toward the use of large units, and quite a number were exhibited having outputs of about 1,000 kilowatts and over. The greater number were for three-phase currents, and all formed the flywheel of their direct-connected, slow-speed engines, while all of the few large continuous-current machines exhibited had to have a separate flywheel. That the field is made the revolving part seems to be almost universal practice, as also the distributed winding on the armature. Single and two-phase alternators and large continuous-current machines were the exception.

Two very ingenious attempts were shown to compound large, three-phase generators, without commutating the main current, one by Hutin and Leblanc and the other by Boucherot. Both excite their direct-current and mechanically coupled exciter, by means of the three-phase alternating current, the exciter therefore having a revolving field, but fixed brushes; in both, the excitation of the exciter is dependent on the voltage of the alternator and on the main current, in the former by means of a shunt and series field-magnet coil and in the latter by means of a transformer combining the effects of both. To obtain direct current from such an exciter the connections between the commutator and the coils in the former are reversed according to a certain law, while in the latter the armature has several windings differing in their number of turns according to a sine law. Both claim to keep the voltage of the generator constant for different currents and load factors. It will be noticed that there is no commutation except that of the small exciting current in the direct-current exciter. Whether they are better or worse than the commutating systems used here, practice alone can decide. While they are interesting studies, it does not yet seem to be proved that for large units at least, a cheaper attendant than these would require, with his hand on the rheostat and his eyes on the voltmeter, is not a more practical solution.

The amortisseur of Hutin and Leblanc, consisting of a short-circuited cage through the poles of the magnets, for facilitating parallel running, seems to be meeting with some favor and is being commented upon very favorably.

The largest generator exhibited was a 72-pole, 3,000-kilowatt, three-phase machine, of the Allgemeine Elektricitäts Gesellschaft of Berlin. Its speed was 83, frequency 100, voltage 6,000, weight about 160 tons, and diameter of revolving field about 24 feet. As many as 21 of these are under construction. It was claimed to be the largest in the world, but this is an error, as generators of 4,000 kilowatts and over are in use in this country, at even slower speeds. Several others above 1,000 kilowatts were shown, the slowest speed being 72, of the 2,700-kilowatt, mixed single and three-phase current Helios machine.

The direct-generated voltages of the three-phase machines were from 2,000 to 6,000 volts; there was one exhibit of a comparatively small generator for 30,000 volts, but as long as good transformers can be bought, such excessively high-voltage machines will probably be used only for exhibitions and laboratories.

There were a number of inductor alternators exhibited, which indicates that they are meeting with some favor.

Connecting lamp circuits to three-phase generators does not seem to be considered a sufficiently serious matter to overbalance the advantages of that system. The method used by the General Electric company of Berlin (that is, the Allgemeine Elektricitäts Gesellschaft, which, even in Germany, is generally abbreviated to A. E. G.) is simply to distribute the lights as evenly as possible over the three branches. All three mains are run into the buildings of even small consumers, although only two may be used, the third being available for changing over a batch of lamps, if necessary, for balancing. The voltage can thus be regulated only for all three branches together, and not for each separately; but this is not considered a serious disadvantage. The Oerlikon company, on the other hand, connects lamp circuits between the ends of only two of the three branches of a star-connected winding, the third branch being then idle; this enables the voltage of that single-phase, alternating-current circuit to be regulated at the machine. By overloading these two circuits 15 per cent., the capacity of the generator is about the same as for motor circuits with a power factor of 0.8. The units in a station can then be alike, and it does not interfere with paralleling, or running motors and lights from the same machine, if necessary. Another method, used in Switzerland, but only with two-phase generators, is to construct a sort of double machine, the two halves of which may be mechanically displaced relatively to each other to generate two-phase currents for power purposes, or they may be connected in line with each other to generate single-phase currents for lighting.

The high-voltage, direct-current series system for power transmission and very limited distribution made another and probably unsuccessful appeal for recognition, in the form of an exhibit by its indefatigable champion, Mr. Thury.

The large engines exhibited were, as a rule, slow-speed, which is the prevailing practice on the continent. The very high-speed steam turbines are also meeting with favor.

Among the various types of motors, the most interesting was the three-phase induction or Tesla type, which seems now to have demonstrated its superiority over all the others, except, perhaps, the continuous-current motor, upon whose field it is, however, encroaching very decidedly, with the present prospect of becoming its equal in importance. The largest company in Germany, and perhaps in the world, estimates that its sale of three-phase induction motors will before long exceed that of its continuous-current motors. Its very large factory, including even the rolling mill, is equipped with these induction motors, mostly direct connected. There is a single textile factory in Switzerland in which 500 of these motors are used for direct driving. The induction motors, almost exclusively of the three-phase and not two-phase type,

are being introduced very largely now, especially in Germany and Switzerland.

A nearly uniform type seems to have been adopted by most of the makers. In this, the primary circuit is the stationary one, and is distributed over the surface like a drum winding, as distinguished from the coils used in the earlier forms of Tesla. It is this distributed winding which is the chief improvement that has made them such a success; it seems to have been first introduced by Dobrowolsky in Berlin. The larger ones are almost always started with a resistance in the secondary external to the motor; in some cases a short-circuiting device is provided on the rotor for use after starting, so that the brushes may be raised while running, to prevent wear. It will be noticed that in some respects this nearly universal practice abroad differs from that in this country, where even very large motors up to 800 horsepower, if not more, are made without any brushes, being started with a transformed current at lower voltage; others are made with the starting resistances on the rotor itself, which also dispenses with brushes.

Among the few other devices exhibited for starting such motors, the object of all of which is the avoidance of slide rings, may be mentioned the ingenious one of Fischer-Hinnen, who uses an inductive resistance of very low ohmic resistance, in parallel with a non-inductive one of high ohmic resistance; together they act like a high-ohmic resistance when the motor starts, owing to the high frequency of the secondary currents, and diminish automatically as the motor increases in speed, because the frequency of the secondary then diminishes; they are permanently connected to the rotor. In the Deri motor the number of poles is changed by a switch in the primary, and the resistances are permanently connected between points of the secondary which have a difference of potential for one number of poles, but are of the same potential for a different number of poles; they are therefore either in or out of circuit and admit of no gradation, which is a disadvantage. Boucherot uses practically a double motor, the field of one of which may be mechanically turned through a certain angle for starting; the two secondaries are permanently short-circuited in series with each other, but have resistances connected between the coils through which the secondary current is forced to pass when one of the fields is displaced, but only then; it seems like a rather complicated device as compared with the simpler slide rings, which it replaces.

For the A. E. G. induction motors, Dobrowolsky claims that they will stand a 200 per cent. overload, have a power factor of over 0.9 and still give the normal output for two-thirds the normal voltage.

Induction motors are built on the continent for high voltages up to 6,000, and I believe even 10,000, thus saving the transformers for all but higher voltages than these.

As to single-phase induction or non-synchronous motors, it looked as though most of their makers thought it best not to exhibit them, or to evade questions asked about them. Among the exceptions may be mentioned the Brown and the Oerlikon motors, both of which start with an auxiliary winding. Brown, who constructs them up to 100 horsepower, states that they start with one-fourth to one-third full-load torque at about normal full-load current. He has even made them for starting with full-load torque at about double normal current. The air gaps are very small, from one to 1½ millimeters. A cheap liquid condenser, made of iron plates in soda solution, is used for producing the artificial starting phase. The Oerlikon motors are claimed to start with one-fourth normal torque, requiring 80 per cent. normal current, and to stand an overload of 50 per cent. An impedance coil is used for starting.

A very interesting installation of single-phase motors, and quite a unique one, exists in Frankfort-on-the-Main, Germany, where about 500 such motors, mostly by Brown are connected to the large single-phase, alternating-current plant, the motor load of which has leveled the load curve very decidedly. They vary in size up to 100 horsepower, and are used even for elevator work. They appear to be satisfactory to the users, even though they must always be started unloaded. This is probably the largest motor plant of its kind, and shows what can be done, even with single-phase motors.

One of the applications of three-phase induction motors which is of special interest, and which seems to have a promising future, is to traction. This three-phase traction system, which is scarcely known in this country, is in regular and apparently very successful use on a number of lines in Switzerland, where it is being introduced by such well-known constructors as Brown, Boveri & Co. and the Oerlikon company. A few of these roads were visited by the writer, and, as far as could be learned, they were running very satisfactorily. The double-trolley wire, which is essential, and which has often been urged as being such a serious objection, does not seem to give any trouble at all; each locomotive or car had even two contacts with each wire. Many of the alleged objections are overcome by the use of the contact bar instead of the trolley wheel, which completely avoids any jumping off of the pole, and greatly simplifies the overhead wiring at the switches, which is, in fact, not complicated at all. The motors are started with resistances in the secondary, as usual. There is no complicated controller, as the two motors are always in parallel. The trains start well and without difficulty, and, it seems, without any very abnormal current. The chief objection to the system seems to be that the running speed is always the same, in which respect it is like a cable road; it is therefore not possible to make up lost time except on a downhill coast, while on steep upgrades there is a considerable demand for power, as the speed is always the same maximum. No system of efficient speed regulation is used, presumably because none has been found to be satisfactory. This seems to be the real and serious objection to the use of the system in this country, where high speed seems to be an essential requirement. One of the freight locomotives was provided with a purely mechanical device for halving the normal speed, but no other information could be obtained than that it was then in the repair shop.

On that bold enterprise, the Jungfrau railroad, which will ascend one of the highest snow peaks in Europe, a very ingenious and apparently novel device is used on one of the Oerlikon, three-phase locomotives, in order to enable a train to descend to a habitable region, even if connection with the power house is broken, or if something should happen to the trolley wires or poles. Ordinarily, in descending, the induction motors act as generators, sending their current back into the line, which, therefore, must be intact. The device referred to consists of a small direct-current generator, driven by the descending locomotive, the current from which is led into one branch of the star or Y-connected primary, and out at the other two ends in multiple. This excites the motor, and it then generates alternating currents in the secondary, which are dissipated in the resistances used for starting; it thus operates as an electric brake, without being in contact with the line.

While three-phase traction in its present state would probably not be practicable here for cities, there seems to be a field for it on long-distance interurban lines with few stops, as it is much cheaper. The estimates for the Jungfrau road showed that the first cost would have been 50 per cent. greater if the continuous current had been used on the locomotives, as is done in this country.

Returning to the subject of alternating-current generators and motors in general, there is a characteristic difference between European practice and that in this country which seems worth mentioning. Here the coils are usually form-wound, and then laid into open slots; there the wires are more generally threaded through completely closed holes, as in the Oerlikon and Brown machines or through holes of which the webs have been cut through with a very thin saw cut, as in the Dobrowolsky machines of the A. E. G. Mr. Brown gives the following reasons for his preference: Lower magnetic resistance, smooth surface of core, seamless-tube insulation, solid poles, ease in parallel running and avoidance of wedges, binding wire, etc.; his experience is that it takes as long to replace a form-wound coil as to thread a new one in place. Dr. Behn-Eschenburg, the engineer of the Oerlikon company, gives his reasons as follows: The smoothness of the surface enables the air gap to be made as small as 0.001 of the diameter in induction motors, which is hardly possible with teeth; with a web over the hole of only 0.1 millimeter the coefficient of magnetic straying can be reduced to 0.04, and a maximum power factor as high as 0.92 can be obtained; the maximum torque will correspond with 3.5 times normal current, and the possible overload can be 2.5 times the normal; if the holes were changed into teeth, all else remaining the same, the magnetization current would be at least doubled, the straying coefficient reduced to about 0.03, and the best current for the resulting maximum power factor of 0.94 would then be more than doubled and the copper conductors therefore increased, or for the same load the power factor reduced to 0.91; the slotted armature would have to be made longer axially if it is to have the same current at no load as the one with holes; moreover, seamless insulation tubes of micanite can be used in the holes, which, if one millimeter thick, will be quite safe for 3,000 volts. However, he quite impartially recognizes the favorable features of slots with form-wound coils, and admits that they may outweigh the others, if a factory is suitably equipped for such work; he believes that under certain circumstances the one, and under others the other, is the better.

Another interesting characteristic difference between American and continental practice is that here synchronous converters, combined with transformers, are more generally used for transforming high-voltage, three-phase currents into low-voltage, direct currents, while on the continent dynamos driven by high-voltage, induction or synchronous motors are the rule. Although the favorable features of each are well understood, the reasons given by such a successful constructor as Brown for preferring motor-generators may nevertheless, be of interest here. He states that they can be regulated with ease and precision; no transformers; both parts can be better designed without making concessions; no hunting; ease in starting; no depolarization possible; secondary voltage absolutely independent of the primary. He admits that the synchronous converter is cheaper and more efficient, but claims that the differences are but slight; he has obtained 90 per cent. combined efficiency for a 250-kilowatt motor-generator set.

The difficulty of not being able to regulate the voltage of a synchronous converter is overcome by Dobrowolsky in a very ingenious and apparently successful way. Instead of passing the continuous current through a booster, which would require an expensive machine, and generally with a very large commutator, he passes the alternating current through an alternating-current booster on the same shaft; this is separately excited with a continuous current, and therefore permits of regulation. The one shown to me would raise or lower the voltage 25 per cent., making a range of adjustment of 50 per cent. It either drives or is driven by the converter. Although this overcomes one of the chief objections to synchronous converters, he has not changed his preference for motor-generators.

Another modification of interest used by this same engineer and others is that six-phase, instead of three-phase, currents are led into the synchronous converter, the advantage being that its output is thereby increased, according to a French constructor, about 45 per cent. The attending disadvantage of six slide rings instead of three is said to be more than balanced. The general use of three core transformers, for three-phase currents, instead of a single one for each phase, as is customary here, is another instance of a difference in practice.

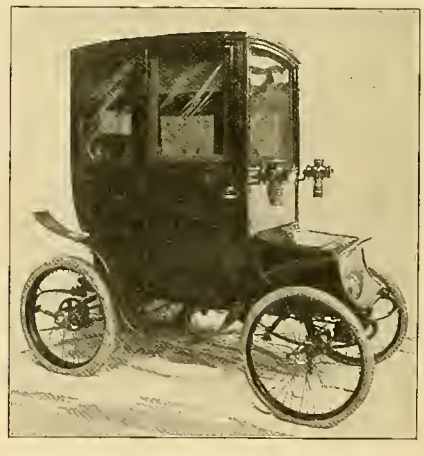
It was of some interest to note the almost complete disappearance of the Gramme ring armature among generators and motors, and the use of multipolar fields for smaller sizes than formerly, especially with motors. The Dobrowolsky system, hardly known here, of supplying three-wire circuits from a single generator by connecting the neutral through induction coils and slide rings to two opposite parts of the armature winding, seems to be meeting with favor on the continent.

A criticism of American motors, made by a prominent German manufacturer who has bought and tested many, was that an American horsepower was only three-quarters of a real horsepower.

[*To be continued.*]

De Dion-Bouton Doctor's Coupe.

The accompanying illustration shows the latest type of automobile, known as a doctor's coupe, designed by the De Dion-Bouton Motorette company of Brooklyn. This carriage has been built to suit the requirements of physicians generally. It was shown for the first time at the Madison Square Garden automobile show in New York city, and is said to have called forth considerable admiration. The frame design, speed-changing gear, levers for operating, etc., are similar to the construction observed with such good advantage in the New York type motorette built by the De Dion company, but in addition to the advantages possessed by that carriage the doctor's



DE DION-BOUTON DOCTOR'S COUPE.

coupe affords complete protection from storms, etc. It has a box of neat design mounted in front, which offers a large storage space, while additional goods may be carried under the seat. The carriage construction, including upholstery, etc., is of the best, while the color and other details are at the option of the purchaser. The coupe shown is equipped with a 3½-horsepower gasoline motor, but a five-horsepower motor may be fitted, which additional power allows of increased passenger capacity. Fitted with the smaller motor the coupe will carry three people, while it will admit four if fitted with the five-horsepower motor, as in this latter instance the front seat is made full width.

Large Storage Battery for Baltimore.

The Baltimore and Ohio Railway company is about to install additional electrical equipment for its tunnel system in Baltimore. It has contracted with the Electric Storage Battery company of Philadelphia for a very large storage battery—one that will require a building 145 feet long by 44 feet six inches wide. The battery will have 320 cells of 39 plates, 19 negative and 20 positive. Each tank, with plates and electrolyte, will weigh 1,800 pounds. The battery will receive the surplus electrical energy generated by the power house when the electric locomotives used in the tunnel are not in operation. This will relieve the power house of the great strain upon it when the motors are in operation.

Gould Storage Battery for Heavy Duty.

When a manufacturer of storage batteries can designate as users of his cell such concerns as the Riker Motor Vehicle company, F. R. Wood & Son and the General Carriage company of New York, and also the Baker Motor Vehicle company of Detroit, Mich., and the Woods Motor Vehicle company of Buffalo, to say nothing of a number of other concerns in the automobile field, the details of construction and newest method of application of that type of cell become of considerable interest to those builders of electric vehicles who are desirous of making a permanent alliance with a manufacturer of batteries.

With the above list of customers to its credit, the

FIG. 1. GOULD STORAGE BATTERY FOR HEAVY DUTY.—ALTMAN & CO.'S DELIVERY TRUCK.

Gould Storage Battery company of New York has all along followed the practice of leaving no stone unturned to further improve its product. One of the latest applications of the Gould battery, and one that indicates an appreciation of this type of cells for heavy duty, is illustrated in the accompanying cut (Fig. 1) of Altman & Co.'s new delivery truck on a New York street.

Altman & Co. are prominent dry-goods dealers in New York. They engaged the services of F. R. Wood & Son of New York to design and build for them a number of special vehicles. The illustration here given shows an electric delivery truck, equipped with a battery of 44 "11EV" Gould storage batteries. The truck is to be used for transferring baggage from the smaller delivery wagons coming from downtown to the districts situated above the Harlem River.

This wagon is 14 feet in length, weighs 6,000 pounds complete, and has battery capacity enough to propel it over 20 to 30 miles on one charge. There are 44 cells, supported in a battery box constructed of channel iron. The cells may be reached through a trap-door in the floor of the vehicle. The vehicle is propelled by two two-horsepower Westinghouse motors, geared to the rear axle in a ratio of 12 to 128. A General Electric controller permits of four forward and two backward speeds.

As in storage-battery vehicle propulsion, especially for heavy duty, the type of cell used is all important, a few details as to the structure and composition of the "EV" Gould cell (Fig. 3), which is used in this heavy duty in the Altman delivery truck, will be valued by motor-vehicle designers.

Generally speaking, the aim of the Gould company has been to provide a plate in which there is the greatest amount of active surface and contact with the active material, with mechanical strength, and in which a process of "formation" is used whereby large capacity, with durability, is obtained. The Gould storage battery has been constantly developed on these lines for the last three years, until now it has a great surface for its capacity without sacrificing its mechanical strength. In forming both positive and negative plates (Figs. 2 and 4), an electrochemical process is used, as practice has demonstrated, the company says, its greatest superiority.

By the Gould process the active material is formed as a thin coating in a cohesive yet porous form, from which gases can be rapidly evolved without dislodging the coating of active material, thus giving free circulation of gases and solution, thereby increasing the efficiency and durability of the plate.

The accompanying picture (Fig. 3), showing the sides of a battery broken away, gives a good idea of the seven-plate "EV" cell. The "11EV" type cell, 44 of which are used in the Altman wagon, has 11 plates, five positive and six negative. Each cell weighs 43 pounds and will give a discharge of 42½ amperes for four hours. In a word, the Gould company figures about 3.9 ampere-hours per pound per complete cell. Again, figuring 170 ampere-hours at 1.92 volts, the watt-hours obtained per pound per complete cell show a remarkable efficiency.

The Electrant.

At the recent automobile show held at Madison Square Garden, the General Electric company had on exhibition an automobile-charging set called the "electrant." The electrant is a device for charging the batteries of electric automobiles. It is intended to be connected to the mains of an Edison system, and when so connected, is suitable for charging automobiles having battery potential of 80 volts. In it is included a Thomson recording wattmeter of the railway type, provided with contacts on the dial, so that when the prepaid amount of energy has been delivered, a circuit will be made and the main switch opened. Across the center of the electrant, on the outside, are four plug receptacles. The resistances in series with these receptacles are so proportioned that 20, 30, 40 and 50 amperes will flow when charging an 80-volt battery from a 110-volt circuit.

When an automobile requires a charge, the plug carried by the automobile is inserted in any one of the receptacles. Upon turning the handle of the door, just above the receptacle, a contact is closed and current flows from the battery of the carriage through an electromagnet in the electrant, and this magnet, attracting its armature, releases the catch on the door and allows it to be opened. A coin may now be deposited in the slot in the apartment made accessible by opening the door, the switch handle turned down, this motion being transmitted by means of the coin to an interior switch-blade, closing the main circuit. The handle must now be returned to its initial position before the door can be closed.

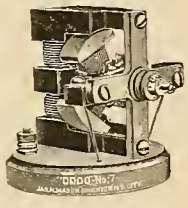
The closing of the door operates an auxiliary switch and current is fed into the battery. As long as the door remains open no current passes. When the prepaid amount of current has been withdrawn, a contact on the meter dial is closed and the main switch is thrown open, returning everything to its initial position, as it was before the carriage arrived. The switch will also be thrown over, provided the plug is withdrawn before the charge is completed, and any unconsumed portion of the prepaid energy reverts to the supply company. This may be avoided in order to change receptacles by pressing the contact button on the left, which prevents the closing of the contact through the release magnet.

Garbage Crematory for Chicago.

The subject of garbage disposal by cremation has been under consideration for some time in Chicago, and in the recent report of the aldermanic special committee having the subject under consideration the establishment of a garbage-cremation plant was recommended. An ordinance providing for the installation of a crematory plant at the municipal lighting station at Chicago avenue and Sedgwick street was drawn up. The finance committee of the City Council at its last meeting sanctioned the recommendation, and the experiment will now be pushed to a thorough trial. The proposition of the Wright Crematory company for the construction of the cell and its adaptation to the boilers, at a cost of $1,630, was accepted, and the special committee, of which Alderman W. F. Brennan is chairman, was authorized to close the contract. The heat from the crematory furnace will be applied to the boilers for generating steam for the plant. The Chicago avenue plant, although not running ordinarily, is in good condition for the test. City Electrician Ellicott said that while similar methods for garbage disposal have been tried in various foreign cities, only an actual trial could show its practicability for this city. If the receipts from the power generated simply defray the expense of garbage collection, the enterprise will be regarded as a success.

The Oddo Motor.

The accompanying cut illustrates a tiny electric motor with a number of interesting features. The Oddo motor, as it is called, weighs only 15 ounces, and its constructors claim that its design is such that it permits practically almost all the magnetism generated to be turned into power. The manufacturer, likewise, lays stress upon the length of the arms of the armature, giving it, through its speed, a strong power. In general, the American Oddity company, 170-172 Broadway, New York, the manufacturer of the motor, claims a surprising efficiency over other motors of the same size and weight. This little machine will run on one dry cell.



ODDO MOTOR

Direct-lift Electro-hydraulic Elevator.

That electricity is the coming power for the operation of elevators has been conceded by many prominent engineers, provided the apparatus is correctly designed and the power properly applied. It has been demonstrated, however, that there is considerable wear and tear on the cables, entailing considerable expense, while the frequent opening and closing of the reversing switches soon burns and deteriorates the contacts. In the new electro-hydraulic elevator introduced by the A. Kieckhefer Elevator company of Milwaukee, the manufacturer seems to have combined the good points of both systems. As shown in the illustration on page 331, an electrically driven pump is connected with compression and open tanks, the compression tank furnishing power for the hydraulic lift, thereby using the hydraulic elevator as a medium between the power and the operation. A large saving in power is thus obtained, and the elevator is easily controlled and operated. Absolute safety is also said to be secured, as no cables have to be depended upon. The landing is also made much easier and

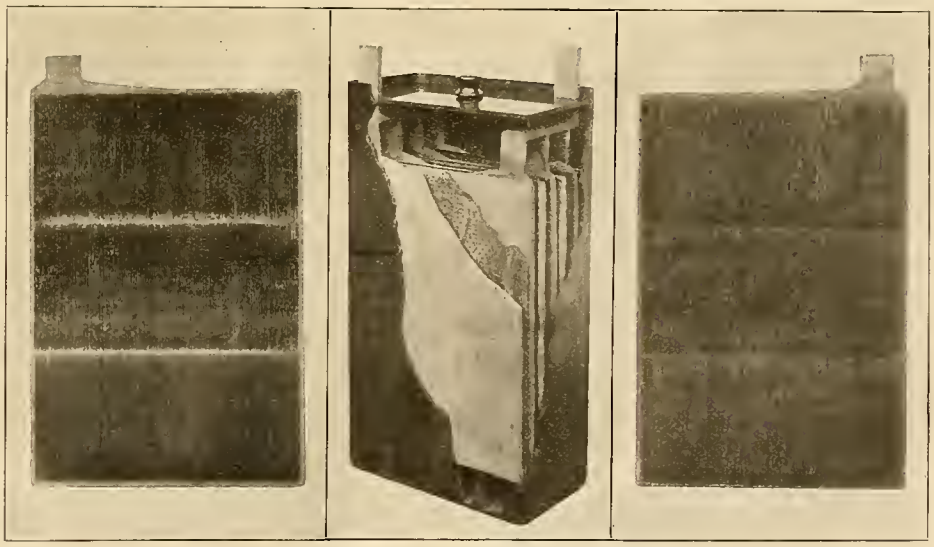


Fig. 2. Positive Plate. Fig. 3. Seven-plate Cell with Shell Broken Away. Fig. 4. Negative Plate.

GOULD STORAGE BATTERY FOR HEAVY DUTY.

almost instantly. The picture to which reference has been made shows one of the five Kieckhefer elevators installed in the new plant of the Milwaukee Harvester company.

Edison's New Air-heating Device.

The newspapers give Thomas A. Edison credit for perfecting a device for heating compressed air which, it is said, utilizes practically all the energy stored in coal. It is stated that by use of the invention it is possible to get power through air compression for less coal per horsepower than through the steam engine. The power of the device rests on the well-known principle of the increase in power of compressed air with increase in temperature. A popular description of the invention is given as follows:

"Two chambers, one inclosing the other, are the essential points of the heater, varying in size according to the volume of coal used. For example, an outer chamber 15 inches in diameter is quite large enough for use in a street car, provided the coal supply be replenished twice or at most three times during the 24 hours. The inner chamber, smaller by two inches than its cover, is constructed with strong walls, equipped to withstand a mighty heat pressure. Circulating air cools the walls of the outer chamber, which, as a result, may be made thinner and lighter. The outer chamber is connected by a pipe with a reservoir of compressed air. On the opposite side of the chamber at the top is another pipe, through which the air is carried with all its giant driving power to the engine which is to be operated.

"Compressed air with a force of 100 pounds to the square inch exerted at the point of application without the addition of heat is made to heat itself. By a simple mechanical arrangement on the main pipe, which acts as a chokeoff, part of the compressed air is carried down into the inner chamber where the coal is. The diverted air feeds the combustion, making it gradual, but complete. There is no outlet for the smoke and gases which accumulate in the inner chamber except a small pipe which opens into the large pipe, through which the power is transmitted direct to the engine that is being operated. Enormous heat and almost trebled power are the results. Not more than one per cent. of the entire energy in the coal is lost."

Affairs of the General Electric Company.

The New York daily papers bear glowing reports of the condition of the General Electric company. The Times is informed from an official source that within a few days the General Electric company will be entirely free from debt. "There were $10,000,000 of debenture bonds outstanding. This amount was brought down to $5,000,000 by redemption, and now this last half of indebtedness is being wiped out by an exchange of stock for bonds at the rate of $400 worth of stock for $500 in bonds." The Sun notes that the stock sold on November 10th for 145⅜ and on November 16th at 165. For the seven-month period from February 1st to August 31st, inclusive, of this year, a report to the New York Stock Exchange shows sales of $14,803,384, royalties and sundry profits of $108,449, interest, dividends and discounts amounting to $202,188, and a liquidation account of $181,953, or total earnings of $15,295,974. Expenses of $12,075,995 leave net earnings of $3,219,979, from which dividends amounting to $548,280 have been paid, leaving a surplus of $2,671,699. This, as stated already, is for the seven-month period. There was a previous surplus of $2,353,031, bringing up the total profit-and-loss surplus to $5,024,730. The sales of the company last year amounted to $22,379,463. At the rate of sales for the seven months of this year the total sales for the year will be something like $25,223,000.

BOOK TABLE.

A Handbook of the Electromagnetic Telegraph. By A. E. Loring. New York: D. Van Nostrand company. 1900. Pp., 116, 3½ by 6 inches, with 24 illustrations. Price, 50 cents.

The fourth edition of this useful little book has recently been published. It is issued in the Van Nostrand's Science Series, thus making it a handy and portable manual. The author has revised the original text considerably, to conform with the present state of telegraph practice, and has also added a chapter describing in outline the duplex and quadruplex methods of telegraphy, which has added materially to the value of the work. Other chapters treat of electricity and magnetism, the Morse telegraph, practical telegraphy and the construction of lines. An appendix, giving suggestions and exercises for learners, completes the volume. The book is of an elementary nature and should be useful to students and beginners.

A syndicate is said to have been formed at Des Moines, Iowa, for the purpose of building an electric or compressed-air railway out of Des Moines, to connect with the Iowa Central railway at Newton. Incidentally, it desires to acquire a controlling interest or working agreement in the Des Moines City Railway company. L. M. Hanna of Cleveland, a brother of M. A. Hanna, and J. C. Rockefeller of the same city, brother of J. D. Rockefeller, are said to be the principal stockholders.

CORRESPONDENCE.

London Letter.

London, November 6.—The annual report of Mr. A. A. Vaysey, electrical engineer and inspector for the corporation of London, or, as it is called, the City, which, by the by, embraces an area of just one square mile, states that last year the total number of arc lamps in use was 507. One of the conditions on which the City of London Electric Lighting company was allowed to change the standard pressure from 100 to 200 volts was that it establish concurrently with the change and under the direction of the Board of Trade a means of testing the value of the supply to the public lamps. Only 11 meters were submitted to the inspector last year. Nine were sufficiently correct, but the others were incorrect. The Aron meter was approved by the Board of Trade for use on alternating-current circuits, and the inspector made a number of tests, with a view to determine the kind of examination that would be necessary before certifying such meters in accordance with the provisions of the electric-lighting orders.

The Chapel Royal, St. James' Palace, is to be lighted in future by electricity. The new illuminant is in course of installation, and the work is likely to be completed within the next fortnight.

Monday saw the initiation of street lighting by electricity in the town of Dudley. A dozen years ago Alderman Bagott, the "Father" of the Council, proposed the adoption of electric lighting, and he was politely laughed at for what was considered an impossible suggestion. Alderman Bagott is still Father of the Council, still an alderman, and has lived to see Dudley streets lighted by electricity. There is every probability that the electric light will be largely taken by storekeepers and residents, the corporation having undertaken to free-wire all premises adopting the light.

An event of some importance took place at Luton last week. It was the laying of the foundation stone of a new motor-car works, which Mr. E. W. Hart intends to erect to manufacture electrical vehicles. I should mention that the British and Foreign Electric Vehicle company is being formed to develop general electric traction work, and that arrangements have been made with Mr. Hart to supply cars to the company. Luton is very favorably situated for the enterprise, being only 30 miles from London, and the train journey being slightly less than 40 minutes. The promotors of the new company have great faith in the future of electricity, in connection with automobilism, and have substantial visions of a car that will not only run more than 100 miles on a single charge, but which can be recharged in considerably less time than has hitherto been possible.

I am officially informed that on Monday of last week, the day of the return of the City Imperial Volunteers from South Africa, the "Twopenny Tube" carried 235,000 passengers. With a comprehensive fare of four cents, results are easily arrived at. Electric underground roads are decidedly the true solution of the present congested state of London traffic.

Wireless telegraphy, as a practical scientific fact, is surely overcoming the incredulity of the world. Saturday's voyage of the Princess Clementine will probably be marked by chroniclers of a later day as the beginning of a new era in the story of commercial intercourse. Two representatives of the Wireless Telegraphy company accompanied the boat from Ostend, and in mid-channel messages were dispatched by electric waves to Brussels. The experiment was entirely successful, and a long vista of possibilities opens to view.

Wireless-telegraph stations are to be established at Gibraltar and Malta.

The Moscow tramways will shortly become the property of the town, and animal traction will be replaced by electricity. The system of electric traction has not been definitely settled yet, though a special committee has collected a mass of evidence as to the different systems. The balance of opinion seems to be in favor of storage batteries. Russia is certainly worth the attention of American firms, as I am informed Moscow is not the only city likely to adopt electric traction soon. W. H. B.

New York Notes.

New York, November 17.—The annual meeting of the stockholders of the Manhattan Railway company was held on Wednesday. The directors and officers were re-elected, as follows: Directors, George J. Gould, Russell Sage, Samuel Sloan, R. M. Gallaway, Edwin Gould, Thomas T. Eckert, Marcellus Hartley, Donald Mackay, G. P. Morosini, Howard Gould, Warren B. Smith, John T. Terry and Alfred Skitt; president, George J. Gould; vice-president, Alfred Skitt; secretary and treasurer, D. W. McWilliams. President Gould, in a statement accompanying his annual report, outlined some of the company's plans for the future. These plans contemplate the extension of the express service from Eighty-fourth street to One-hundred-and-twenty-ninth street, on the Third avenue line, materially shortening the running time of express trains between Harlem and the lower part of the city. This improvement is expected to be put into effect within the next 30 days. President Gould reported that the electrical installation is making excellent progress. The heaviest work at the main power station at East Seventy-fourth street is completed, and the superstructure is being rapidly erected in anticipation of the first arrivals of machinery, due for delivery next month. The first electric train is completely equipped, and through the courtesy of the officials of the Metropolitan Street Railway company in furnishing the necessary power, it will be put in operation on the Second avenue line without delay. The report for the year ended September 30th shows the gross earnings for the last year to be $9,950,735, with net earnings of $4,755,422, and a net income, deducting bond interest and taxes, of $2,066,778. The corresponding net income of 1899 was $1,321,640.02. The operating percentage, excluding all taxes, was 52.21, compared with 56.69 in 1899. The number of passengers carried was 183,788,851, an increase of 6,584,293 over last year.

The Wall street rumors that Metropolitan and Brooklyn Rapid Transit are soon to be allied have subsided, and they were undoubtedly premature. Nevertheless, it is probable, says the Tribune of this city, that the whole vast network of local lines, from the outer edge of Queens on the east, throughout the territory of Brooklyn, and from the Battery to the upper borders of The Bronx, will eventually come under one control.

The complaints of the residents of the Twenty-sixth ward against the surface and elevated-railroad service of the Brooklyn Rapid Transit company were heard by the state railroad commissioners last Thursday. The complainants contended that the operation of trains on the Lexington avenue elevated road was defective; that an insufficient number of trains were operated, and that the passengers were not only huddled together inside the cars, but also on the front and rear platforms during the rush hours of the morning and evening. The residents also complained of the neglect of the company in running through cars across the loop without change. In answer, the company admitted the principal allegations of the complaint in regard to discontinuance of stations and curtailment of service between specified hours on some of the elevated lines. The answer says, however, that the system at present in operation at the loop on Sundays, as well as week-days, is far more convenient for the traveling public than the operation of all through trains would be. Answers were also received to complaints about transfers, in which the company contends that the privileges are ample.

Electric cars were operated this week for the first time on the surface line which extends from the Fort Lee ferry, at the foot of West One-hundred-and-thirtieth street, through upper Broadway, Forty-second street and First avenue to the Long Island railroad ferry, at the foot of East Thirty-fourth street. The new cars are well equipped and comfortable and of the latest type.

The transfer of the Consumers' Gas company and the Consolidated Gas, Electric Light, Heat and Power company of Newburgh, N. Y., took place last Thursday in this city, the new owners being mainly New York capitalists. The new company is to be known as the Newburgh Light, Heat and Power company. The capitalization of the two old companies was $750,000, but the new capitalization is to be $1,000,000. It is believed that the Consolidated Gas company of New York is the purchaser.

DeWitt C. Bunnell, oldest son of the late Jesse H. Bunnell, and head of the Bunnell Telegraphic and Electrical company of this city, died on November 11th, of typhoid fever. Mr. Bunnell was in his twenty-fourth year. M. L. G.

Canadian Intelligence.

Ottawa, Ont., November 17.—It is announced by the Grand Trunk railway authorities that 8,000 incandescent lamps will be used in the electric-lighting plant which is now being installed in the Grand Trunk company's shops at Point St. Charles, Montreal. The Chambly Electric company has been awarded the contract to supply the power.

Messrs. W. S. Foster of Rickford, Vt., Dr. C. Cotton of Cowansville, H. C. Williams of Knowlton, G. Stevens, H. E. Allen and C. A. Nutting of Waterloo, Ont., will apply to the Ontario government for letters patent to be incorporated under the name of the Brome Lake Electric Power company, with a capital of $50,000.

Messrs. W. T. Pember, G. H. B. Hooper and W. D. Earngey of Toronto, Ont., have been incorporated as the Magnetic Electric Brake company by the Ontario government, to manufacture, sell and deal in magnetic electric brakes. The capital of the new company is $500,000, and its head office is in Toronto.

The Manhattan General Construction company of Newark, N. J., has appointed Mr. E. J. Philip of the Steam Specialty company, Toronto, to be general selling agent in Canada for the well-known enclosed-arc lamps of the former company.

The Montreal Electric Street Railway company has introduced an innovation in street-railway building in the reconstruction of its track on St. James street, in that city. Steel ties, to which the rails are firmly bolted, are used. The system has been tried in India and various countries in the tropics, and, it is understood, has given much satisfaction.

At Sault Ste. Marie, Ont., another great center of electrochemical industry is springing up. A company has been organized, with a capital of $30,000,000, to develop the waterpower on both the Canadian and United States sides. On the Canadian side 14,000 horsepower is now being used, while 10,000 horsepower will be taken by the American

Alkali Works. Other industries, such as nickel reduction works and chemical works, are contemplated.

In McGill University, at Montreal, there are 30 fourth-year students in the engineering department. Of this number, 18, or 60 per cent., are taking the electrical course. The electrical department of the university is now taxed to its utmost capacity, and, notwithstanding the extensive improvements made in it during the last five years, the university authorities are now confronted with the problem of providing still greater accommodation, both as regards space and additional appliances. Professor R. B. Owens, formerly of Lincoln, Neb., is in charge of the electrical department.

The Lakefield Portland Cement company of Lakefield, Ont., will have its works operated entirely by electricity. The waterpower is situated about five miles from the works, to which electric current will be transmitted at a pressure of 10,000 volts, by a 600-horsepower generator, and transformed at a substation at the works. In the works 14 motors, of various powers, will be distributed to provide power for the different departments of manufacturing. The installation is now in progress. After the works are supplied, it is the intention of the company to furnish light for the town.

In the big telegraph suit to be tried at Toronto, Ont., in which the Great Northwestern, the Western Union and the Montreal Telegraph companies are interested, the Court of Appeal was asked whether the case could not be tried immediately. Opposing counsel objected, stating that the case was one of vast importance and should come before the full court of five judges; that over $90,000,000 is invested in the disputing corporations, and that it would not be fair to the shareholders to proceed at present, as only four judges could be secured to hear the case. The court agreed, directing the case to stand over. The action was brought to attack an agreement by which the Montreal Telegraph company was absorbed.

The initial installation at the works of the Chambly Manufacturing company, at Chambly, Que., from which point current is transmitted direct to the city of Montreal, 17 miles distant, consists of four two-phase generators of 2,000 kilowatts' capacity each, wound to generate current at 12,000 volts. The plant was so designed, however, as to provide for the installation of eight machines of the same capacity. The demand for power has been so great that the Chambly company has found it necessary to install the additional equipment originally provided for, and, accordingly, the four additional generators will be wound for 2,200 volts, and, by means of transformers, the current will be stepped up to 12,000 volts for distribution over the circuits.

The growth of electric lighting and power in the city of Montreal is said to be remarkable of late, and has reached great proportions. It is learned that, during the last four years, the number of lights in use in the city has increased from 54,000 to 100,000 The Royal Electric company has also in operation over 5,000 horsepower in motors. The obliging users of these motors have contracted with the company to run the machines only between the hours of 7 a. m. and 4 p. m. Thus the power load is entirely a day load, and does not interfere with the lighting load. Between the hours named, the day load averages from 80 to 90 per cent. of the lighting load, a condition that is believed not to exist elsewhere in the world. A. V. W.

From the Buckeye State.

Columbus, Ohio, November 17.—The regular quarterly meeting of the directors of the Southern Ohio Traction company was held at the offices in Cleveland on Tuesday, with Will Christy of Akron in the chair. The report of the business done by the lines between Dayton and Cincinnati was very encouraging, indeed, and it is said that the company has stirred up one of the biggest electric-railway projects that has ever been conceived in this state—one that has been indirectly hinted at in this correspondence before. It is nothing more or less than a line stretching across the state from north to south and connecting the two great systems, the Northern Ohio and the Southern Ohio Traction companies, with branches formed by the Western Ohio Traction company and lines that may be constructed by an eastern Ohio Traction company. On this line through trains of three or four cars drawn by a motor car will be run, and it is expected that a good freight and express business can be done also. The extensive investments of the men interested in all of these companies alike show that there is something in view for the future, and the location of the systems of roads they are forming only goes to prove the idea just outlined. The report at the meeting showed gross earnings from May 1st to November 1st of $171,040.62 and net earnings of $88,076.69. Less interest on bonds, there is a surplus from this business of $42,406.95, and a dividend of three-fourths of one per cent. quarterly was declared, payable December 1st. Chairman M. J. Mendelbaum of the executive committee reported good progress in the negotiations for extensions in Cincinnati.

C. W. French of Mansfield is promoting an electric line from Canton to Mansfield, through Wooster, Massillon and Alliance. He is endeavoring to interest local capital along the line.

T. L. Childs has prevailed upon the commissioners of Stark County to reopen the matter of granting a franchise for an electric road from Canton to Akron. He promises to have the road completed by October 1, 1901, if the franchise is granted. Meantime the commissioners are making an investigation as to what support the Ohio Trust company of Chicago has agreed to give the road.

It is said that the necessary capital has been secured for building the line of the Barberton, Doylestown and Massillon Railway company, which A. E. Townsend is promoting. It is reported that the Knickerbocker Trust company has agreed to take the bonds and that the Empire Construction company will build the road.

There is a contest in Huron County over the franchise through that territory, between the Sandusky and Interurban road and the Cleveland, Elyria and Western. It is yet hard to tell which will be the lucky one, but the Sandusky company seems to have the majority of the people of the county with it.

The Hamilton county commissioners have granted a franchise to the Cincinnati Street Railway company to extend its Warsaw avenue line to connect with the Eleberon avenue line, thus forming a belt line which will be of great advantage to the people of Price Hill, as well as other portions of the city.

The Bullock Electrical Manufacturing company of Cincinnati has closed a contract with the McCloud River Electric Power company of Shasta, Cal., for furnishing the equipment for a power plant to operate a copper mine. The plant will consist of four generators of an aggregate capacity of 2,000 kilowatts, and the current will be transmitted 30 miles to the mines. The plant will be operated by waterpower. The contract amounts to $100,000.

The generating machinery of the Hillsboro and Chillicothe Traction company, now being projected, will be operated by waterpower, very likely, as there is a stream close to the line which will furnish an abundance of power, if its use can be secured at a reasonable figure.

The Toledo Blade is responsible for the assertion that within the next two years that city will be connected with Chicago, Cleveland and Detroit by electric lines.

Work began on the extension of the Grove City line from Columbus to Morgan Station last Wednesday.

The Toledo, Fremont and Norwalk Electric Railway company has secured the right-of-way between Fremont and Oberlin. It is said this company will also build lines to Marblehead, on the lake, and to Tiffin, as soon as the main lines are completed.

It is said the Columbus, Lima and Northwestern Railway company, incorporated a few days ago, will build an electric line, but this cannot be verified. The charter will allow either electricity or steam as a motive power.

The Sandusky, Norwalk and Southern Railway company of Sandusky, Ohio, was incorporated, with a capital stock of $400,000. It is the intention of the new company to build a line from Sandusky through Erie, Huron and Richland counties to Mansfield. The articles of incorporation will allow it to carry freight, passengers, express matter and packages. The incorporators are John Whitworth, Truman B. Taylor, Emil G. Schmidt, Henry G. Miller and William E. Guerin, Jr.

The Marietta Electric company, Marietta, Ohio, has filed notice with the secretary of state of increase of capital stock from $75,000 to $250,000. A. L. Gracey is the president of the company and J. S. H. Torner, secretary.

The Warren Electric and Specialty company, Warren, Ohio, has increased its capital stock from $100,000 to $200,000.

It is stated that an electric line will be built from Clyde to Columbus, to parallel the Sandusky division of the Big Four road. It is to connect at Norwalk with the Toledo, Fremont and Norwalk, and may be made a part of that system. O. M. C.

Northwestern Notations.

Minneapolis, Minn., November 17.—The Des Moines Edison Light company of Des Moines, Iowa, has filed amended articles increasing its capital stock from $450,000 to $1,125,000. The increase is made to take over the Capital City company's business and to provide funds for improvements and extensions to the plant.

The water board of St. Paul is hunting down all cases of electrolysis to place the blame. The street-railway company has been cornered in one or two instances, and the telephone company is under suspicion.

The promoter of the Milwaukee and Lake Geneva Electric Railway company appeared in Lake Geneva, Wis., the day before the expiration of the company's franchise and had some plowing done. The franchise required that work must be started within a year.

The street-railway company raised new poles for its trolley wires in Davenport, Iowa, by attaching a rope to the pole and to a street car, which was backed away, and raised the pole easily.

The United States Court has set aside the verdict against the Western Union Telegraph company, obtained by Frank M. Nye of Minneapolis. A telegram was sent over the wires of the company, reflecting on Mr. Nye's political integrity, alleging that he had been bought off from supporting certain candidates. The lower court gave a judgment of $500. The higher court holds that the small number of employes, bound to secrecy, who would see the message during transmission, does not constitute publication.

A. G. Whitney of Fargo, N. D., and others have bought the property of the Benton Power and Traction company at St. Cloud, Minn., and will improve it and extend the heating mains.

The Board of Public Works of St. Paul has indorsed the plan of the city engineer for a municipal lighting plant.

The Twin City Rapid Transit company has made all preparations to get through the coming winter without having its service interrupted. Several additional snowplows, weighing 25 tons each, have been provided. The old rotary plow will be placed on the Stillwater line.

H. O. Batchelder of Omaha is the inventor of a device, which he calls the polimeter, to keep passengers informed as to the location of the car. The principle is similar to the indicators attached to elevators in office buildings which show at which floor the car stands.

The city of St. Paul is taking bids until December 4th for lighting the streets of the city for one year with gas, electricity and gasoline.

The council of Lincoln, Neb., is having plans and estimates made for a municipal electric-lighting plant.

The Dyersville Light and Water company has been incorporated at Dyersville, Iowa, with $15,000 capital stock, to establish light and water systems.

Engineer F. W. Cappellen of Minneapolis is preparing plans for a street-lighting system for the city of Duluth, Minn., to cost $100,000.

Petitions will be circulated through all the important cities of Wisconsin, asking the next Legislature to repeal the law whereby street-railway companies pay taxes to the state on the gross-earnings basis.

Legal proceedings to cancel the franchises of the street-railway companies operating at Appleton and Superior, Wis., have been begun before Attorney-general Hicks. In both cases the forfeiture of the franchises is asked by reason of poor service, tracks in poor repair, cars not properly heated, etc.

Under the new charter recently adopted by the city of Duluth, Minn., it is found that the lighting fund has a certain amount which had not been figured on. Lakeside and Woodland will therefore be accommodated with electric street lights, which have been demanded so vigorously for some time.

Public sentiment is being aroused in Tacoma, Wash., to induce the council to grant the street-railway company permission to change its line in order to avoid the hill on De Lin street. This was the scene of the fatal accident of July 4th last.

The Electric Light and Power company of Glendive, Mont., has been incorporated, with $10,000 capital stock.

The Duluth-Superior Traction company is lengthening the curves of its line between Duluth and Superior, in order to run double-truck cars between those cities. The long cars are expected to be in service before the first of the year. R.

Gleanings from Colorado.

Denver, November 16.—Work has been begun on setting up the two generators in the new power station of the Colorado Springs Electric company, which is located four miles north of Colorado Springs, at the coal field. The dynamos, which are of 750 kilowatts, were furnished by the General Electric company. It is expected that the station will be in running order by December 15th. The officers of the company believe that the plant will be one of the "crack" installations in the West.

It is expected that the power plant of the Telluride Power Transmission company will be completed early next month. The electrical machinery is of the General Electric make. The manager of the company is Mr. L. L. Nunn.

The United States Circuit Court of Appeals has handed down a decision in favor of the plaintiff in the case of the Pike's Peak Power company against the city of Colorado Springs. The case is one of no little interest, as it involves the validity of the company's franchise. The City Council of Colorado Springs gave a franchise for 20 years for the use, for generating electricity, of the waters of Lake Moraine, near Pike's Peak. The Pike's Peak Power company, to which the franchise had been assigned, spent a large amount of money in building a tunnel to convey the water from the west to the east side of Pike's Peak, and in building a power plant. A year and a half ago many people in Colorado Springs considered the grant unwise, and an agitation for the repeal of the franchise resulted in action by the council revoking the privilege. Suit was brought by the company to annul the council's action, but that body's action was sustained. An appeal was taken to the Circuit Court of Appeals, and its decision has just been handed down, reversing the decision of the trial court. The court takes the ground that the City Council had power to grant the franchise, but had no power to repeal it, and gives as reasons therefor that the owners of the franchise, having accepted it, acted under it and made expenditures authorized thereby. Thus, the franchise became a contract, and a revocation of the ordinance granting the franchise is forbidden by two provisions of the constitution of the United States, the one prohibiting the passing of a law impairing the obligation of a contract and the other forbidding the taking of property without due process of law.

Work has been begun on the power house of the Lacombe Electric company, to be built on West Twelfth avenue, on the bank of the Platte River. The structure which is to contain the arc plant will be attractive in appearance and will be the best appointed station in Denver. Its dimensions will be

110 by 99 feet. The walls will be pressed brick. Steel trusses will be used and the roof will be of corrugated iron. The boiler room is to be 42 feet in length and the engine and dynamo room 52 feet. A brick wall will separate the two rooms. A gable is built over each department, the gable ends carried up and curved in brick. Space is provided for six engines, which are to be belted to 12 arc machines. Five engines and 10 dynamos are to be installed at the outset. The engines will be Ball compound, condensing, and the dynamos of the Western Electric type. The boilers will be furnished by the Heine Boiler company. It is expected that the plant will be in operation by January 1st. A temporary building, to accommodate the incandescent-lighting plant, will be built at the east end of the power station, designed for the arc plant, and work on the foundation has already been begun. The architects of the former structure are Mareau & Norton of Denver.

PERSONAL.

Senator Cushman K. Davis of Minnesota, who is lying at his home in St. Paul seriously ill from blood poisoning and other complications, is an old-time telegrapher.

W. P. Crockett of Boston recently removed to Chicago, where he will represent the Bossert Electric Construction company of Utica, N. Y., and the Hart Manufacturing company of Hartford, Conn.

John T. Burke, a well-known electrical man of Omaha, has been appointed representative of the Westinghouse Electric and Manufacturing company in Nebraska and Kansas, with headquarters at Omaha.

Mrs. Hertha Ayrton, wife of Prof. W. E. Ayrton of London, and herself an electrical writer of note, thinks that there is an opening for women in the making of electrical instruments. The work is well within the scope of women, Mrs. Ayrton considers; "any woman having a logical mind and some interest in the study could make a way for herself."

The forthcoming marriage of Mr. Samuel McClintock Hamill and Miss Maria Woodward Baldwin is announced. The ceremony will be held in Grace Church, Baltimore, at 3:30 p. m., on November 27th. Mr. Hamill is prominently identified with the interests of the General Electric company, being general manager of the Brush Electric company and president of the Siemens & Halske Electric company. He is one of the best-known men in the electrical field and will receive the hearty congratulations of a host of friends. The bride is the daughter of Mr. and Mrs. William Henry Baldwin of Baltimore.

ELECTRIC LIGHTING.

Citizens of Port Austin, Mich., have voted to issue $15,000 in bonds to construct an electric-light plant.

The Marysville Light and Fuel company has been incorporated in Kansas, with $12,000 capital stock.

The Ohio Valley Electric company will spend about $200,000 in enlarging its electric-light plant at Ashland, Ky.

The Rawlins (Wyo.) electric-light plant will be enlarged at once and the capacity doubled. The improvement will cost $5,000.

Albert Moore and associates of Arkadelphia, Ark., have been granted a franchise for the erection of an electric-light plant in that town.

London, Ohio, has voted to issue $5,000 worth of bonds for the purpose of purchasing new machinery for the electric-light plant in that city.

W. H. Watt of Hailey, Idaho, will erect an electric-light plant on the Hood River, Oregon, to furnish power for mining. The plant is to cost $300,000.

The Appleton City Water and Power company of Appleton City, Mo., was recently incorporated for $5,000, by J. B. Egger, R. N. Burns and J. S. House.

The Roland Park company of Roland Park, Md., will issue $200,000 of bonds for improvements and etxensions, to include an electric-light plant and waterworks.

Bids will be received until December 1st for the electric lighting of the city of Shreveport, La., for a period of five years, from June 1, 1901. N. B. Murff is the comptroller.

The city of Waynesville, N. C., has decided upon the establishment of a plant for electric lighting. A committee has been named to secure plans and estimates. F. W. Miller is the city treasurer.

The stockholders of the Queens Borough Electric Light and Power company of Long Island have voted to increase the capital stock from $250,000 to $410,000. The company is supplying light for Far Rockaway and Rockaway Beach, and power for the trolley line running between these two cities. The plant is now being enlarged.

The Waukegan (Ill.) Electric Light company has started up its public hot water heating system, the piping for which has just been installed in the business center. An exhaust system is used, with 7,000 feet of mains at present installed, $25,000 having been expended. This winter's service will be largely experimental, and upon its success will depend the extension of the heating plant. It is run in connection with the electric-light plant, the water being heated by the waste steam.

The directors of the Binghamton (N. Y.) General Electric company were elected on November 9th, as follows: James H. Roberts, S. C. Normile, W. A. Tucker, J. Brodie Smith, George F. O'Neil, George W. Dunn and P. L. Saltonstall. These directors subsequently elected officers as follows: President, George W. Dunn; vice-president, George F. O'Neil; secretary, James H. Roberts; treasurer, P. L. Saltonstall, and general manager, S. C. Normile.

Contracts have recently been let by the Consumers' Heat and Electric company of Bloomington, Ill., for its new plant in that city. A 300 and 100-kilowatt, direct-current generator will furnish power for a balanced three-wire system. Exhaust steam will be transmitted to business blocks and residences within the radius of a mile from the station, for heating purposes. The company, which is capitalized at $75,000, is a reorganization of the former Citizens' company, whose electric plant was burned out recently. Charles G. Armstrong of Chicago has been engaged as consulting engineer of the company.

The village of Harlem, Ill., will soon make extensive improvements. It has had a municipal plant for street lighting in operation for a number of years, using a 500-volt, direct-current generator, burning 10 enclosed-arc lamps on a circuit. The trustees recently decided to make a complete change in this old system, and in addition to street lighting will take contracts for private lighting. There will be installed a 3,600-light Warren, alternating-current dynamo, with marble switchboard complete, and one 300-horsepower, four-valve engine. The contract for the entire electrical installation has been awarded to J. Holt Gates & Co. of Chicago.

The city of Blue Island, Ill., is about to make some extensive improvements in its lighting plant. The two high-tension arc machines will be taken out and there will be installed one 2,500-light Warren alternating-current dynamo, belted to a 300-horsepower Ideal four-valve engine. The old switchboard will be taken out and a handsome and modern marble switchboard will take its place. The old street-lighting system will be replaced by series alternating arc and incandescent lamps, burning from the same circuit, using regulators and step-up transformers. The primary voltage at the station will be 1,000 volts. This will be raised to 2,000 volts for the street-lighting circuit. The entire change will be completed within the next 60 days. J. Holt Gates & Co. of Chicago have been awarded the contract for the complete installation.

ELECTRIC RAILWAYS.

A corps of engineers has completed a preliminary survey of the route of the proposed Indianapolis, Morristown and Rushville electric railway, in Indiana.

The Inland Trolley company of Philadelphia is preparing to begin work on its line from Chestnut Hill northward, toward Fort Washington and North Wales.

The Interurban electric line, operating between Lorain and Cleveland and Sandusky and Huron, Ohio, is securing a right-of-way for a line from Norwalk to Lorain.

Plans for the construction of an electric railway through the center of the Michigan fruit belt are now being made by a number of Chicago capitalists, headed by J. J. Sturm.

At a recent meeting the City Council of St. Charles, Mo., granted a franchise to the St. Louis, St. Charles and Western Railway company, to operate an electric road over certain streets of that city.

The announcement is made that the first cars will be run over the new Holland interurban line to Grand Rapids, Mich., on December 1st. Grading on the road is within two miles of the latter city and tracklaying will begin without delay.

The Ann Arbor and Jackson Electric Railway company of Michigan has given a contract to the Barney & Smith company of Dayton, Ohio, for 10 cars, 50 feet in length, each equipped with toilet rooms, smoking compartment and card tables.

The Omaha and Fremont Railway company has been incorporated, in Nebraska, for $750,000, by I. Noyes, president; J. S. Knox, secretary, and others. The new road will run between Omaha and Fremont, and the motive power will be electricity or compressed air.

The City Council of New Haven, Conn., has granted the Fair Haven and Westville railroad permission for building an extension to the Yale field. The committee on railroads and bridges has reported in favor of double-tracking the Congress avenue line.

J. A. Hamilton of White Cloud, Mich., is at the head of a syndicate of Michigan and Indiana capitalists, who have incorporated the Toledo and Chicago Railway company. The projected electric line is to traverse the northern tier of Indiana counties and the southern tier of Michigan counties, with Chicago the western, and Toledo the eastern, terminal points on the road.

A sleet and hail storm served to cripple the service on the Metropolitan, South Side and Lake street elevated lines in Chicago for about an hour on the evening of November 16th. The use of a mechanical scraper on the third rail of the Northwestern elevated railroad served to keep that line from being tied up.

The officers of the Peninsular Traction company of Battle Creek, Mich., a concern which is planning to build an electric railway between Grand Rapids and Battle Creek, report that they have secured the entire township rights between the two cities, and that sufficient capital is in sight to build and equip the entire road.

The Milwaukee Light, Heat and Traction company has presented to the Common Council of Kenosha, Wis., a franchise asking for a right-of-way through the city for its Chicago-Milwaukee line. The company asks for the use of but one street in the city. The ordinance has been referred to a special committee.

The Parkersburg and Marietta Electric Railway company has been incorporated in West Virginia, to build a line from Parkersburg to Williamstown, and thence across the Ohio River to Marietta, Ohio. J. N. Camden, W. N. Chancellor, C. C. Martin, J. M. Jackson, Jr., and C. H. Shattuck, all of Parkersburg, are the incorporators.

Thieves have removed 2,400 feet of trolley wire from the poles of the Calumet Electric Street Railway company on the line of the road between Colehour and Roby, Ind. The robbers took advantage of the fact that the line is not being operated over that section at the present time, and conducted their operations in broad daylight. The South Chicago police were notified, but have made no arrests.

It is reported that negotiations are under way for the purchase of the Elgin, Carpentersville and Aurora electric line by the Chicago and Elgin Electric Railway company. The company has secured a right-of-way from Elgin to Chicago by way of Wheaton, and recently was granted a franchise by the Elgin City Council. The Elgin local company has a line from Carpentersville to Geneva, a distance of 18 miles, besides the city system.

Eastern and Chicago capitalists are said to be interested in a scheme to construct a system of subways in the principal streets of the business portion of Chicago, which would be used solely by the traction companies and the city, should the municipal authorities desire to use them, for sewerage, conduits and such like purposes. It is stated that the eastern men interested have investigated the question and are satisfied that the subway would be a paying investment, even though it took more than $50,000,000 to carry out the project. Gabriel J. Norden, an attorney in Chicago, is said to be representing the capitalists.

PUBLICATIONS.

A handsome bulletin on "Lundell Motors for Electric Vehicles," issued by the Sprague Electric company of New York, describes the application of a new type of Lundell motors for the propulsion of electric automobiles.

The Western Electric company's new fixture catalogue contains reproductions of the various styles and designs of thoroughly first-class goods. Not only are plain and ornamental fixtures for residences displayed, but those for offices, factories and stores as well. The needs of office men, doctors, dentists and artisans have been considered in the line of specialties. A copy will be sent on request.

The Mining and Metallurgical Journal of New York and Los Angeles, a semi-monthly periodical of the character indicated by its name, has been purchased by Mr. W. J. Johnston. Mr. Johnston was for years the publisher of the Electrical World and is well known in electrical circles. He is so much impressed with the future of mining and metallurgy, it is said, that he has decided to devote his energies hereafter to that field of technical journalism.

Rossiter, MacGovern & Co. of New York and Brooklyn present a neat 32-page October catalogue of their "as-good-as-new" electrical machinery. The list of machines quoted includes General Electric, Westinghouse and other first-class makes of generators for railway, power and lighting, car motors, stationary motors, engines, boilers, cars, trucks, lamps, transformers, etc. Two complete railway power-station equipments of 300 and 2,500-horsepower capacity, respectively, are listed.

George D. Broomell has written, and the Ben Franklin company of 232 Irving avenue, Chicago, has published, a paper on "English Spelling." The essay was read before the Chicago Society of Proofreaders, and in it the author takes an advanced position in favor of spelling reform. Mr. Broomell's paper is interesting and gives evidence of careful preparation. The writer takes up the well-known objections to spelling reform and answers them all to his satisfaction. He contends that the only real objection is the inconvenience of making the change and believes that whatever is accomplished will be done gradually, with slow departure from the old system at first. Mr. Broomell practices what he

preaches in this paper, which is an object-lesson of "fonetic" spelling. The pamphlet makes 32 pages and is sold for 10 cents.

SOCIETIES AND SCHOOLS.

The first annual meeting of the Illinois State Electric association will be held at the University of Illinois, at Champaign, on November 27th.

Andrew Carnegie has announced his intention to found a polytechnic school in Pittsburg. He will give enough money to erect and furnish the buildings, on condition that the city furnish a site. Mr. Carnegie will also provide for the maintenance of the institution with an endowment of $1,000,000 worth of gold bonds bearing five per cent. interest.

Director Robert H. Thurston of Sibley College at Cornell University, Ithaca, N. Y., is reported as saying that the faculty is trying to decrease the engineering course from four to three years. The plan will be to advance the entrance requirements so as to include modern languages, physics and higher mathematics, these subjects being taught in the arts department. A Society of Mechanical Engineers has been organized by junior and senior students in Sibley College. The society has the support of the faculty and has elected L. J. Carr of Batavia, Ill., president.

ELECTRICAL SECURITIES.

The Northwestern Elevated Railroad company of Chicago is said to be preparing to sell its outstanding issue of bonds at 105 and to substitute for them a new issue bearing a lower rate of interest. The outstanding issue consists of $5,000,000 five per cent. gold bonds, which may be called on any interest day by giving 30 days' notice. The plan is to substitute four per cent. bonds, and the financial arrangements for the retirement of the old issue and the putting out of the new is in the hands of Blair & Co. of New York. It is said that the Illinois Trust and Savings Bank is a large holder of the present securities, it being currently reported that this bank holds in the neighborhood of $2,000,000 of these bonds.

MISCELLANEOUS.

The Paris Exposition was closed on November 12th.

Evanston, Chicago's North Shore suburb, has its own electrical troubles, and the mayor suggests the employment of a city electrician.

A London dispatch to the New York Sun states that the United States machinery exhibit at the Paris Exposition has been purchased in its entirety by a Lancashire engineering firm and will be re-erected in Lancashire.

A German genius has recently patented a new electric time alarm for heavy sleepers. A number of contacts are located under the springs of a bed in such a manner that, at a certain hour, the alarm begins running and cannot be stopped until the sleeper leaves the bed.

A contract has been awarded for equipping the Washington monument at Washington, D. C., with an electric elevator instead of the present steam apparatus. It will be the highest single elevator in the world, being 500 feet high. The Eiffel Tower has two or three elevators which carry passengers to the top by stages.

Electrical utilization of windpower is being tried in the Baltic region, in Europe, it is said. An experimental plant, consisting of a windmill, a dynamo, a battery of accumulators and electric motors, has been put up at Wittkiel, near Kappeln, situated at the entrance of the Schlei, the longest of the narrow fjords which the Baltic sends into Schleswig, Germany.

In Chicago the experiment is being tried of placing red-globed arc lights at fire-alarm boxes and green lights for patrol boxes. The plan is only to be tried on electric lights for the rest of this year. The glass globes are half red or green and half clear. If it is found that the arc lamps do not give sufficient light under the new system the plan will be abandoned at the beginning of the year.

The exports of copper since January 1st to October 1st of this year were 63.22 per cent. of the domestic production, or 56.15 per cent. of the production and imports during this period. Deducting the exports of copper from the production and the imports of the metal, and taking the balance as representing domestic consumption, the latter in that case would show an average of about 24,521,473 pounds a month for the nine months.

Among many interesting features of the new railway station of the Compagnie d'Orleans, at the Quai d'Orsay, Paris, is a mechanical contrivance for the transit of baggage from the trains to the upper part of the station, a distance of something like 20 feet. Passengers go down by numerous staircases and lifts—of which there are no fewer than 15. The baggage, however, is transported by means of inclined planes. The motive power is electricity, the supply being generated at an electric station on the spot, connected with the electric storehouse at Ivry. The lighting of the station, as well, is supplied from this local sub-station, which represents 1,200 horsepower.

In Honolulu recently an electric-light wire and a power wire of the Hawaiian Electric company became crossed, with disastrous consequences. The large current thus thrown on the wires of the electric company worked havoc in the dynamo room, compelling a shutdown. According to the newspaper account, fires were started all over town wherever there was a wire on which the insulation was not of the highest kind, but fortunately none of these did any particular damage. One man was killed and several received severe shocks.

After repeated failures to secure a satisfactory negative of a train in motion, Ayrault Green, an expert Chicago photographer, recently made the Burlington's "Denver Flyer" take its own picture. This he accomplished by an electric switch, which, when connected with the rail, closes the circuit as soon as it is struck by the engine. The switch communicates with a set of dry cells, and thus a shutter release is operated. When the successful test was made, the switch was put in place about six feet behind the spot where it was calculated that the front of the engine would appear when the shutter was released. When the engine struck the switch it closed the circuit, the high-speed shutter moved, and the picture was correctly registered on the center of the plate.

Tests are now in progress in Washington, D. C., on storm warning lights, to be placed on the new signal towers recently authorized by Congress to be established in the principal harbors of the country. The object aimed at is to increase the carrying capacity of the lights. While the present maximum is about five or six miles, it is hoped to reach a distance of 12 miles at sea with the new oil lamps, and 15 to 18 miles with the electric lights in ordinary weather. Makers of lamps in this country and in Europe have entered into the competition, which is now closed, for equipping the 300 stations contemplated. American makers have protested against the award of the contract to foreign manufacturers, and Chief Moore of the Weather Bureau has decided that preference will be given to American bidders unless the European lens greatly exceeds in power the American lamp.

United States Minister Bryan of Rio de Janeiro, Brazil, reports that early next year there will be inaugurated at Belle Horizonte, the capital of Minas Geraes, Brazil, under government and municipal support, a permanent exposition of the products and manufactures of that vast state, the population of which now exceeds four millions, and whose industries—mineral and agricultural—are being actively developed. According to his report, in 1899, the gold product of the state of Minas exceeded $3,000,000, an increase of $1,000,000 in value over 1898. Several citizens of Minas Geraes who are interested in promoting American enterprises are willing to undertake the erection of a pavilion in which to exhibit machinery from our country at this forthcoming exposition. Mr. Bryan recommends that American manufacturers of agricultural, dairy, electrical and mining appliances, who desire to avail themselves of an inexpensive opportunity to exhibit their improved machinery, communicate on this subject with the United States consulate-general in Rio de Janeiro.

TRADE NEWS.

The Tinthoff Electric company of Chicago has been incorporated, with a capital stock of $2,500, to manufacture electrical machinery and apparatus. The incorporators were John Anderson, Charles A. Anderson and Milton Stamm.

The Cicero Yaryan Heating and Lighting company has been incorporated at Chicago, with a capital stock of $2,500, to operate water, heat, light and power plants. The incorporators are William O. Merrick, Charles Woodward and W. J. Kasper.

The Naugle-Holcomb company has been incorporated at Chicago, with a capital stock of $500,000, for manufacturing railway ties, telegraph poles, etc. The incorporators are E. E. Naugle, W. H. Holcomb and Alfred P. Hopkins. This company succeeds the well-known firm of Naugle, Holcomb & Co., which was dissolved on November 12th by mutual consent.

Sealed proposals will be received at the office of the supervising architect, Washington, until December 5th, for the installation of a wiring system for the extension of the United States custom house and postoffice at Dubuque, Iowa. Copies of the drawings and specification may be obtained at that office or at the office of the superintendent of construction, Dubuque, Iowa, at the discretion of the supervising architect.

The Washington office of the Westinghouse Electric and Manufacturing company has just made a large sale of electrical apparatus to Kingan & Co. of Indianapolis, Ind. About three years ago Kingan & Co. installed a large Westinghouse direct-current electric plant in their pork-packing establishment, but recently they decided it to be materially to their interests to replace the direct-current with alternating-current apparatus. The new installation will consist of two 300-kilowatt, engine-type, two-phase, alternating-current, 440-volt generators and a number of type C induction motors aggregating nearly 1,000 horsepower.

Alphonse Major of 461 Pearl street, New York, who has been identified with the cement business for many years, has filed a petition in bankruptcy, with liabilities of $4,901, largely for advertising, and assets consisting of cash, $18; bicycle, $7; watch and chain, $21, for which he claims exemption; five shares of stock of the Major Cement company, of unknown value, and patents for a water filter and cooler, and an ice receptacle for water cooler, value unknown.

The Western Electric company of Chicago has executed a trust deed to the Chicago Title and Trust company, upon 225,000 square feet of land at West Polk street and the river, to secure a bond issue of $500,000, payable in five years and bearing 4½ per cent. interest. The security offered is the former Young and Farrell Diamond Stone Sawing company's plant, for which the Western Electric company paid last August $617,500. The land has frontages of 528 feet on Polk street, 400 feet on Stewart avenue, formerly Beach street, and 400 feet on the south branch of the river. It was improved to some extent with one-story brick structures used by the stone company, but work is now under way on a large manufacturing building to be devoted to heavy foundry and factory work, particularly to the construction of cables used in electrical work. Besides this improvement, the existing structures are to be remodeled. The work will cost about $200,000.

BUSINESS.

J. Holt Gates & Co., 15 Monadnock block, Chicago, have been awarded contracts for a complete electric-lighting plant at Rio, Wis., also for the electrical machinery for the city lighting plant at Nappanee, Ind., and a new plant at Cuba, Ill.

The Electric Appliance company, Chicago, states that its sales of Packard lamps during the last year were nearly double those of any previous year. This record has been made in the face of the fact that the conditions of sale of incandescent lamps are more severe than ever before.

The steam-exhaust head manufactured by the B. F. Sturtevant company of Boston, Mass., is an interesting example of the application of centrifugal force. The steam escaping through curved pipes in the head throws the water against the sides, where it escapes through a drip pipe while the steam passes out of an opening at the top. These heads are built in sizes ranging from one inch up to 36 inches. The Sturtevant company has just received an order for two large exhaust heads, one for a 30-inch pipe and one for a 36-inch pipe, which are to be built on this design.

The Emerson Electric Manufacturing company of St. Louis, Mo., announces that it is now making over 200 different kinds of alternating-current motors, in sizes of 2½ horsepower and smaller, and that it is in a position to furnish satisfactory single-phase motors for any alternating current. The Emerson company is anxious to hear from central-station managers and superintendents who are experiencing difficulty in procuring a sufficient load on their day circuits, believing that it can be of considerable assistance to central stations in developing this branch of their business. Samples of any size motor made by the Emerson company will be sent to any responsible central-station company or dealer on 30 days' trial, with the understanding that if the motor is not thoroughly satisfactory, it may be returned at the end of the 30 days.

The American Bridge company has just closed a contract with the North German Lloyd Steamship company, calling for the erection of two steel buildings on the banks of the River Weser at Bremen, Germany. The machine-shop building will be 100 feet in width and 300 feet in length, two stories in height. The foundry building is to be 75 feet in width and about 600 feet in length. Both buildings are designed after the best American practice. The contract has been secured by the American Bridge company in competition with the best German bridge shops, and shows the extent to which this class of work can be carried. This is a deserving triumph for the American Bridge company, and will doubtless lead to further contracts of the same kind. Another contract of the company provides for the furnishing of over 700 tons of structural steel to go to the New York Navy Yard naval-powder depot, near Dover, N. J., and to the naval magazine at Iona Island, N. Y.

Alfred B. Herrick, the well-known street-railway expert of New York city, announces that the demand for the Herrick electric inspection and testing system having made it impossible for him to give it his personal attention, he has made arrangements with the instrument house of Elmer G. Willyoung, 82 and 84 Fulton street, New York, by which the latter will manufacture and market the apparatus under designs approved by Mr. Herrick. Mr. Herrick will personally inspect and furnish a certificate of inspection of each instrument turned out. With this instrument it is possible to make a complete test of car equipments in an extremely short time, and by use of the ordinary help, such as is generally found about a trolley station. This instrument is now in use by the Hartford Street Railway company,

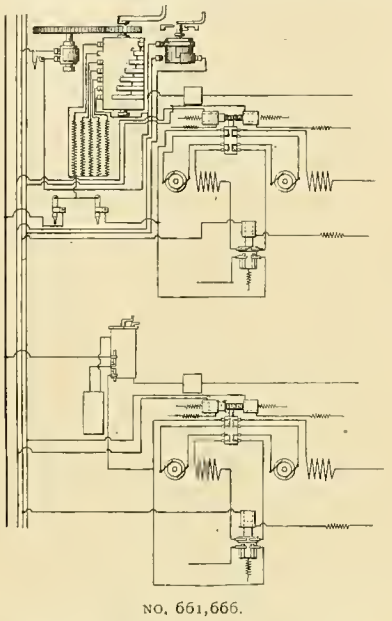
Hartford, Conn.; Albany Street Railway company, Albany, N. Y.; South Side Elevated company, Chicago, Ill.; Tramway company, Milan, Italy; British Government railway, Sydney, Australia; Union Traction company, Philadelphia, Pa.; North Jersey Railway company, Newark, N. J. A contract has also been closed with the New Orleans and Carrollton Railroad company, New Orleans, La., for the installation of a set of apparatus.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 13, 1900.

661,491. Emergency Brake Switch. William M. Brown, Johnstown, Pa. Application filed October 14, 1898.

In the switch described are a plurality of fixed contacts, arranged in pairs, one contact of one pair being connected to the supply circuit and the other contact of the same pair to the regular motor circuit, the remaining contacts being connected to the respective motor terminals. The switch has a movable member which in one position connects the two contacts of the first-named pair, and in the second position disconnects the contacts, and connects the other contacts in their respective pairs. The connections between these last-named contacts and the motor terminals are such that when the switch is in the last-mentioned position the motors are connected in a closed circuit with one element of each connected to cause a current flow through it in a direction reverse to the normal flow.



NO. 661,666.

661,498. Electric Fuse. Joshua L. Cohen, New York, N. Y., assignor of fifty-one one-hundredths to Herschel P. Copeland, Jersey City, N. J. Application filed January 4, 1900.

An electric igniting device consists of a non-conducting, combustible material, a compound affixed thereto, and a conducting wire adapted for igniting and flashing the compound. A flame is thus produced in connection with the combustible non-conducting material when an excessive current of electricity is applied thereto.

661,516. Trolley. Henry S. Goughnour, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed March 21, 1900.

In the trolley described are shown, in combination with a pivoted trolley pole, a spring for elevating the same, a slide forming a bearing for one end of the spring, and a rod having a bearing for the opposite end of the spring, and connected to the pole. A latch device is provided for the slide, as well as a connection between the pole and the latch device, for tripping the latter when the pole assumes a certain position.

661,518. Controlling Device for Electric Circuits. Edward W. Hammer, Chicago, Ill. Application filed August 31, 1899.

The invention relates to an electric circuit, comprising a magnet in series with the main circuit, a shunt circuit containing an electromagnet, and a connection leading from the main circuit above the series magnet to the shunt circuit below the shunt magnet. A circuit-controlling device is operated by the series magnet and adapted to control the connection, so as to cause a reverse current to flow through the shunt magnet. Means are described for breaking the main circuit, and a second circuit-controlling device in the connection is adapted to be operated to break the connection before the main circuit is broken.

661,520. Automatic Steering Device for Torpedoes. Caryl D. Haskins, Newton, Mass. Application filed August 2, 1897. Renewed April 12, 1900.

With a torpedo are shown a steering apparatus therefor and a magnetic determining device for the apparatus controlled in its action by the magnetic mass of the object to be attacked. This steering apparatus comprises an operating electric motor and a magnetic determining device in the circuit of the motor. A timing device is also described governing the action of the determining device.

661,538. Brush Holder for Dynamo-electric Machines. Christian W. Kragh, Madison, Wis., assignor to the Northern Electrical Manufacturing company, Madison, Wis. Application filed September 11, 1899.

In a brush holder for dynamo-electric machines are combined a holding piece to which the brush is attached, a support upon which the holding piece is movably mounted, and a flat spring attached to the support and connected with the holding piece by a sliding contact, so as to press elastically the brush against the commutator. A conductor is fixedly attached to the support and to the holding piece so as to give a fixed connection around the connection between the support and holding piece.

661,578. Toll-collecting Device for Telephones. William A. Foss, Cleveland, Ohio, assignor to the American Toll Telephone company, Cleveland, Ohio. Application filed July 26, 1900.

The toll-collecting machine described comprises an oscillating toll-receiving hopper, means for oscillating the hopper to the extent required to discharge the toll therefrom, a gong or sound-yielding body, and a suitably applied movable hammer having an arm extending into the sweep of the toll-representing coin or check so as to result in the operation of the hammer directly by the coin or check during the toll-discharging oscillation of the hopper.

661,588. Electric Welding Apparatus. Adolph F. Rietzel, Lynn, Mass., assignor to the Thomson Electric Welding company, Lynn, Mass. Application filed June 1, 1899.

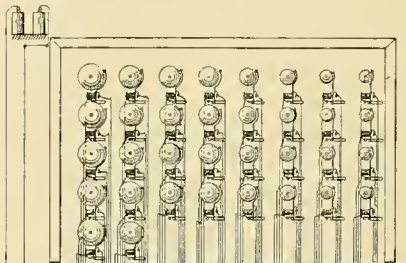
The invention relates to an electric metal-working machine in which are combined with clamps forming the terminals of the heating circuit and relatively movable to and from one another, means for automatically opening and closing the clamps at predetermined intervals. These opening means are mounted upon the bed of the machine and unconnected with the clamps. An automatic feeding mechanism is described for supplying to the clamps the articles to be welded.

661,589. Electric Welding Apparatus. Adolph F. Rietzel, Lynn, Mass., assignor to the Thomson Electric Welding company, Lynn, Mass. Application filed September 23, 1899.

In this electric metal-working apparatus are shown, in combination with an electric-heating device, an electric welding device, means for holding one part of the work in the heating device independently of other parts of the work, and means for bringing the part of the work held in the heating device into the circuit of the welding device without moving it from the circuit of the heating device. Means for including another piece of work therewith in the circuit of the welding device are also described.

661,600. Trolley Wheel. Thomas I. Duffy and Charles McMahan, Chicago, Ill.; Duffy assignor to McMahan. Application filed July 16, 1900.

An electrical contact spring for trolley wheels comprises an outwardly dished plate of conducting material adapted to be secured on a trolley pivot, between the harp arm and the trolley wheel, and is provided on its outer side with a depression adapted to receive a washer, also of conducting material, adapted for contact with a harp arm at a point adjacent to the trolley pivot. A plurality of inwardly curved radial spring arms are shown integral with the plate, and adapted to engage with their outer ends and press inwardly, a trolley wheel or the like, the arms being spaced at equal distances around the wheel.



NO. 661,740.

661,619. Method of Recording and Reproducing Sounds or Signals. Valdemar Poulsen, Copenhagen, Denmark. Application filed July 8, 1899.

The method consists in impressing upon an electric circuit containing an electromagnet undulations of current corresponding to the sound waves of speech or to the signals, and of simultaneously bringing successive portions of a magnetizable body under the influence of the electromagnet and thereby establishing in the body successively varying magnetic conditions. Finally, an electromagnet connected in a circuit is subjected successively to the various magnetic conditions established in the body.

661,666. System of Electric Train Control. Charles B. Martin, New York, N. Y., assignor to the General Electric company of New York. Application filed October 23, 1897.

This system of train control embraces in combination one or more motor equipments, a main controlling switch for controlling the supply of current to all the motors, and a circuit-changing switch or switches in co-operative relation to each motor equipment. Means may be located at any desired point for operating the circuit-changing switch or switches without connecting the motor circuits to the source of supply. (See cut.)

661,669. Connecting Conductors to Carbon Brushes. Albert L. Rohrer, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed July 22, 1898.

A carbon brush is described having a plating of good conducting metal thereon, a conductor soldered to the plating, and a yielding non-resilient conductor connected in good conducting relation to the conductor. The means described for carrying current from the brush to the stud in a brush holder consists of a flexible non-resilient conductor provided with a clip making a close fit with the brush.

661,714. Telephone Circuit. Isaiah H. Farnham, Wellesley, and George W. Davis, Revere, Mass., assignors to the New England Telephone and Telegraph company, Boston, Mass. Application filed May 11, 1900.

A telephonic circuit is composed of two conductors open at one end and provided with a series of branch extensions from the conductors to normally open terminal switches inclosed in a series of boxes. The other end of the circuit is closed through an electric generator; a branch from one of the conductors including transmitting and receiving telephones is normally open at the hook switch. A signal circuit-controller having its windings in one of the conductors, and a signal in a circuit parallel with the generator open at the controller and normally closed by the hook switch, are included. A portable telephonic set is shown inclosed in a box consisting of a telephone transmitter, a receiver and a double plug connector united in series by conducting wires.

661,731. Thermostatic Device. Robert G. Callum, Washington, D. C. Application filed December 30, 1899.

A thermostatic device is described having a thermostat provided with an adjustable extension carrying a shoulder, two contacts, and a third contact between them, the free end of which is in the path of the shoulder.

661,732. Thermostatic Device. Robert G. Callum, Washington, D. C. Application filed January 9, 1900.

In this thermostatic device are comprised a thermostatic coil encircling a fixed shaft, a rock arm loose on the shaft and connected at one end to the coil, and two contacts each of which is a screw carried by an adjustably mounted bracket. A spring contact is adjustably supported between the aforesaid contacts, and normally held against one of them to provide a closed circuit. The end of the intermediate contact is placed in the path of, but disengaged from, the rock arm and adapted in the movement of the arm, to be carried away from the one contact, to break the normally closed circuit, and against the other contact, to establish a second circuit.

661,740. Chime of Bells. Hermann Kruschwitz, Neu-Untermhaus, Germany. Application filed May 19, 1899.

In a musical instrument of the character described are included a soundboard carrying a plurality of electric bells in harmony, while electrical means are shown for causing a continuous sounding of one or more of the bells, and mechanical means for causing a single stroke of the bells. A shifting frame, dampers carried thereby to deaden the sound of the bells, and pedal levers for actuating the dampers, are also shown. A battery, a contact plate, electrical connections between the plate and the battery, and bell mechanism and a keyboard having two sets of keys, are described. (See cut.)

661,742. Circuit Controller for Electric Engines. Henri Letord, Orlando, Fla., and Joseph S. Letord, Kansas City, Mo. Application filed February 27, 1900.

The electric engine is provided with a handpiece and is located in a main circuit, in combination with a main circuit closer, a pole changer in the main circuit, and attachments to the handpiece for operating, respectively, the main circuit closer and pole changer. (See cut.)

661,771. Electric Circuit-breaker. Benjamin P. Rucker, Philadelphia, Pa. Application filed June 25, 1900.

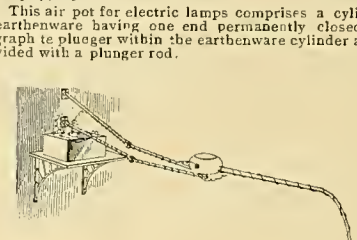
The invention relates to a circuit-breaker having a plurality of switches adapted to break the circuit at different points. One of the switches is adapted to be operated automatically by an abnormal current to break the circuit, and adapted to be operated by the other switch, to make the circuit. The other switch is adapted to break the circuit when actuated to operate the automatically operated switch.

661,820. Electrical Apparatus. Martin Schupner, Nyack, N. Y. Application filed June 16, 1900.

As an apparatus for applying a current of electricity to the body are described in combination an induction coil, a source of electrical supply, and a chair having metallic plates thereon for contact with a patient. The induction coil is located between the source of supply and the chair and is connected electrically to the plates by means of a conductor. A conductor is connected to the other pole, having bracelets thereon for engagement with the arms of an operator, whereby the circuit may be made by contact of the patient with the plates and the operator.

661,839. Dash-pot for Electric Arc Lamps. Thomas E. Adams, Cleveland, Ohio. Application filed May 7, 1900.

This air pot for electric lamps comprises a cylinder of earthenware having one end permanently closed and a graph te plunger within the earthenware cylinder and provided with a plunger rod.



NO. 661,742.

661,880. Electric Brake Controller. John C. Lincoln, Cleveland, Ohio, assignor to Arthur L. Garford, Elyria, Ohio. Application filed October 2, 1899.

In combination with a source of electricity are described an electric motor and a brake magnet, a controller adapted to connect the motor through the brake magnet to generate current, and apply the brake, and adapted also to connect the current from the source through the brake magnet and field coils. The motor is closed through the brake magnet in such direction that its movement generates current, and is adapted to connect the independent source of supply through the brake magnet and field coils at the same time that the motor current is flowing through them.

REISSUE.

11,872. Traveling Contact for Electric Railways. Thomson-Houston Electric company, Boston, Mass., assignee of Albert Wahl and C. A. Coffin, administrators of Charles J. Van Depoele, deceased. Application filed September 28, 1900. Original No. 495,443, dated April 11, 1893.

The invention comprises, in an electric railway, the combination of a car, an electric overhead conductor above the car, and parallel with the line of travel, and an upwardly extending trailing arm carrying a contact device at its free end, adapted to make underneath contact with the conductor. This arm is supported on the car on vertical and transverse axes, so as to permit the contact device to follow the position of the conductor, notwithstanding great variations of height and of lateral displacement.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, DECEMBER 1, 1900. No. 22

Direct-connected Turbine and Dynamo at Paris.

By Frank C. Perkins.

The turbine exhibit of Escher, Wyss & Co. of Zurich, Switzerland, was one of the most novel at the Paris exhibition. The hydrophor of this firm and the direct-connected turbines shown in the accompanying illustration were particularly interesting.

A large reservoir was constructed at the top of a high steel framework, to the top of which visitors or attendants could mount by an iron stairway. This reservoir was 8.2 meters high and the water was delivered to it through one of the vertical standpipes by a direct-connected, continuous-current electric motor and pump combination seen in the illustration.

The water from this reservoir was used to drive a Francis turbine, and to this turbine was coupled a direct-current multipolar dynamo. The water was delivered to the turbine from the reservoir at the rate of 250 liters per second, operating the turbine shaft at a speed of 450 revolutions per minute.

The ratio of the amount of current delivered by the dynamo which was operated by the turbine to the amount of current delivered to the electric motor whose power was used to raise the water to the reservoir represents the efficiency of the entire combination.

By this method of exhibition a continuous operation was effected, supplying current to the electric motor and receiving back again the current from the generator.

A 550-horsepower turbine was also shown. Its diameter was 1.1 meters. It was a high-pressure, double turbine, having automatic hydraulic regulation. This turbine was designed to operate at a speed of 375 revolutions per minute, with a fall of water of 92 meters.

This and other turbines exhibited were built for operating electrical generators at various power plants in Europe. One of these has a capacity of 2,500 horsepower and was designed to operate at 160 revolutions per minute. This turbine was of the horizontal double type, with a diameter of 1.6 meters.

A direct-connected dynamo and turbine was also exhibited which will be installed at St. Maurice for supplying current for lighting the village of Lausanne, Switzerland. The generator was built by the Compagnie l'Industrie Electrique of Geneva and was designed by M. Thura. It is a six-pole, direct-current generator and is directly connected by a flexible coupling to a 1,000-horsepower turbine which is to operate at 300 revolutions per minute under a head of 34 meters.

Another interesting exhibit was a 600-horsepower turbine soon to be installed at Vezere. This is a simple turbine of the Francis type, and has a diameter of 1.1 meters. It will drive the direct-connected electrical generator at a speed of 300 revolutions per minute under a head of 43 meters. These examples of waterpower machinery indicate the leading position of Switzerland in this field.

DIRECT-CONNECTED TURBINE AND DYNAMO AT PARIS.

Albany and Hudson Third-rail Line Opened.

The electric railway owned and operated by the Albany and Hudson Railway and Power company of Hudson, N. Y., was formally opened on November 22d, when a train of two cars made a round trip between Hudson and Rensselaer, formerly called East Albany, the southern terminus of the road. The passengers included some of the leading railroad men and electrical engineers in the state. More than ordinary interest attached to the event because this is said to be the longest third-rail road in the world (the distance being 39 miles), and also the first railway catering for both freight and passenger traffic whose motive power is supplied through the third rail.

Power is obtained from Stuyvesant Falls for running the trains and for lighting and furnishing power to several towns along the line. Water is brought a distance of 3,000 feet to the generating station, the head being 104 feet. The company has a plant of 4,500 horsepower in three large generators and 1,500 horsepower in seven smaller dynamos, the total capacity being 6,000 horsepower, besides a 2,500-horsepower steam engine that has been installed for emergency use.

The road runs through a hilly country, but it is said the cars mount the grades easily. The cars are operated by means of the third rail from the central power station at Stuyvesant Falls to a short distance south of Rensselaer, and by means of a trolley between Hudson and the falls and from a point a short distance south of Rensselaer to that village. Sub-stations are established at North Chatham, at Nassau and at two other points along the line. The construction of the railway has been completed at a cost of $3,100,000, the company being capitalized at $2,500,000. The inspection train maintained an average speed for the distance, 39 miles, of about 35 miles an hour, and on some stretches the speed was as high as 50 miles an hour. The road is equipped with 20 cars, seating 60 passengers each.

It is the purpose of the company to carry passengers through from Hudson to Albany and freight from Hudson to Rensselaer. The line will serve as a feeder for both the New York Central and the Boston and Albany steam railroads in bringing farm products from the countryside to those lines, and will thus be a benefit to the farmers, as well as to the steam roads. The company owns franchises that enable it to control nearly all of the water privileges in Columbia County, lower Rensselaer and northern Dutchess, and which will aid the corporation materially should it decide to extend the line to Poughkeepsie, as it is said will probably be done. It is believed by some that this road is really the beginning of an electric line from Albany to New York.

Electricity for Cripple Creek Mines.

A number of contracts are being made for furnishing electric power to the Cripple Creek mining district. The Colorado Electric Power company, whose generating station is at Canon City, and other electrical concerns are installing new hoisting plants. The Little Frank S. Gold Mining company, the Hart Gold Mining and Leasing company, the Mercer, Shell & Fitch company, the O'Hara and Burt company and other mines have secured electrical hoisting plants. In addition to the hoists, new blowers have been installed in the Portland, Vindicator, Comanche, Plume and others, and an electric heater in the Moon-Anchor mine. A contract has been closed for lighting the Stratton properties. Within the next 60 days the Colorado Electric Power company will have a number of electric drills in operation throughout the district. The introduction of this style of drill promises to revolutionize mining operations in the district, for it is asserted that the new drill will permit a saving of 50 per cent. in running cost, while maintaining a much higher degree of efficiency at work. Points underground where the more cumbersome machine drill is not able to reach, it is said, will be accessible with this new drill.

Electric Catafalque Terrorizes Mourners.

A New Brunswick (N. J.) undertaker purchased an automobile catafalque operated by a storage battery and electric motors and introduced it at a funeral at St. Francis Church in that city recently. The catafalque stood in the center aisle at the entrance, and the pallbearers were directed to lay the coffin upon it. When it suddenly started up the aisle with its burden, the pallbearers cried out in terror, and a panic in the congregation resulted. The undertaker had much difficulty in persuading the mourners to return to the service.

Damage by Tornado at Colorado Springs.

A windstorm approaching a tornado in violence visited Colorado Springs on November 22d and caused considerable damage to the electrical plants and equipments. The great velocity of the wind continued for about 12 hours, so that the linemen found it difficult to begin immediate repairs on overhead circuits. Considering the fact that wires were blown together in many places, it was fortunate that no serious accidents from contacts with live wires were reported. Shortly after the storm struck the city the mayor notified the Colorado Springs Rapid Transit company and the lighting companies to shut off current, so that at night the city was without transportation or electric illumination. For hours the city was without communication with the outside world, as the circuits of the telephone and telegraph companies were down. The Colorado Telephone company was the greatest sufferer from the storm. Its loss was estimated by General Manager Field at $12,000. In the city no great amount of damage was sustained, as the telephone wires to a great extent are underground. The bulk of the damage was caused to the long-distance lines. On the Pueblo line the wires were down for a distance of 10 miles and for five miles on the Cripple Creek lead. At one point a barn was fairly blown through the Denver lead.

The pole lines of the telegraph companies suffered great damage. The Postal company had 178 poles down at Colorado Springs and 48 were overturned at Monument. Two hundred Western Union poles were blown over between Denver and Pueblo.

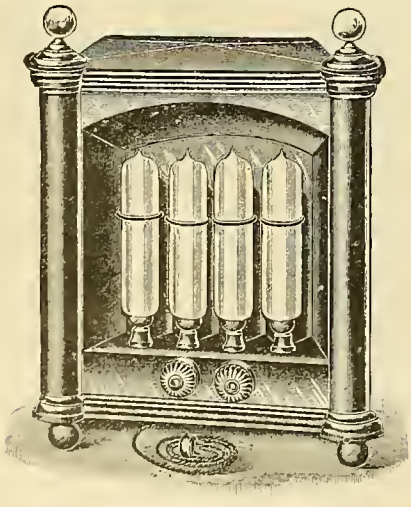
The loss of the Colorado Springs Electric company was estimated at about $6,000. Two of its stacks at the power station were blown over and its pole line was badly damaged.

The overhead construction of the Colorado Springs Rapid Transit company suffered considerable damage, and its loss was estimated at $1,200.

The electric companies made a splendid record in restoring service in their respective fields. Every available lineman was put to work and communication was restored to a great extent on the day following the storm. On the following evening the business section was lighted and cars were run on the usual schedule on the second day.

Incandescent-lamp Heater.

To use incandescent lamps to make an electric heater seems to be decidedly uneconomical, but the English manufacturer who does it explains that a special type of "heat lamps" is used and that the light, combined with the heat, gives something of the cheerful effect of an open fire. The effect is



INCANDESCENT-LAMP HEATER.

heightened by placing the lamps in a framework of polished copper resembling an open grate in appearance, as shown by the accompanying cut. Four large lamps are placed in the recessed portion, and when the reflecting sheets of copper themselves become heated, the current of air which passes behind them through specially arranged channels not only prevents backward radiation to the wall of the room, but also, by flowing into the apartment, warms the atmosphere. The standard sizes consume one kilowatt an hour. If one pair of lamps be cut out by means of one of the two switches at the front of the heater, the current consumption is reduced one-half. The advantage of instantaneous action and the absence of dirt, gas and smoke are pointed out.

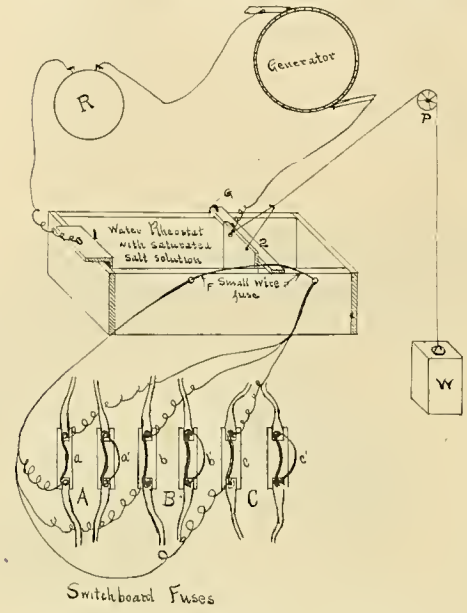
Pratt City, Ala., contemplates the construction of an electric-light plant.

Method of Using Engine Without Governor on Electric-lighting Circuit of Several Branches.

By C. C. Griggs.

Twice within two months the writer has experienced trouble with governors on the engine of an electric-light plant owing to breakage. One was a flywheel governor and the other was a spring-and-belt governor. The work was of such a nature that a shutdown was an impossibility, and other governors not being at hand, with no means of repairing the broken ones, the only thing that could be done was to lash the broken governor fast in such a way that it allowed the engine to take full steam, and then run the engine by throttle.

This at first thought seems simple enough, but, as it happened in this case, the dynamo was feeding



METHOD OF USING ENGINE WITHOUT GOVERNOR ON ELECTRIC-LIGHTING CIRCUIT OF SEVERAL BRANCHES.

into several different mains, each one carrying a pretty stiff load. With close attention everything ran smoothly, until a short-circuit occurred on one of the mains, blowing a fuse, with the natural result that the sudden letting up of the load made the engine speed up. Before the engineer could reach the throttle, fully one-half the lamps on the other circuits, as well as a number of sockets, were burned out.

To prevent this accident occurring again, the writer hit upon the following idea, which in succeeding cases worked admirably and may be interesting to some of your readers.

The dynamo is a 250-volt, direct-current generator. A water rheostat, the water being strongly saturated with salt, was placed in the field rheostat circuit. As illustrated in diagram, No. 1 and No. 2 represent the two anodes. No. 1 is stationary in the box. No. 2 is partly held down by means of a catch (G) on one end of the supporting block, the other end being held down by means of a small copper wire (F) fastened to insulators on the side of the tank. This wire passes over the block to which anode No. 2 is attached. It is in shunt with one fuse block on each line, the fuses on the switchboard being represented by (a), (b) and (c). (A), (B) and (C) represent three mains. The companion fuses (a'), (b') and (c') for the time being are straddled with heavy copper wire, so as to compel the short-circuit to blow (a), (b) or (c).

Attached to anode No. 2 is a cord passing over pulley (P) to which is suspended weight (W). When a short-circuit comes in over a line and blows any one of the fuses (a), (b) or (c), it also necessarily melts the wire (F), holding anode No. 2 in place. This end being released, the supporting frame slips from under catch (G) and the weight (W) instantly pulls it clear of the water, thereby breaking the field circuit and stopping further generation by the dynamo.

Of course, the engine runs away, as it would do if but one fuse were blown, but no damage is done to the lamps on the other lines. The only delay occurring is the time it takes to stop the engine, readjust apparatus, cut out short-circuited line, and start up again.

In the work in which the writer is engaged—furnishing lights to steam shovels, lights in clusters on "jacob staffs" to drillers, and furnishing lights for tunnels on railroad construction work—where almost any and everyone is handling the wires, short-circuits are very frequent; hence the above apparatus was used to enable the running of the plant, until new governors could be obtained.

New Drop-by-drop Battery.

Considerable attention has been attracted by a new primary battery invented by an Ohio man and which is, in several respects, a departure from existing types. At the request of the Western Electrician, Mr. C. M. Swingle, principal of the high school at Millersburg, Ohio, furnishes the following brief description:

"Mr. O. A. Spahr is the inventor of the new battery cell and also the discoverer of a new electrolyte. From what the new cell will do and from what we can say of the new electrolyte, it may be judged that the two will work somewhat of a revolution in certain electrical matters.

"The new cell is disk-like in form. Those that have been constructed are eight inches in diameter and 1¼ inches in thickness. The carbon plates are exposed, the zinc being placed between two carbons. There are pockets in the interior wall of the cell—one to contain an amalgamating substance and the other a depolarizing agent. The fluid is introduced into the cell at the bottom through a small lead tube, dropping, drop by drop, into the end of the tube above the cell. The object of the small tube is that air may be conducted into the cell to serve as a depolarizing agent.

"This cell, when the new fluid is put into it, develops a very high voltage and more than 30 amperes. A single cell fuses No. 24 copper wire, the zinc being 6½ inches in diameter. Eighteen of these cells run a two-horsepower motor at 2,500 revolutions a minute. The weight of the 18 cells at work, together with the tray they sit in and the reservoir filled to run 12 or 15 hours, either successively or otherwise, is very little over 100 pounds. We have calculated that these cells will work at least 100 hours without change of zinc.

"The efficiency of the new cell is largely due to the electrolyte used. It is a combination such as has never been used before. It has been used in Fuller cells on the switchboard work here for six months without the least attention. (I speak of closed-circuit work.) On the open circuit work it has been used for a year with just as good results. The manager has been so well pleased that he has already put in Fuller cells at Orville, and will do so at other places as soon as old supplies are used. The expense with Fuller cells charged with the new electrolyte is not one-third as much as for ordinary cells."

Barmen Suspended Railway.

The suspended electric railway between Barmen and Vohwinkel, in Germany, which was described and illustrated in the Western Electrician of April 21st last, has been publicly opened by the German emperor and empress with great eclat. The system employed is that of the late Eugen Langen of Cologne. It is a one-rail overhead arrangement with dependent cars. The chief advantage claimed for this system by the builders is the low cost of construction and operation. While, for the construction of the Berlin electric elevated road, which is placed upon spans of a width of 63 feet, 1,800 kilogrammes of iron were used per meter, the Barmen road, with spans 90 feet wide, did not consume more than 1,065 kilogrammes of iron per meter. Hence the Berlin road costs more than double the price of the Barmen road. For the operation considerably less electric current is needed, as the loss through friction is not as great as with the ordinary two-rail system. The utilization of the river course contributes largely toward reducing the original cost, as no expensive right-of-way or real estate was necessary to be purchased.

Mineral Products.

A chart showing the mineral products of the United States from 1890 to 1899 has been issued by the United States Geological Survey of the Department of the Interior. The figures given are preliminary to the official report on the mineral resources of the United States for 1899, which will form Part VI. of the twenty-first annual report of the survey. The production of copper increased from 265,115,133 pounds, valued at $30,848,707, in 1890, to 585,342,124 pounds, valued at $104,190,898, in 1899. For the year 1899 the following statistics are given for the production and value of the minerals mentioned: Zinc, 119,408 tons, at $13,731,920; quicksilver, 30,454 flasks (of 76½ avoirdupois pounds net), at $1,452,745; aluminum, 5,200,000 pounds, at $1,716,000; platinum, 300 troy ounces, at $1,800, and mica, 3,118,570 pounds, at $101,465. The total value of the metallic products for 1899, including the figures for pig-iron, gold and silver, was $527,218,084, compared with $343,400,955 in 1898 and $305,735,670 in 1890. David T. Day is the chief of division of mining and mineral resources.

G. D. Dunlevy is superintending the construction of an electric-light plant in Hillsboro, N. D.

The Largest Induction Motor in the World.

As is well known, Germany and Switzerland are in the forefront in the design and manufacture of polyphase apparatus. Except the United States, no other nation approaches these countries in the extent to which this late extension of electrical engineering has been developed, although a respectable showing is made in Belgium, France and Hungary. To the enterprising and widely-known firm of Brown, Boveri & Co. of Baden, Switzerland, established nine years ago by Mr. C. E. L. Brown, who, at the age of 37, ranks with the most distinguished electrical engineers in Europe, is due the existence

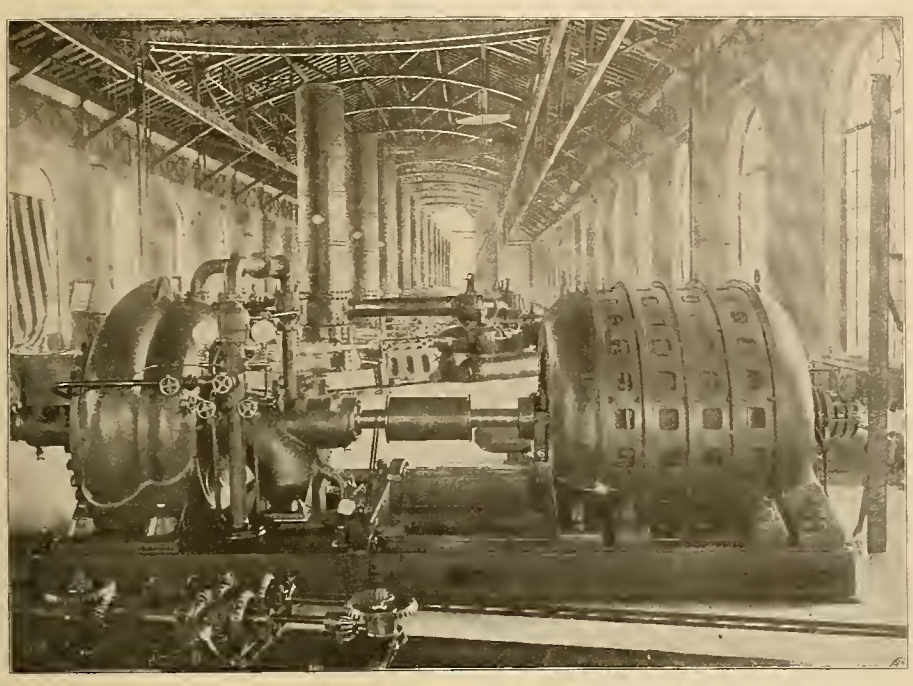


FIG. 1. THE LARGEST INDUCTION MOTOR IN THE WORLD DIRECTLY COUPLED TO CENTRIFUGAL PUMP.

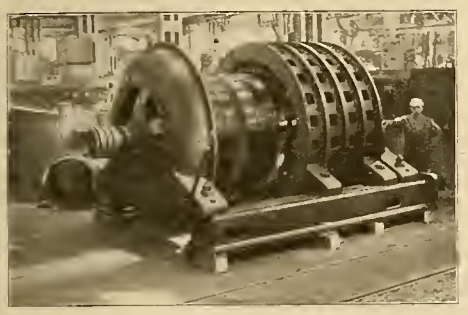


FIG. 2. THE LARGEST INDUCTION MOTOR IN THE WORLD. —MOTOR DRAWN OUT ON BED-PLATE.

of the largest induction motor yet constructed, which is illustrated by the accompanying pictures. Reference is made to the two-phase machine of 1,000 horsepower installed in the waterworks at Geneva, Switzerland. It is fair to state, however, that the Westinghouse company of Pittsburg has built two induction motors of 850 horsepower each which were shipped to Paris and used to drive direct-current generators supplying current to the motors for the moving sidewalk at the exposition.

Fig. 1 shows the 1,000-horsepower motor in the municipal pumping plant at Geneva, where it is directly coupled to a Sulzer centrifugal pump working against a head of 460 feet. The motor weighs 27 tons and runs at a speed of 344 revolutions per minute. The stator has 10 poles, with six holes per phase per pole. The rotor has 180 holes, with two conductors to each hole connected like a cylindrical drum armature with a three-circuit wave winding. As may be seen from Fig. 2, the front part of the motor is arranged to slide along the bed-plate, taking with it the rotor, and thus rendering every part of the winding easily accessible for examination and cleaning. The three ends of the rotor winding are brought to three slip rings, which are connected with a starting apparatus, by means of which resistance can be inserted in the rotor circuit at starting. The motor is operated at 3,000 volts and, in addition to its large size, is of unusually high speed.

Current for the Geneva waterworks plant is obtained from the power house at Chèvres, where Brown, Boveri & Co. have installed six two-phase generators of 1,200 horsepower each, as well as a switchboard 98 feet long, consisting of 15 generator panels and a number of feeder panels. Waterpower is utilized as the prime mover in this station. A view in the dynamo room at Chèvres is shown in Fig. 3.

FIG. 3. GENERATING STATION NEAR GENEVA, SWITZERLAND, SUPPLYING CURRENT TO THE LARGEST INDUCTION MOTOR IN THE WORLD.

Brooklyn Company Enjoined from Infringing Condict Patent.

On October 29th an order was filed and on November 5th an injunction entered in the series-parallel controller case in which the Thomson-Houston Electric company and Edward H. Lavis were the complainants and the Brooklyn Heights Railroad company the defendant. The suit was brought before Judge E. Henry Lacombe in the United States Circuit Court, Eastern District of New York, and involved letters patent No. 393,323 issued to George H. Condict for improvements in switches for electric motors. The order states that the defendant has infringed certain claims of the patent and enjoins the Brooklyn Heights company from further infringement. On October 30th a supplemental order was issued, partially suspending the injunction so as to allow the defendant time to remove the infringing apparatus from 48 motor cars in use on the lines of the company.

A new electric-light plant is being erected at Joseph, Ore.

The Plant of the St. Croix Power Company of Wisconsin.[1]

By Henry Floy.

Introductory.

The considerable number of high-tension, long-distance transmission plants already in successful operation, might not render the completion and starting of a 25,000-volt plant of any particular interest, except that in all engineering work, and especially in electrical lines, the "newest" usually means something of a change from, and improvement upon, anything previously constructed.

There are, however, some features, both hydraulic and electrical, connected with the plant of the St. Croix Power company, recently put into operation, which I think will prove of more than ordinary interest to the members of this Institute.

General Description.

About two years ago the St. Paul Gas Light company of St. Paul, Minn., owing to increasing business, the depreciation and antiquity of its generating apparatus and the expense of operating four distinct stations, foresaw that it must build a single modern and larger steam-generating plant or arrange for securing current by means of long-distance transmission through the development of one or more of the waterpowers within reasonable distance of St. Paul.

Upon investigation it was found that 27 miles east of St. Paul, on Apple River, in the state of Wisconsin, there was a natural fall of about 30 feet. Above the fall a dam could be built to a height of 47 feet, thus affording, with a slight drop in the river below the fall, a total head of 82 feet. Apple River is fed from innumerable springs and some 25 lakes in northwestern Wisconsin, and in consequence its discharge is remarkably uniform the year around. With the head afforded, the minimum flow of water in the stream would yield about 2,000 horsepower continuously, and during most of the year nearly twice that amount. By the building of a dam, a large reservoir would be formed, from which the impounded water could be drawn in any quantity necessary to carry the peak of any load in St. Paul, provided sufficient capacity was installed in waterwheels, generators and transmission line. It was thus demonstrated to the St. Paul Gas Light company that the power that could be made available at Apple River Falls by a development of the character just outlined, would permit not only the complete shutting down of its four steam plants and avoid the necessity for building a modern steam plant, but also provide it with nearly twice the salable output of its old stations.

Accordingly, about a year and a half ago, there was organized under the laws of the state of Wisconsin the St. Croix Power company. This company is friendly to the St. Paul Gas Light company, and to the latter the former contracted to sell all the current it could generate by the development of a power plant at Apple River Falls.

Generating Station.

The generating station is a fireproof structure of brick and iron, about 140 feet by 50 feet, divided longitudinally by a partition wall, thus separating the wheel room from the dynamo room. (See Fig. 1, next page.)

In the wheel room are four main sets of waterwheels, space being reserved for the fifth unit, which

1. Abstract of paper presented at the meeting of the American Institute of Electrical Engineers, New York and Chicago, November 23, 1900.

may be added later. Each set consists of two 36-inch special Victor wheels, mounted horizontally in a nine-foot, cylindrical, steel wheel chest from which they discharge through a six-foot draft tube, eight feet long. Each pair of wheels is, of course, on a single shaft, which extends through the end of the wheel chest built into the partition wall, and is direct-connected to a 750-kilowatt generator. Each wheel chest is supplied from the penstock by its own feeder pipe, in which is located a 36-inch gate valve operated from a shaft driven by a 7½-horsepower electric motor. Each wheel chest is surmounted by an automatic spring relief valve having an opening 12 inches in diameter. There are two exciter wheels, each direct-connected to a 30-kilowatt, direct-current generator. The exciter wheels have their own branch feeder pipes, wheel chests and separate gate valves.

The waterwheel governors are of an improved type of the Geissler pattern. They are guaranteed to maintain the speed within three per cent. of normal for any instantaneous change in load not exceeding 25 per cent. of the load at the moment of variation. The governors are electrically controlled, being operated by the 125-volt exciter current.

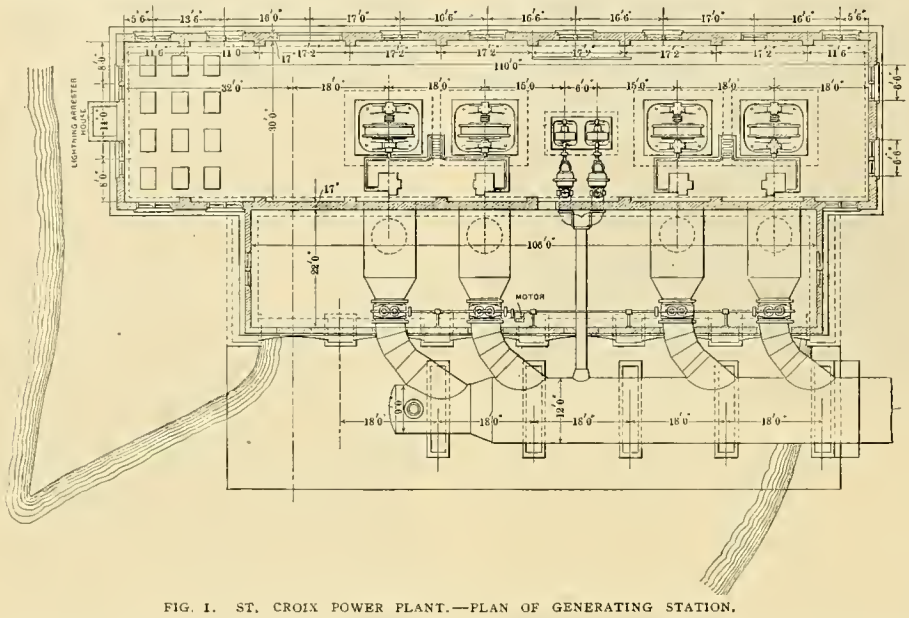


FIG. 1. ST. CROIX POWER PLANT.—PLAN OF GENERATING STATION.

All the alternators are 750-kilowatt, three-phase, 800-volt, 60-cycle, revolving-armature, separately excited machines, running at 300 revolutions per minute. They will carry full load continuously without heating more than 40 degrees C. above the temperature of the surrounding air, and have an inherent regulation slightly under five per cent. on non-inductive load.

The direct-current exciters are shunt-wound, operating at 925 revolutions per minute, and each machine is of sufficient capacity to excite five 750-kilowatt alternators.

Across the lower end of the dynamo room is the marble switchboard, consisting of an exciter panel, four generator panels, two transformer panels and a local-service panel. The exciter panel is supplied with the usual instruments, but the alternator panels are each equipped with one main oil switch, in series with two triple-pole, quick-break jaw switches, for throwing the machine on to either two sets of bus-bars. At the top of the panel is an ammeter, an indicating wattmeter, and a field ammeter, with the usual synchronizing lamp, field switch and voltmeter plug. The transformer panels will each be provided with an induction recording wattmeter, a single three-phase oil switch of special design, having a capacity of 1,500 kilowatts at 800 volts, and a potential indicator which enables operators at the generating-station switchboard to determine the voltage at the St. Paul sub-station, regardless of the power factor of the load or the drop in the line.

A brief description of this type of potential indicator may not be amiss. Across the terminals of the main transformer leads is connected a small transformer supplying in its secondary circuit, an electromotive force in step with and proportional to that of the generator. In series with the main transformer leads is a small series transformer, which supplies in its secondary circuit a current always in step with and proportional to its primary current. The secondaries of the two transformers are connected in series through an inductive resistance and an ohmic resistance. Both the inductive resistance or reactance and the ohmic resistance are so adjusted that for a given current through them, their respective electromotive forces have the same value relative to the electromotive force of the potential transformer as the reactance and resistance electromotive forces of the transmission circuit have to the electromotive force of the generator. Therefore, the local reactance and resistance electromotive forces reduce the electromotive force supplied by the potential transformer to a potential indicator connected in this local circuit, in the same proportion as the line reactance and resistance electromotive forces cut down the generator voltage, and thus the potential indicator at the generating station is made to indicate the voltage at the point of distribution.

The local service switchboard panel is equipped with switches for controlling the electric heaters by which the power house is warmed, also the incandescent and arc-lighting circuits and the motors driving the blowers.

There have been installed six air-blast transformers of 500 kilowatts' capacity each, which step the voltage up directly from 800 to 25,000 volts. As operated, the transformers are connected in two sets of three each, with "Y" connections. The low-tension side of each set of transformers is joined directly with the transformer panel switches, and the high-tension side with Westinghouse "spider" switches, through the use of which either bank of transformers may be connected to either or both of the transformer circuits.

All the electrical apparatus in the power plant was furnished by the General Electric company, except the high-tension switches and the alternating-current arc lamps, which latter were purchased from the Manhattan General Construction company. These lamps are of the enclosed type and require 6.6 amperes. They are operated in series directly from the 800-volt bus-bars, there being eight lamps and regulator in each circuit.

A 20-ton hand crane, traveling the entire length of the dynamo room, affords a convenient method for handling the heavy machinery.

25,000-Volt Overhead and Underground Transmission Line.

Two three-wire, three-phase transmission circuits, each consisting of 24½ miles of overhead, bare copper wires, and three miles of underground cables connect the generating plant with the distributing station in St. Paul.

Both overhead circuits are carried on a single line of poles. The wires of each circuit are on one side of the poles and are supported so as to be at the vertices of an equilateral triangle having 24 inch sides. The conductors are of No. 2, B. & S. medium hard-drawn copper wire, carried on glass insulators of the "Provo type"—the same as those used on the 40,000-volt transmission in Utah. The insulators are seven inches in diameter and have a triple petticoat. They are mounted on special locust pins, boiled in paraffine, carried on two four-inch by five-inch Oregon fir cross-arms. The poles are mainly of Oregon fir and are spaced not more than 110 feet apart. No poles less than 30 feet in length and eight inches in diameter at the top are used. Poles of minimum length are planted 5½ feet in the ground and six inches deeper for every additional five feet in their length. The line was designed to be practically level, irrespective of configurations in the earth's surface. The corners and angles in the line are reduced to as few as possible, consistent with securing a right-of-way at a reasonable price; no angle in a conductor at any insulator is less than 165 degrees, thus avoiding any dangerous tendency to break the pins. In making a right-angle turn special construction is used (see Fig. 2), affording seven points of support for each wire. For slight turns two or three poles, as may be required, are set 10 feet apart, but no more than one insulator per wire is allowed on a single pole.

The transmission line really takes its beginning at the terminals of the step-up transformers in the dynamo room of the generating station, whence it passes through the Westinghouse high-tension switches into a brick lightning-arrester house abutting against the end of the power house. Here are located choke coils and lightning arresters. From the arrester house the wires pass out through circular openings in the wall, which are sheltered by a gabled roof and run thence in a general western direction to a similar arrester house in the city of St. Paul, where they terminate in the heads of the underground cables.

No special engineering difficulties were met with in the construction of the aerial line, except in crossing the St. Croix River, which is about half a mile wide, with precipitous banks, 100 or more feet in height. Advantage was taken of a bridge built by the Wisconsin Central railway, and long oak pieces were fitted between the ties every 50 feet throughout the length of the bridge. These oak pieces project about 20 feet beyond the edge of the bridge and on them the six wires are carried in a horizontal plane. To nullify any bad effects of the ironwork in the bridge, the wires of each circuit are spiraled three times in the length of the bridge.

As is usual with two parallel, three-phase circuits, one circuit is spiraled twice relatively to the other circuit, in addition to the transpositions on the bridge, to prevent mutual induction.

Six feet below the power-transmission circuit, on a separate cross-arm, are carried two No. 10 galvanized-iron wires, which constitute the telephone line. The wires are transposed at every fifth pole, which very satisfactorily avoids any inductive effects in the line and results in very efficient telephone service.

There are two three-conductor, lead-covered cables, connecting the lightning-arrester house with the distributing sub-station located on Cedar street, in the very center of the business section of St. Paul. These cables are in four-hole McRoy vitrified-clay conduits laid in concrete. The conduits follow the grade of the streets, except where it was necessary to pass under a number of railroad tracks in a deep cut. Here, the conduits end in the top of a brick well about 50 feet in depth, down which the cables drop, passing from the bottom of the well in other conduits to another well on the opposite side of the tracks, through which they rise again to the conduits laid below the pavements of the street.

In considering the use of cables for 25,000-volt transmission underground, the writer found that a number of reputable manufacturers not only declined to bid on his specifications, but would not entertain any proposition for furnishing such cables, even under their own specifications. There were only two companies that would undertake the work, and accordingly a contract was entered into with these companies, one to furnish a rubber-insulated and the other a paper-insulated cable.

The specifications provided that the general design of both cables should be the same, that is, each conductor having an area of not less than 66,000 circular mils is composed of seven strands of copper wire enclosed in insulation, the three laid up in jute, and the whole enclosed in a jacket of the same insulating material as that used about each conductor. Outside of the jacket is the lead sheathing, one-eighth inch in thickness, making the cable complete about 2¼ inches in diameter.

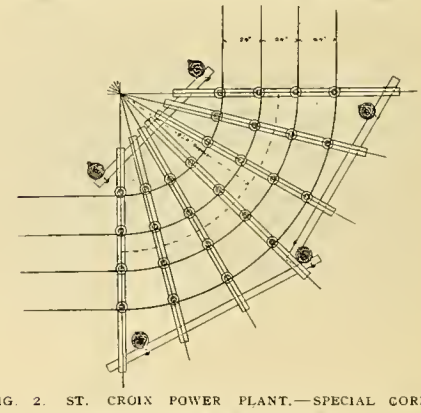


FIG. 2. ST. CROIX POWER PLANT.—SPECIAL CORNER CONSTRUCTION IN POLE-LINE WORK.

The National cable is insulated with paper treated with a secret compound. The insulation about each conductor is nine thirty-seconds inch in thickness. That of the enveloping jacket, four thirty-seconds inch thick. The covering of this cable is of lead, protected on the exterior by a coating of tin.

The insulation of the Safety cable is about a 35 per cent. compound of the best "old up-river" Para rubber seven thirty-seconds inch thick, around each conductor, wrapped with a drilled tape, served with jute, with the jacket five thirty-seconds inch thick. The sheathing of this cable is of lead, mixed with three per cent. of tin.

The contracts entered into with the above companies for cables included not only their manufacturing the cables and testing them to 40,000 volts in their factories before shipment, but also the installation of the cables complete ready for operation in the conduits in St. Paul. The contracts further include a guarantee for a period of five years protecting the purchaser against any breakdown in the cables, except those due to extraneous and mechanical injuries, and further permitting at any time during that period, the testing of the cables in situ, up to a potential of 30,000 volts. The writer's aim in having the contract for each cable awarded to a separate company was to secure the benefits of competition in promptness of delivery and perfection of manufacture. Furthermore, as underground work of such tension had never been attempted before,

[*Continued on page 354.*]

OBITUARY.

Washington H. Lawrence.

The death of W. H. Lawrence, at his home at Dover Bay, near Cleveland, Ohio, on November 23d, ended a successful life. Mr. Lawrence was the president of the National Carbon company of Cleveland and was one of the best-known business men in Ohio. Death resulted from the effects of an operation performed on his left arm two days before his death. Some months ago the arm was broken while Mr. Lawrence was taking exercise on a tennis court and the bone refused to heal properly, necessitating the surgeon's aid.

Washington H. Lawrence was 60 years of age at the time of his death. He was descended from one of the oldest families of Massachusetts, his ancestry being traced back to Robert Lawrence, who was knighted by Richard I. The first member of the family to move to this country was John Lawrence, who was one of the settlers of the Massachusetts Bay colony. Joel B. Lawrence, the father of the deceased, came to Olmsted, Cuyahoga County, Ohio, in 1833, and at this place on January 17, 1840, the son was born. At 12 years of age he was left an orphan, but with the energy which made his later life a success he went to work to prepare himself for his future career. After going through the common schools at Olmsted he took a course at Baldwin University, and at 19 years of age he became associated with Milton Baldwin in the management of Hon. John Baldwin's extensive milling and real estate interests in Kansas. In 1859 he became associated with his brother in business at Hannibal, Mo., but in a few years he returned to Ohio to look after the interests of the family estate, and in 1864 he removed to Cleveland, where he became associated with other gentlemen in the manufacture of the Domestic sewing machine. Later on he had charge of the sale of the Howe sewing machine for five states, and at the same time conducted a manufacturing business at Elyria.

It was not until the early 70's that Mr. Lawrence became associated with Charles F. Brush in the Brush Electric company. For some time after that the success of electricity for commercial use was rather doubtful, but the promoters had faith, and shortly they began to see their rewards in a growing business for the company. When, in 1882, Mr. Lawrence decided to sever his connection with the business in order to take a needed rest, the Brush company commanded a capital of $3,000,000 and was the largest electrical establishment in the world.

For some years Mr. Lawrence devoted his time to the manageemnt of real estate which he had purchased in Cleveland, but in 1886 the love for manufacturing pursuits overcame him and he associated himself with A. W. Masters in the manufacture of carbons in what is now the Wilson avenue factory of the National Carbon company. Later on Mr. Masters withdrew because of failing health. Mr. Lawrence, Myron T. Herrick, James Parmlee and Webb C. Hayes became the owners under the name of the National Carbon company. In 1891 the company erected the largest carbon factory in the world on a tract of land in Lakewood, near Cleveland. The capacity is about 20,000,000 carbons a month. Within the last year Mr. Lawrence became president and manager of the Brush Electric company and the Sperry Electric Railway company. But he was able to look after this extra work with ease as well as manage the very large business of the carbon company.

Mr. Lawrence was married to Miss Harriet E. Colister of Cleveland, and she, with seven children, four of whom are married, survives him. The funeral took place on Monday last from the family residence at Dover Bay, and the interment was made at Lake View cemetery.

Col. Lester S. Hills.

Col. Lester S. Hills, an old-time telegraph operator and later a well-known electrical man in Chicago, for several years employed by the Chicago Edison company, died at his home, 375 Wabash avenue, Chicago, on November 22d. Colonel Hills was born in Hartford, Conn., in 1835, and when a boy worked as a telegraph operator side by side with Thomas A. Edison in New York city. He was colonel of the Life Guard regiment of the Hartford militia during the Rebellion. After the war for several years he was engaged in promoting electrical and other industries. He was chiefly instrumental in obtaining the Lake View and Hyde Park electric-lighting franchises in Chicago. In 1891 he entered the employment of the Chicago office of the Thomson-Houston Electric company as salesman and agent and retained his position with that company and its successor, the General Electric company, until 1894, when he went with the Chicago Edison company. His position with the latter company was that of agent in the contracting department, in charge of the electric-sign work. Colonel Hills was an energetic and industrious man and well liked by his associates. He was quite active in ward and city politics. A wife and two sons survive him.

Lieutenant Haeseler.

Lieut. Francis Joy Haeseler, U. S. N., who died at the New York Naval Hospital on November 20th of typhoid fever, was known as an electrician and was an expert in the application of compressed air in mechanics. In the naval battle off Santiago he was in charge of the starboard turret of the battleship Texas and earned high praise for the manner in which his guns were served. Lieutenant Haeseler made the 12-inch guns of the Texas rapid firers by improving the method of loading. He made it safer to handle big guns by altering the electric firing systems so that a gun could not be discharged until the breech lock had been completely closed.

A Reconstructed Country-house Plant.

In the issue of the Western Electrician of October 2, 1897, was described an interesting isolated electric-lighting plant at the country residence of Mr. H. N. Higinbotham, near Joliet, Ill. Since that date the continually increasing demands for electricity for light and power upon the extensive farm and grounds of the place have necessitated an increase in the output of the plant. The gas engine which formerly furnished the power caused some trouble in the absence of a skilled attendant, and it was decided to utilize for the enlarged plant waterpower that had for many years driven an old grist mill on a creek near the place.

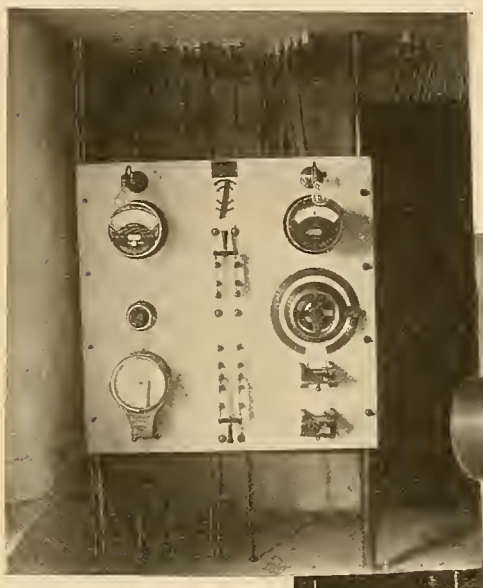


Fig. 3. Switchboard.

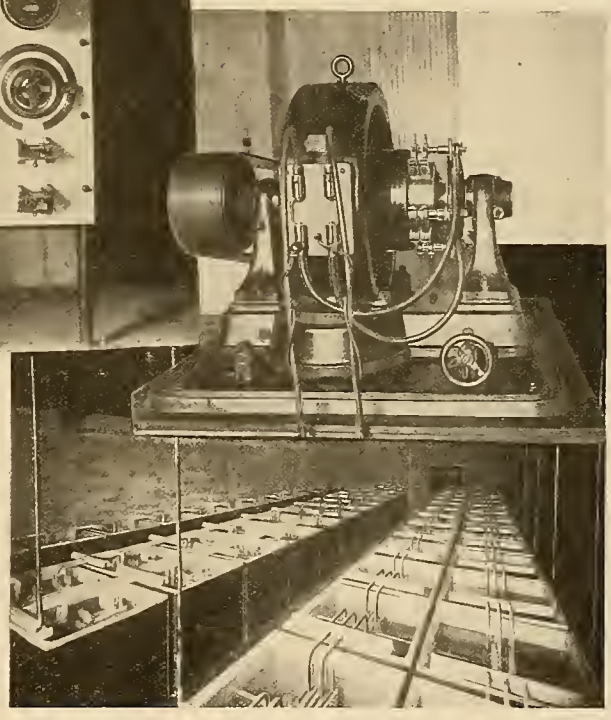


Fig. 1. Generator.
Fig. 2. Storage Battery.
A RECONSTRUCTED COUNTRY-HOUSE PLANT.

A room in the mill was renovated and fitted up as a dynamo room, and a horizontal turbine took the place of the old overshot wheel. Owing to the small size of the stream, the power supply is uncertain and an enlarged storage battery was found necessary, one to be charged once in three or four days or a week. The mill pond has been deepened and enlarged and made into a charming lake, an adornment to the grounds. When operating the mill the waters in this lake are considerably reduced, owing to the scant supply of the stream. In place of the former 10-kilowatt dynamo, a Holtzer-Cabot machine of 17.5 kilowatts' output was installed, giving a current of 100 amperes at 175 volts. An illustration of this machine may be seen in Fig. 1.

Power is taken almost wholly from the battery and not from the generator, contrary to the practice with the old power station. It had been found that the old battery of 58 cells was giving out, and an entirely new accumulator set was installed in a room at the mill especially fitted to receive it. Fig. 2 shows a view of the new battery.

The walls of the battery room were stone-lined, the pine floor painted, and on it was spread a coating of pitch. In this room have been placed 68 lead-lined storage cells of the "D-5 Special" type of the Helios-Upton company's make. The battery has a guaranteed output of 200-250 ampere-hours, at a discharge rate of 40 amperes, and is insured by the company for seven years. Each tank now holds five 14 by 14-inch plates, but is built to hold 15 to 20 plates, as it is expected ultimately to triple the capacity of the plant. Twelve of these cells are "end cells," to be switched in or out of circuit, as the varying demands of the load may require.

It is expected that ultimately it may be necessary to draw on the plant for 150 amperes for eight hours, as already machinery in the creamery and about the farm is being driven by electric motors, and this power will be extended more and more to meet the demands of the establishment.

The switchboard, shown in Fig. 3, is of white Tennessee marble, and is very simple in arrangement. The ammeter and voltmeter are of the standard round-dial Weston type. The swtiches on the board were designed especially for this installation; they include underload and overload circuit-breakers, switches for the two circuits of the ground lighting and an end-cell switch.

The wires leading from the power house to the residence are lead-covered, and are carried in underground conduits. This main line is over 1,500 yards in length. From the house branch lines lead to the stable, creamery and other outhouses of the farm as well as to the lamp posts about the grounds, and altogether there are more than two miles of wiring. The potential drop in these lines is about 10 volts.

Telephone connections extend from the residence to the mill, and the operation of the power house is controlled from the mansion, as was the case with the older plant.

The new installation is considered to be more economical than the older plant, and it will allow for ample application of electric power to all the demands of the farm, as they may arise.

Rubber and Guttapercha.

Major J. Orton Kerbey, an old-time telegrapher, who has devoted much attention to the crude-rubber trade, having been United States consul at Para under Secretary Blaine, believes that Cuba, Porto Rico and the Philippines offer a great field for the cultivation of rubber and guttapercha. He says that rubber trees are indigenous to Cuba, and, although the native species furnishes rubber only half as valuable as the Hevea or Para rubber of the Amazon region, he is of opinion that the latter variety may be cultivated in Cuba and Porto Rico, eventually saving the United States the $80,000,000 which, he says, is annually sent to England to pay for Brazilian rubber. Moreover, he says that rubber that is now growing wild in certain districts of Cuba can be used at once commercially. Crude rubber is worth a dollar a pound in gold coin in any of the markets of the world. A gallon of milky sap coagulates a pound of rubber. A matured tree will yield three to eight gallons of sap. Guttapercha, which is of the same family as caoutchouc, is used for cable insulation. The supply comes from the Dutch islands of Java and Sumatra, adjacent to the Philippines. It is believed that guttapercha is indigenous to the Philippines, and was transplanted in Java and Sumatra. It is a more valuable product than rubber, costing $1.50 a pound in gold, and is a necessity for cables. Major Kerbey, who is now in Pittsburg, believes that American capital may profitably find employment in taking up large tracts of Cuban land for rubber culture.

The plant of the Citizens' Electric company, furnishing light for commercial purposes at Hughesville, Pa., was burned recently.

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Speaking of literary men in public life, the London Spectator comments on the technical equipment of modern authors and gives several instances where researches made for literary purposes might prove of some value in a parliamentary career. "Outside the ranks of trained engineers," it says, "who would be better equipped to assist the inquiry into the efficiency of machinery—say, water-tube boilers—than Mr. Kipling?" The conception of Mr. Kipling as a competent boiler inspector is rather droll, not to say strained. It is to be hoped that the writer did not intend to give a sly intimation that Mr. Kipling's verses are machine-made.

One of the great engineering projects of the century relates to a tunnel under the Strait of Gibraltar, connecting Europe and Africa. According to Mr. Monaghan, the United States consul at Chemnitz, a Parisian engineer has recently finished a plan by which the Spanish railroads terminating in Gibraltar will be connected by such a tunnel with the railroad lines of Morocco. Several of the men interested in the scheme are now said to be in Morocco trying to obtain permission to build a railroad in that country. "Technically," says the consul, "the plan is not impossible, as it is merely a question of boring through rock." There is, of course, no immediate prospect of the building of such a tunnel, for political and financial objections of great weight would have to be met, to say nothing of unforseen physical obstacles that might be encountered. But it is interesting to reflect that the advantages of electric traction add greatly to the feasibility of such a route; if the Gibraltar tunnel is ever built, it is pretty sure to contain an electric railway.

The production of copper by the electrolytic process now amounts to about 20,000 tons per annum in the United States. Although this is a little less than seven per cent. of the total copper production in this country, the quantity is still a large one and shows the importance of this branch of applied electrolysis. Moreover, the process has by-product possibilities which may become important. In the electrolytic treatment of the ore the impurities are separated from the metallic copper and drawn off from the vat in a mass called "sludge." As this residue is usually rich in the precious metals, it is treated for these, and large amounts are recovered. It has also been found that the non-metallic elements tellurium and selenium accumulate very rapidly in this sludge, and if there were any great demand for them it could be filled from this source at very small cost. The American electrolytic copper works are accumulating many tons of these minerals annually at their establishments. Selenium, as is well known, has the remarkable property of varying in electrical conductivity with the action of light, and if Mr. Szczepanik's "telectroscope" ever materializes, there should be a considerable demand for it.

Mica is used to a considerable extent in electrical manufacturing, and for this reason it is of interest to observe that the domestic production of this mineral seems to be decreasing, while the imports are on the increase. The report of the United States Geological Survey for the calendar year 1899 shows that in that year the value of the sheet and scrap mica produced in the United States was $101,465, as compared with $131,098 in 1898. On the other hand, the value of imported mica last year was $275,984 and in 1898 $150,082. The principal sources of supply in this country are in New Hampshire, North Carolina, South Dakota and New Mexico, while most of the imported mica comes from Canada, although Germany, Great Britain, Argentina, Brazil and the British East Indies add respectable quotas. The increase in importation is due to some extent to the demand of the electrical trades and is in the face of a heavy duty. Under the existing law mica has two specific classifications and rates of duty—one as "unmanufactured," dutiable at six cents a pound and 20 per centum ad valorem, the other as "cut and trimmed" at 12 cents a pound and 20 per centum ad valorem. Although the burden is not a very grievous one, it would seem that the duty on mica, especially in the "unmanufactured" class, might well be reduced.

At the meeting of the British Institution of Electrical Engineers three weeks ago Professor John Perry, in his presidential address, told his colleagues what he considered to be some plain truths. Professor Perry is an Irishman by birth and a highly educated engineer, with a taste for mathematics. He has spent a considerable proportion of his 50 years in college professorships, and he has taught classes in two hemispheres. With such an equipment, native and acquired, it is not to be wondered that he should speak his mind freely when he believed the time was ripe for an outspoken utterance.

Professor Perry put before his hearers these questions: "Is electrical engineering to remain a profession, or is it to become a trade? Is this Institution to continue to be a society for the advancement of knowledge in the application of scientific principles to electrical industries, or is it to become a mere trades union?" As may be inferred from this opening, the president's address was a plea for broad recognition of the value of scientific research as well as an indignant protest against what he thought was a general spirit of antagonism to such research. The speaker decried rule-of-thumb methods, and said that electrical engineering owed its being altogether to scientific men—to the laboratory and desk work of a long line of experimenters and philosophers. He said that an electrical engineer must have such a good mental grasp of the general scientific principles underlying his work that he is able to improve existing things and ways of using these things. "It has become the custom to call this 'theory,'" said Professor Perry, "and I suppose I must follow the custom." In elaborating what he meant by "theory" the president made some very pertinent and truthful observations:

To gain what we call "theory" a good general education is most helpful; mathematical knowledge is very helpful; laboratory and workshop experience are extremely helpful. There is one qualification which the electrical engineer must have, and without which all other qualifications are useless, and if a man has it no other qualification is supremely important, and this absolutely indispensable qualification is that a man shall love to think about and work with electrical things. He must like these not because of the money he can make through electrical contrivances, nor even, I think, because of the name he may make before the world—this would be mere liking or cupboard love, which has no lasting quality. So long as we have men in this country who have the true love for scientific work of which I speak, so long shall we have a real profession of electrical engineering, for such men are always scheming new contrivances and improving old ones and utilizing the services of all helpful people, and especially of capitalists. When we have reached a state in which nobody schemes new things because the existing things are perfect, there will no longer be a profession of electrical engineering.

Professor Perry characterized the American engineers as "practical idealists" and said that his hearers should follow them in taking care that standardization of apparatus was not obtained at the sacrifice of the inventive faculty. The electrical engineer should have imagination—a strong imagination well under control. "Why," exclaimed the lecturer, "even the writers of leading articles in the daily papers can talk of the wonders of electricity and what may yet come to pass; and yet we who make machines and use them and switch the marvelous thing on and off and take all sorts of liberties with it—we are like Calibans, oblivious of the wonders of the fairy isle—like soulless priests making a living in the temple of Isis—like Aladdins, who rub our lamp only to get the necessaries of life!" Professor Perry then went on to contend that the English engineers knew too little theory and pointed to the great advance of three-phase work in Switzerland to prove his case. On the occasion of the visit to that country a year ago some of the British engineers, "said to be eminent and thought to be practical," asked questions and made remarks that showed that they did not know the most elementary principles of three-phase working. There is an absolute necessity for great change in English ways; "and it is this scrapping part of the business that we dislike in England." In this respect England and Spain and China differed from England's own colonies.

In closing, Professor Perry spoke warmly in favor of mathematics—mathematics taught and used in a common-sense way to attain an end. "Mathematics ought to be the natural language of the electrical engineer, and at present it is a foreign language. We are at the beginning of our development, like monkeys, whose necessities have increased faster than their powers of speech." The concluding paragraphs of this vigorous address were eloquent in praise of the spirit of research in pure science, the "beautiful young mother" of electrical engineering.

While it may be that in his almost impassioned plea for more scientific training and methods in electrical work Professor Perry has overstated the case, as some of our English contemporaries contend, the address furnishes much food for thought—and not for Englishmen alone. With the example of the German and Swiss engineers before them Americans must realize that the "theory" often sneered at is not, in sober earnest, to be despised.

The Paris Exposition of 1900.

By Carl Hering.

Part II.

In electric railroading there seemed to be comparatively little of special interest to Americans besides the three-phase motor system and the contact bar already referred to, both of which deserve more attention here than they are getting. The new Metropolitan underground electric road quite recently opened in Paris is apparently an excellently constructed, but wretchedly managed, road. American management would diminish the total time of transit and increase the profits greatly. It is an improvement over the new underground road in London in that motor cars are used instead of locomotives, but being directly under the street, instead of very deep, as in London, the excellent device of a descending and an ascending grade between stations, to aid acceleration and stopping, cannot be taken advantage of. Both of these roads use American electrical machinery.

The two new electrically operated extensions of several steam railroads into the central parts of Paris, the new and much-needed electric railroad to Versailles and the new conduit road in Paris are all of interest. A surface contact line and one using accumulators are also being tried in Paris. The Western railroad, one of the largest steam railroads of France, is making very extensive preparations toward introducing electric traction on its lines by more improved methods than its Heilman locomotives. If our steam railroads were as enterprising, the replacing of steam by electric traction would progress more rapidly here. Through the kindness of Mr. Clerault, the chief engineer of this enterprising steam railroad, our Institute had the pleasure of accepting an invitation for a personally conducted visit to its interesting plant. It has already in operation, in part, a large three-phase power station near Paris, accompanied by extensive laboratories; has constructed an electrical extension of its steam lines toward the center of the city; is building the new electric line to Versailles, over an excellently constructed and well-graded private roadway, and has under construction a number of electric locomotives. Paris is therefore at last beginning to avail herself of the advantages of electricity for traction, and will unquestionably be very greatly benefited thereby. If, with this modern traction force, a more modern and more American system of managing and operating the city tramways were introduced, the Parisians, the many visitors and the owners of the tramways would all be the gainers.

In the exhibition itself may be mentioned the two miles of moving platform, which differed from the one in Chicago in that the motors were stationary while the rails moved. The third-rail electric railroad, paralleling it, but running in the opposite direction, was virtually an American exhibit, and was managed more like American roads, making a refreshing contrast to the wretchedly managed tramways and omnibuses in the city. Both the platform and this railway were fed from two 800-horsepower induction motor-generator sets made in this country, the induction motor, started by its mate, being one of the largest ever made. The conduit road which was shown was also virtually one of those developed in this country. A short section of the "suspended" railway was exhibited, but whether this struggle for recognition was successful seems questionable. Another curious departure shown in operation was the trolley automotor, a system of running electrically driven vehicles on ordinary roads, but taking current from an overhead-trolley wire. The novel feature was that the small contact carriage running on the two wires was geared electrically to the motors by means of a local three-phase current, so that it tended to travel slightly faster, thereby always leading and keeping the connecting cable taut. A field for it might exist where omnibuses are now used.

A number of large electric locomotives were exhibited, notably one from Berlin, showing that heavy electric traction is making progress. One, weighing about 45 tons, exhibited by the French steam railroad known as the P. L., M., was operated with accumulators carried on a tender, but the claims made for it by the attendant were so remarkable that a verification is desirable before they can be considered. Although it was dated 1896, I was told that it was "not yet" in constant use.

In electric lighting, one of the most interesting features was the debut of the Nernst lamp. After long and tedious labors on the part of the Allgemeine company of Berlin, the interesting laboratory experiment of Nernst, that a filament of a non-conductor like magnesia becomes a conductor after it is heated, has been developed into a form of high-efficiency, incandescent lamp, which is now claimed to be ready for the market; but, although several hundred were burning there daily, it was not possible to buy one. It resembles the usual incandescent lamp, except that the bulb is open; the filament is somewhat thicker and much shorter than that of a carbon lamp; the light is very much whiter and more brilliant. It can be lighted with a match, alcohol torch or automatically by a platinum wire preheater with a magnetic interrupter. Either alternating or continuous currents can be used, but the filament must be exposed to the air. The lamps are made for 25, 50 and 100 candlepower at 220 volts, and therefore do not yet compete directly with the usual 16-candlepower lamp. The efficiency is said to be 1.5 watts per candle, or about twice as good as the present carbon lamp of the same voltage. The filament is said to be made of magnesia, mixed with the rare earths, like zircon, thorium, etc. The life is claimed to be very satisfactory, though no figures could be obtained, but the perishable parts, valued at only 25 per cent. of the probable cost of the lamp, can easily be replaced, the bulb being open.

The material of which the filament is made has a rapidly falling temperature coefficient, much worse than carbon, which would make it extremely sensitive to changes in voltage. This is overcome by a very ingenious method, to which the present success of the lamp is due; it consists in placing a very fine iron wire in series with the filament, the wire being so proportioned that it is heated by the normal current to that temperature (about 450 to 500 degrees C.) at which it has a very rapidly rising temperature coefficient; the resulting characteristic of the two in series is therefore a rising one. This fine wire consumes about 10 per cent. of the voltage. The price of the lamp, it is thought, may be about 50 cents.

Among the novelties in arc lamps which attracted some attention during the few days it was on exhibition was the Bremer lamp, in which the carbons contain certain salts, like those of magnesia, together with fluor calcium, that deposits a white oxide on surrounding bodies, which acts both as a Nernst conductor and a white reflector, the carbons being inclined like the letter V. A reliable German authority found the efficiency to be 0.13 watts per hemispherical candlepower. The light is said to be steady and bright, but soft.

The only enclosed-arc lamps exhibited were from this country, directly or indirectly. These lamps, which are so largely adopted here, are scarcely known on the continent, and in France, at least, it seems that they are not even wanted, on the ground that the light is too blue and unsteady and the efficiency too low. As manual labor is much cheaper there than here, and arc lamps are not used nearly as much, the chief advantage of this lamp is not appreciated, at least not yet. The arc lights there are, as a rule, much steadier, and are almost universally connected to constant-potential circuits, our series system being almost unknown. The general type of regulating mechanism which is in favor is that in which the coil applies a brake to an escapement wheel which tends to revolve by the weight of the descending carbon; the regulation is therefore very sensitive and gradual. Cored carbons of a fine quality are, moreover, almost universally used. Generally only two lamps are in series across the usual 110-volt mains, but in some cases as many as three are connected, with an increase in light efficiency; in such cases the lamps are of the differential type, in which the regulating mechanism is actuated not only by a shunt coil, but also by one in series.

The exhibits of electric chandeliers and like fixtures were mostly French, and were generally very tasteful, artistic and often very beautiful, although frequently marred by external wiring, as with many of them concealed wiring is impractical. The accessories, on the other hand, such as circuit-breakers, small switches, lamp sockets, motor-starting resistances, etc., were frequently quite bad or too complicated, from an American standpoint. There would seem to be quite a market abroad for the better classes of American goods of this kind. It is hard to understand why electrically started fires are not more frequent on the continent with such poor appliances of this kind that one finds in use there.

The relatively large number of exhibits of switchboard switches for breaking currents of very high voltage indicates the rapid introduction of high-tension currents. In many of them the well-known double horn is used for extinguishing the arc, which is an indication of the effectiveness of this simple device.

A novel departure in switchboards, especially for dangerously high-voltage machines, consisted in placing all the switching apparatus belonging to one machine on or under a post or pedestal near the machine itself, and so that the attendant faces the machine. The actual switches are under the floor, where they are out of the way and easily accessible from a pit below, only the levers, handwheels and instruments being on the pedestal; the attendant is thereby protected from all the possible danger. It is the standard practice of the Oerlikon company.

The use of silver fuse wire in place of lead alloys, by a very large German company, on the ground of greater reliability and constancy, deserves mention. For the same fusing current the amount of metal volatilized is the least for silver.

The non-interchangeable fuses of Siemens & Halske were of some interest and seem to supply a need.

Among the cable exhibits there were three for underground work in which multiple-cored cables were subjected to 25,000 and 30,000 volts alternating, the insulation in one of these being impregnated paper without any rubber.

A German maker of aluminum goods showed that this metal can be welded without solder or flux by simply heating it to a certain definite temperature, at which it softens. The use of aluminum line wires makes this simple method of interest to electrical engineers.

The number of different types of meters exhibited was about equal to the number of their exhibitors, but the Thomson meter in nearly the same form as made in this country is the one most frequently used; several hundreds a day are claimed to be made by the French company which manufactures them. The field for a good, cheap and simple ampere-hour meter for small consumers of continuous current is filled very satisfactorily in France by the O'Keenan meter, of which 11,000 are already installed. In principle it may be said to be like a d'Arsonval galvanometer or Weston instrument, in which, however, the coil is mounted so that it may revolve continuously, the number of its revolutions being registered. This coil or armature is a shunt to a very low resistance in the main circuit. It is extremely sensitive and the coil requires only 0.6 microwatt to start it; it will register as little as five watts in the lamp circuit or one per cent. of its range, has a straight-line characteristic, and is not appreciably affected by temperature changes. A somewhat similar one is about to be introduced in this country, and there is no doubt a large field for it.

The well-known and ingenious Aron double-pendulum meter was well exhibited in various forms, including one for three-phase currents. It is said to be used to some extent in Germany, but would probably not find much favor in this country.

An interesting and promising modification in the Thomson type of watt-hour meter, shown in the German section, consisted in using a three-coil armature like that in the original Thomson-Houston arc-light machines; this enables the same magnetic force to be produced by a much smaller weight of the revolving part, with several attending advantages of importance.

Prepayment meters are meeting with some favor, and there might also be a field for them in this country among small consumers.

In telegraphy, the exhibit which seemed to attract most attention was the very ingenious printing-telegraph system of Professor Henry A. Rowland of Baltimore. The tender merely presses lettered keys, like on a typewriter, and at the other end the message is received in print on a sheet of paper, ready for delivery, without requiring any operator. An alternating current of constant frequency is passed over the single line and operates synchronous motors, by means of which the necessary synchronism at the two stations is obtained. The different characters are transmitted by the suppression of various combinations of the half waves of the current. At the receiver end those waves are received in a large number of relays, various combinations of which operate a few electromagnets for printing the characters and moving the paper laterally and lengthwise. The typewheel revolves continuously, and the paper, directly beneath it, is struck from below at the exact moment when the desired letter is over the paper. Four messages are sent at the same time in one direction, the line being loaned to each operator in succession for short recurring periods. This is then also duplexed, making eight messages simultaneously over one wire, each, it is claimed, at a speed of 45 words per minute. It does not seem to be used commercially yet, and whether it will be equal to or better than the printing-telegraph system which has been in satisfactory commercial use between New York and Chicago for some time, devised by one of our members, can be determined only by equally severe tests.

There were several exhibits of the wireless-telegraph system, though none by Marconi's company. The modifications were only in details, and did not include any way of making the system selective. It is now bing introduced commercially and there are a number of installations in regular use.

The telegraphone was one of the very few entirely novel inventions of promising value exhibited. This extremely ingenious and very interesting invention of Poulsen, a Dane, has been so thoroughly described in the journals that a mere mention will suffice here. It may be said to be a magnetic phonograph in which a long, hardened steel wire is passed rapidly near the magnet of a telephone receiver, the magnetic variations of which are thereby recorded on it in the form of permanent magnetism. By then passing this wire under small pieces of iron attached to a diaphragm, the same sounds are reproduced. I had the pleasure of hearing such a reproduction and can vouch for the statement that it is much clearer than from an ordinary phonograph, as there is an entire absence of that objectionable scratching noise, there being no mechanical contact at all. Its suggested applications are numerous, including duplex and multiple telephony.

Those interested in the controversy between the vertical and the horizontal telephone switchboard found a good opportunity to compare them, as each was exhibited by its most ardent defender, the vertical board being advocated by one of our large and prominent companies, and the horizontal by a similarly prominent German company, which is introducing it in its country, notably in Berlin. The chief advantage claimed for the latter is that two operators, sitting on opposite sides, can use the same board and that, therefore, the length of board for the same number of subscribers is halved.

Electrochemistry was one of the electrical classes in which the most pronounced recent development was shown, although the exhibits were not sufficiently complete to show the true state of that art. This branch of electrical science has opened what promises to be one of the important fields in which there is an opportunity for great development. Products which not many years ago existed only as rare and expensive specimens, and some which were not even known, are now made electrically by the ton.

Electric furnaces were shown in operation. There was also a very fine exhibition of the extremely in-

[*Continued on page 356.*]

DEVELOPMENT OF THE TELEPHONE FIELD.

Train Dispatching by Telephone.

By J. J. Nate.

There is no question, in view of what has thus far been accomplished, of the successful use of telephones for train dispatching on short lines, at terminal stations, switching yards and during track elevation. I am indebted to Mr. C. F. Annett, assistant superintendent of telegraphs of the Illinois Central Railroad company, for some interesting data in regard to the work accomplished and the use the Illinois Central company is making of the telephone in this department of its work. Referring to the Omaha Bridge and Terminal railway, which is used for the Illinois Central terminals into Omaha, I am informed that all train orders issued in that part of the system are handled by telephone, with special forms of blanks. As designated on these blanks, the train dispatcher calls the number of the form to be used before sending the order. The scheme works admirably. Chief Train Dispatcher W. B. Ormond states that the advantage over the telegraph lies in the fact that he recognizes the person answering the telephone call. In recognizing the voice, as only certain operators are allowed to handle train orders, he is assured of the identity of the operator answering. Mr. Annett states that at several other terminals telephones are used entirely for dispatching engines and yard crews, and that telephones are used for this purpose exclusively in the Illinois Central terminals at New Orleans. In the official time table of the Omaha Bridge and Terminal Railway company special rules Nos. 6 and 7 read as follows:

6. Night and day telephone offices are located at Illinois Central freight depot (Omaha), East Omaha Junction, Missouri River bridge, North Junction, train dispatcher's and yardmaster's offices, Council Bluffs.

7. Special orders directing the movement of trains, varying from or additional to the time table, will be issued by telephone over the signature and by the authority of the chief train dispatcher.

It will be seen that the telephone is used exclusively and is recognized as the medium of dispatching all trains.

Perhaps the most interesting and heaviest amount of business ever handled in this way was in connection with the elevation of the St. Charles Air Line railroad in Chicago. The St. Charles Air Line is about one mile in length from the west end of the Air Line bridge over the Chicago River to the Lake Front near Fourteenth street, crossing Clark, Dearborn and State streets, Wabash, Michigan and Indiana avenues, and also crossing the four tracks of the Illinois Central, where all Michigan Central, Big Four and Illinois Central passenger trains go in and out of the Park Row depot. This line also crosses all those railroad tracks running both south and west at Sixteenth and Clark streets—those of the Lake Shore, Rock Island, Chicago and Western Indiana and Santa Fe roads. It is not unlikely, also, that the train operation of the Chicago and Alton, Wabash and other roads was taken into account when the Air Line track elevation was going on. Regular trains used the Air Line at the Illinois Central crossing, near Fifteenth street, every seven minutes, not including Air Line trains. The Lake Shore and Rock Island passenger trains crossed the Air Line at the "S" crossing every 10 minutes. The Western Indiana trains used the Air Line crossing at another point every five minutes. The State street cable cars crossed the line at three-minute intervals and the Wabash avenue cars at five-minute intervals. These facts will give some idea of the train-order work handled by telephone. The work was done during May, June, July, August, September, October, November and December, 1898, and January, February, March and April, 1899. All trains were given from one to three telephone orders, and without an accident. At the beginning of the elevation Trainmaster H. R. Hopkins gave instructions that all responsibility for movement of trains on verbal orders given by telephone service would be with the operator on duty. During the elevation a total of 57,038 engines and 369,165 cars was moved in the 12 months, the average being 156 engines and 1,011 cars a day. Seventy-five per cent. of the business was handled between 7 a. m. and 7 p. m. The dispatchers were J. Atkinson and R. S. Hay.

I think, after such a showing, absolutely no question can exist as to the successful use of telephones for train dispatching, even under the most difficult of conditions, unless, perhaps, it would be over the main lines, where an immense amount of general business in addition to this work must be taken care of instantly. As to the efficiency of telephones and liability to get out of order as compared with telegraph instruments, I believe that, with intelligent use, the greater credit should be given to the telephone instrument. This could not be claimed, perhaps, for the earlier class of apparatus on the market some years ago, but that condition is changed, and the product of a high-grade Independent telephone manufacturer is to-day as complete and efficient as any telegraph instrument ever manufactured, and in the experience of not only the Illinois Central, but a dozen of our other prominent railway companies who have made use of the telephone in this class of work, it is found to be reliable and satisfactory.

Telephony in Great Britain.

The National Telephone company, profiting by the experience of the telephone system in America, particularly in San Francisco, intends to extend its operations in Great Britain in a way that will bring the benefits of telephone communication within the reach of a much wider circle than at present. The company is prepared to fit up and maintain telephonic instruments on subscriber's premises on the party-line system. The cost of service is collected at the time by an ingenious arrangement on the penny-in-the-slot system, hence there is no account to meet monthly or quarterly, as the case may be, and all liability is confined to the following rates: Two dollars and 50 cents a month for each subscriber on a two-party line, $2 on a four-party line, and $1.25 on an eight-party arrangement. Under this last head the total cost works out at $15 per annum.

Owing to the many complaints made by subscribers of the delays in getting connection with places in the country, the National Telephone company has communicated with the Postoffice in the hope of remedy. The response, however, is to the effect that a minimum of 20 minutes must always elapse before any reply can be made as to when a call for a telephone district outside the metropolis will be answered. It is believed that an insufficiency of trunk lines and a lack of employes are responsible for this new and vexatious regulation, which is certainly not a hopeful augury for the coming Postoffice telephone system in London.

Line Construction in the Frozen North.

A telephone line has been completed between Fort Smith, on the Slave River, and Graham Landing, in the Northwest Territories, Canada. It is 16 miles in length and runs through a dense forest. John Trewhella of Fort Simpson, on the Mackenzie River, who constructed the telephone system, states that it was necessary to clear about half the way of trees. In one place the ground was frozen to a depth of three feet below the surface, and it was necessary to brace all the poles in that portion of the line. It was impossible to dig a hole, as it was in swampy ground, and when a fire was used to thaw out the soil the water would soon put out the fire. Mr. Trewhella says: "This was in the month of August. In the winter we have it 60 degrees below zero, so I will have the opportunity of seeing how the line works then. I have just finished the job and it is working all right now."

Telephones in Russia.

Telephone franchises were sold at auction in St. Petersburg, Russia, on November 21st. The new régime begins in November, 1901. The government has prescribed the condition of rentals, and the franchises were given to the bidders fixing the lowest rates to subscribers. The St. Petersburg municipality won in that city, agreeing to demand 45 rubles ($34.65) annually, compared with 250 rubles ($192.50) hitherto charged. The Western Electric company of Chicago was unsuccessful. Rates in Russian cities have been fixed as follows: Odessa, 48 rubles; Riga, 57 rubles; Warsaw, 69 rubles, and Moscow, 79 rubles. The prices for restaurants, hotels, etc., are 30 per cent. higher for a single user and 10 to 20 per cent. lower for telephones in general use, the custom being to place telephones in a corridor for the use of the entire building. The long-distance lines remain the property of the government.

Long-distance Work in Australia.

Australia is rapidly pushing ahead in the matter of telephone extension. Some time ago the governments of New South Wales, Victoria, South Australia and Queensland conferred on the advisability of connecting their respective capitals, but the cost was declared to be prohibitive. It has finally been agreed that, for a start, wires should be erected only between Brisbane, Sydney and Melbourne, and the outlay will involve an expenditure of over $200,000. The postmaster-general of Victoria is now inviting estimates for the construction of the line between Melbourne and Sydney.

Selective Calling Arrangement for Party Lines.

Patents have been applied for by W. S. Burnett and W. H. Goodhal of Milwaukee for a device known as a "multiplex telesig." The invention is designed to be attached to a party-line telephone circuit, and when so connected is calculated to allow any subscriber to be called without disturbing others upon the same line.

"The call on the line is indicated from the main office by a telegraph key which is manipulated by the operator so as to tick off any of the dots or spaces of the Morse telegraph code," says the Milwaukee Journal. "The principal technical device of a subscriber's instrument is a cylinder. Compactly set around this cylinder and parallel with its shaft are small pins, which are depressed or remain in position as the operator dictates upon the key at the other end of the line. When the end of the particular call has been reached at the main office in the course of the dictation, a key in the box answering to its number falls into the cylinder, and the bell rings up the telephone of that especial number. Every key is, of course, different and answers to the subscriber's list registered at the main office. The pins in the cylinder always fall back into place at once by a self-acting spring and are thus at all times ready for a new impression. The machine will be introduced to the public within seven months or so. It is possible with this system to maintain on a single circuit of telephone service, station signaling on railroads, police and fire signaling, messenger service, etc. In laying submarine mines for the protection of coast lines or cities, any number of torpedoes could be placed upon a circuit and any one exploded without in the least disturbing any of the others. In wiring hotels, instead of running a network of wires to the desk, one wire will be run down and any guest called up without disturbing the others."

Consolidation of Bell Companies in the South.

It is reported in dispatches from Atlanta, Ga., that the Southern Bell Telephone and Telegraph company and the Cumberland Telephone and Telegraph company, operating exclusively in the southern states, are to be consolidated under a single management. The report adds that following this there will occur a consolidation "of all the Bell systems, including the consolidated companies of the Cumberland and Southern Bell, the Chesapeake and Potomac, the Chicago, New York and Boston, and all other systems under the direct management of the American Telephone and Telegraph company, with headquarters in New York." If this latter report be true, it is hardly likely that the consolidation will take place for some time yet, although the recent sale of stock by the Iowa Telephone company to stockholders of the Central Union Telephone company might indicate a tendency in that direction.

Extensions in Eastern Iowa.

The Bishop Telephone company of Central City, Iowa, of which J. H. Davis is manager, has finished the erection of a metallic circuit from Manchester to Dyersville, where it connects with the Standard company's line for Dubuque. The Bishop company has also completed a line from Manchester through Masonville to Winthrop, a distance of 14 miles, which gives through service to Waterloo and all the intervening towns along the Illinois Central railroad between Waterloo and Dubuque. The Central City exchange has been removed to larger quarters on Main street, and it is said that the Bishop company, with its day and night service, now gives as close attention to the wants of its patrons as any telephone company in Iowa.

Removal of the Erie Offices.

The Erie Telegraph and Telephone company will abandon its Lowell offices in the Glidden building on or about December 1st and will locate its entire clerical force in New York and Boston. In New York the company will occupy the eighteenth floor in the American Surety company building at 100 Broadway, and in Boston the fourth floor in the building at 15 Congress street. The departments transferred to New York will be those of President Glidden, Vice-president Pettengill, Secretary Perham, General Auditor Thorpe and Advertising Manager Greenslitt; to Boston, Vice-president Adams and Treasurer Grant. A private telegraph line will connect the New York and Boston offices. President Glidden says that he will divide his time between the New York and Boston offices.

The Independent Telephone company of Greeley, Colo., has secured 175 subscribers, and work, it is announced, will be commenced at once. An exchange will be opened at Evans, six miles distant, where 28 subscribers have been obtained.

Telephone News from the Northwest.

It is rumored in Minneapolis that there is a scheme on foot to form an Independent telephone company in Minneapolis and St. Paul, to interest local business men.

The Bell Telephone company has just completed stringing about 18,000 feet of new cable at Janesville, Wis.

The Pepin (Wis.) Telephone company will rebuild its line to Stockholm and Durand.

The Marshfield Telephone company of Marshfield, Wis., has increased its list from 123 to 153 subscribers in the last six months.

The Mississippi Valley Telephone company of Minneapolis has satisfied the judgments secured against it, and the deputy sheriffs who have been in charge of certain property of the company have withdrawn. The judgments aggregated over $17,000. Work will be now pushed extending the system through the suburbs.

The Standard Telephone company is installing an exchange for Sun Prairie, Wis.

The Kingston-Kimball Co-operative Telephone company is constructing a line between Kingston and Kimball, Minn.

A farmers' telephone line is being built from Rushford, Minn., to Choice, via Bratsberg. There will be 22 connections on the line.

The Dwelle Telephone company is constructing a new line between Plainview and Beaver, Minn.

It is probable that the objection of the Northwestern Telephone Exchange company in St. Paul to the city stringing police-alarm wires on its poles will be withdrawn. The company is using a number of poles erected by the fire department, and if the police department is barred from the company's poles, the city can retaliate.

The Iowa Telephone company has brought suit against the county treasurer at Des Moines, to prevent the sale of its property for delinquent taxes. The suit grows out of the city's claim to the right to tax all corporations, the same as individuals, under the constitution.

The Fort Dodge (Iowa) Telephone company has entered into an agreement with the Hawkeye Telephone company, whereby its toll service will be greatly extended and improved. A line is now being constructed to meet that of the Hawkeye company at Eagle Grove, which will give a number of new connections.

The council of Tacoma, Wash., has passed a new telephone ordinance which requires the company to furnish the city with 40 instruments free. The city is at present paying $81 a month for 28 instruments.

The voters of Mystic, Iowa, refused to grant a franchise to Charles A. Farrington, for a local exchange.

C. W. Lewis and D. C. Bradley have bought the interests of Messrs. Browne and Wettstein in the Centerville Telephone company of Centerville, Iowa.

The Ottumwa (Iowa) Telephone company has increased its capital stock from $40,000 to $75,000.

The Mutual Telephone company of Des Moines, Iowa, has made a showing of its receipts and expenses. The rentals paid for the quarter ended September 30th were $9,796, and the amount due was $559. The amount paid for the quarter ending December 31st is $10,944, and the amount due is $749. There are 1,520 telephones in service.

The Michigan Telephone company is arranging to place its wires underground at Houghton, Mich.

C. E. V. Draper is erecting poles for a local exchange at Mandan, N. D. The work will be hurried to completion.

The Wisconsin Telephone company has just completed an exchange at Mondovi, Wis., which starts with 60 connections.

The Missouri River Telephone company is preparing to install a local exchange for Geddes, S. D.

The Ada Telephone company has been incorporated at Ada, Minn., with a capital stock of $1,000.

The Salem Telephone company of Salem, S. D., has had its system in operation since May, but it recently declared a dividend of 10 per cent.

A telephone line is to be constructed between West Point and Bancroft, Neb., 20 miles.

An Independent company is just installing an exchange for Maquoketa, Iowa. The Iowa Telephone company has lately put on a night service there.

The Inland Telephone company will build a line from Hillyard, Wash., north 40 miles. R.

Ohio Notes.

The opening of the Akron People's Telephone company's plant at Akron was an important event in the history of telephone business in the northern part of the state. On the evening of November 23d the offices of this company in the Hamilton building were thrown open, and hundreds of people called to inspect the excellently arranged exchange. The guests were conducted through all the rooms, from the manager's office to the workshop and storage-battery room. The greatest interest was taken in the operating room and the working of the new switchboard. Adjoining the operating room is the room containing the distributing board and the terminal heads, and in still another the batteries are found. One room has been fitted up for a recreation apartment for the operators, and there are also lockers for their use. All the rooms were handsomely decorated with plants and flowers, and the guests were given a People's button and a folder describing the system.

The Newark Independent Telephone company has been connected with Columbus, after some delay. The United States company encountered trouble at Granville, which put the work back to some extent. Newark also has direct connection with the Mount Vernon exchange.

The ordinance granting a franchise to the Stark County Telephone company in Canton was to have been put upon its third reading last Monday evening, but for some reason council adjourned before this could be done. The motion to adjourn came from a member who has been favoring its passage, and some people take this to mean that there is trouble in store for the new company.

The directors of the Urbana Telephone company, at a meeting held a few days ago, voted to extend the lines in two different directions from Urbana in order to accommodate persons who live in the country. When these lines are completed, the company will have Champaign County pretty well wired, and the service will be second to no local company for a town of that size.

The United States Telephone company has completed a line from Coshocton to Zanesville and has entered the latter place over the right-of-way of the Zanesville Telegraph and Telephone company, the City Council having so far failed to grant a franchise. It has replaced the old poles of the local company with new ones, and both companies will use them. The line from Newark is within a few miles of Zanesville.

At a special meeting of the council of Alliance, Ohio, last week an ordinance was read for the first time granting the Columbiana County Telephone company a franchise to enter that town. It was passed and referred to the city solicitor. The company has constructed the lines to the city limits, and some time ago an ordinance was passed giving the company the right to operate in the town, but it was afterward found to be defective.

The Ashley Telephone company, Ashley, Ohio, is progressing well with the work of getting subscriptions. Forty have already been secured. The town is small, but a very good business will be done. The office will be in the Scheble block.

The Citizens' Telephone company of Columbus has filed a supplemental mortgage to the State Savings Bank and Trust company to secure an additional issue of bonds. The company is authorized to issue $700,000 in bonds, but as yet has issued only $450,000.

The Harrison Telephone company of Harrison, Hamilton County, has been incorporated, with a capital stock of $5,000. It is the intention of this company to build a system to connect the towns of Okeana, New London, Venice, Cleves, Elizabethtown, New Baltimore, Miamistown and Harrison. The incorporators are Alexis Burk, Robert P. Burk, John Wakefield, Joe C. Bevis and others.

The Mentor Telephone company, Mentor, Ohio, has filed notice with the secretary of state of an increase of capital stock from $5,000 to $10,000.

O. M. C.

In Colorado.

The City Council of Colorado Springs has granted to the members of the school board the right to erect poles in the streets and alleys and string wires in order to connect the school buildings with a telephone system. It was stated that negotiations with the Colorado Telephone company had been opened, but the board had found that the work could be done more cheaply if a contract were given to an Independent concern.

The Colorado Telephone company has opened a line between Pueblo and Sugar City.

The strike of the linemen of the Colorado Telephone company at Colorado Springs has been declared off. The Electrical Workers' union decided that the strike was begun without authority and refused to support the men. The strikers asked for an increase in wages from $2.85 to $3 a day and a decrease in hours of work from 11 to 10. D.

TELEPHONE MEN.

Alvin Moraweck, for a long time connected with the Ohio Valley and Cumberland Telephone companies in Louisville, has been appointed superintendent and general manager of the Cumberland Telephone company in Memphis, Tenn.

The executive committee of the American Telephone and Telegraph company, consisting of President Alexander Cochrane, Charles W. Amory and Henry S. Howe, is expected to visit St. Louis soon and inspect the telephone property in that city. En route to St. Louis, the committee will visit several large cities. It is stated that St. Louis is probably selected as one of the points of inspection from the fact that the largest Independent telephone company is in operation there.

Angus S. Hibbard, the capable general manager of the Chicago Telephone company, has a popular article entitled "How to Use a Telephone" in the Saturday Evening Post of Philadelphia of November 24th. The gist of Mr. Hibbard's advice is contained in the following concluding sentences: "If asked to reduce to epigrammatic form the best advice to the telephone patron, I would say, 'Be courteous.' A broad application of this rule would work wonders in the effective use of the telephone."

The Cumberland Telephone company has bought the telephone system at Nicholasville, Stanford and Lebanon, Ky., owned by J. A. Kelly and B. T. Conway, for $25,000, as well as the system at Danville.

GENERAL TELEPHONE NEWS.

Tests of practical value, it is said, have been made by the Erie Railroad company recently looking to a superseding of telegraph messages by telephone service in the operation of trains. Instruments have been attached to the regular telegraph wires at different points and important orders have been accurately transmitted verbally.

The first underground conduits laid in Memphis under the recent ordinance requiring all electrical wires to go underground have now been completed by the Cumberland Telephone company. Four miles of trenches have been opened, calling for 150,000 feet of cables. The final report on the work has been pronounced altogether satisfactory by City Engineer Bell.

A new telephone company is being organized, to furnish telephone service to Norfolk and Portsmouth, Va., at greatly reduced prices. It will be necessary to raise about $200,000, and great inducements are being offered to those whom the plant will serve to become subscribers to the stock. At present, it is given out that the prospective company will furnish telephones to subscribers at $12 to $15 a year.

Las Vegas, N. M., is said to have lower telephone rates than any other city of its size in the Southwest. A few weeks ago the local competing company received a flattering proposition from prospective Denver buyers, but before acting submitted it to the influential business men of the city. Ample stock was at once subscribed to put the company on a firm basis and insure all needed improvements and extensions.

President Doherty of the village of Bellwood, who, says the Chicago Times-Herald, a few weeks ago impressed a posse and arrested nine telephone linemen who were attempting to string wire through the village, declares that while he is president the village of Bellwood will be without telephones. He met three linemen in Melrose Park and made the declaration: "They are no good and we get along very well without them. After I am out of office telephone wires can be put up any place, but there will be none in Bellwood while I am in office."

At a mass meeting on November 21st of citizens of Logansport, Ind., resolutions were passed instructing the City Council not to act in the matter of granting a franchise to the Central Union Telephone company. A franchise was approved, however, making a rate of $24 a year for business houses and $18 for residences, with the provision that two per cent. of the gross receipts go to the city. The Central Union company's franchise soon expires. The price now is 75 cents a month for residences, in order to compete with the Mutual Telephone company.

The Dutchess County Telephone company of New York, with principal offices at Poughkeepsie, and having a capital stock of $125,000, was recently incorporated. The general route covered will take in the city of Poughkeepsie, the principal towns, villages and cities of Dutchess County, the New York state counties adjoining Dutchess County, and that portion of the state of Connecticut which adjoins Dutchess County. The directors are A. A. McGlashan, Myndert J. Van Kleeck of New York city, H. A. Tucker and Asa Lippincott of Brooklyn, George W. Sutton, John H. Scofield and Arthur E. Walradt of New Rochelle.

The Cumberland Telephone company of New Orleans, which some time ago bought up the competing company in that city and then almost doubled its rates, has won a signal victory over the Board of Trade and a number of individual citizens who brought suit before the State Railroad Commission against the concern. The commission has refused to issue an order reducing the telephone charges in New Orleans, and now the Cumberland company may raise or lower the rates at will. There is said to be great dissatisfaction over the decision, the business men contending that the city is now at the mercy of a grasping monopoly which will exist until the franchise runs out. The Cumberland company owns two franchises covering the entire city.

MANUFACTURERS AND DEALERS.

A handsome reminder that 1901 is near at hand, in the form of a calendar, is being distributed to the trade by G. B. Pratt, Gowanda, N. Y., eastern representative of the Eureka Electric company of Chicago. The picture on the calendar is a winter scene and shows two Cupids. Mr. Pratt will be pleased to mail a copy of the calendar to any person interested in telephone apparatus.

The Western Telephone Construction company, Chicago, has secured the contract to furnish the Binghamton, N. Y., telephone exchange with a 2,400-capacity, 1,200-equipped, complete central-battery equipment. The Western company has recently furnished the Chicago and Alton Railroad company with telephone equipment for its main line between Chicago and Bloomington, connecting the general offices of the company in Chicago and the Union Station with Bloomington and other points along the line. It has also furnished the Union Elevated Loop, Chicago, with telephone equipment, connecting the main offices in the Fisher building with all its stations upon the Loop.

The Plant of the St. Croix Power Company of Wisconsin.

[*Continued from page 348.*]

there was some question as to whether rubber or paper would prove the more durable insulator under these conditions.

While, of course, the ultimate success of 25,000-volt underground transmission can only be determined by the lapse of time, and the action of high voltage in its effect on the insulation, nevertheless, the success in operating seems to have demonstrated the wisdom of the experiment, and great credit must be given to the companies for their co-operation in undertaking what had never before been attempted and what many manufacturers prophesied would result in failure.

The calculated resistance of each conductor between the generating and distributing stations is 23 ohms. The drop in voltage between the same points, for 3,000 kilowatts, delivered with a 90 per cent. power factor and 25,000 volts' initial potential, figures 7.7 per cent., operating both lines in multiple, which will be the usual practice.

Sub station and Apparatus.

The distributing station in St. Paul is an iron and brick building, designed to contain the necessary apparatus for reducing the potential and controlling and transforming the energy received over the transmission line, for distribution in the city of St. Paul. The building is 50 feet by 70 feet, 2½ stories in height. One-half of the building has a basement divided into two rooms; one, in which all the static step-down transformers and high-tension switches are located, is connected by a tunnel with the street conduits; the other serves as a toilet room and place in which to locate the apparatus for heating the station. The main floor is divided into three rooms open to the roof. The larger room, 50 feet by 50 feet, contains six 250-kilowatt rotary converters and two marble switchboards, extending along two sides of the room. The second room on this floor serves as a hallway to the main room, and affords a place in which to locate telephone box, etc. The third room is open from the roof to the basement, but is entirely cut off and separated from all the rest of the building, except for a single door from the hallway. This room is intended for a storage battery, which it is planned to install later.

Each conductor of two high-tension cables passing through the tunnel into the transformer room ends in one terminal of a single-pole knife switch, to be operated only when current is off the line and installed to permit convenient testing of cables, etc. The other terminal of each switch is connected to a high-tension bus-bar, from which taps are taken off to the high-tension switches controlling the circuits to the different sets of transformers. The ends of the cables are also connected to static discharges, which are merely a number of standard lightning arresters, connected in series.

The high-tension bus-bars and their taps to the high-tension switches and from the switches to the transformers are single conductors, insulated with one-fourth inch of best Para compound, and guaranteed to withstand 25,000 volts continuously. The conductors are carried in conduits made of wood pulp, indurated with asphaltum, manufactured by the Fiber Conduit company. The conduits are guaranteed to withstand 20,000 volts without breaking down.

The high-tension oil switches are of the single-pole, three-break type, operating under oil and designed to break 25,000 volts and 50 amperes. The switches are closed by hand, but opened by the releasing of a latch controlled by a local circuit from the main switchboard upstairs. There are 24 high-tension switches in all—12 connected with each set of the cable bus-bars. As all high-tension work is three-phase, this necessitates the closing of three switches to connect any set of transformers with either set of bus-bars. (See diagram of connections, Fig. 3.)

There are four banks of static step-down transformers—two banks consisting of three 22,500 to 78-volt, oil-cooled, 300-kilowatt, three-phase to six-phase transformers, and two banks of two 22,500 to 2,100-2,700-volt, oil-cooled, 200-kilowatt, three-phase to two-phase transformers.

Each one of the 300-kilowatt transformers has a single winding on the primary, and two entirely distinct and separate windings on the secondary. By connecting three of these transformers in a set, the three-phase to six-phase transformation is effected. One set of these transformers supplies current to the rotary converters, operating between the positive and neutral wires, and the other set to those rotaries operating between the neutral and negative wires of the Edison three-wire system of distribution throughout the city. There is kept on hand a spare transformer in case of breakdown, but as all transformers in the sub-station are connected in delta, it is perfectly feasible to successfully operate, although there are but two transformers of a set connected in circuit. In fact, this was the method of operating for the first few weeks after starting the plant, and until the remainder of the transformers were received.

The two identical sets of three-phase to two-phase, 200-kilowatt transformers provide for the alternating-current distribution throughout the city. On the front of each transformer case is mounted a quick-break, multipoint switch, connected with leads brought out from the secondary windings of the transformers. The movement of the switch throws more or less turns of the secondary in circuit, and thus adjusts the potential in steps of 21 volts to any desired point between 2,100 and 2,700 volts.

The plan of operating from the generating station is to maintain, irrespective of load or line loss, the potential on the high-tension bus-bars in the sub-station, at 22,500 volts, as shown by the potential indicators previously described. This potential gives 78 volts for the rotary converters, which potential may be varied seven volts either up or down, by use of inductor regulators, of which there is one for each rotary. In a similar manner, the potential for alternating-current distribution is regulated by the setting of the multipoint switches at any point between 2,100 and 2,700 volts, depending on the load.

The use of six-phase transformers and converters is novel. The reason for the adoption of six phases instead of three phases was to secure the advantages of reduction of copper losses in the armature, and the accompanying reduction of temperature and its better distribution. At first sight, it might seem that the increased complexity involved in the use of six phases would not counterbalance the advantages to be gained. Practically, however, the use of six rings and the necessary additional taps to the windings on the armatures amounts to nothing in the operation of the machines. The dividing of the secondary windings on the transformers for two independent circuits results in no complication or expense. On account of the large current, the use of six conductors between the transformers and switchboard and between the switchboard and rotaries, was necessary, whether three-phase or six-phase machines were installed. The switchboard is practically the same for either number of phases, except that the number of main switches was increased from two to three. This disadvantage, however, may be disregarded when a decided increase in the capacity of the rotaries is secured. The rotaries are ordinarily started from the direct-current end, but are equipped with breakdown field switches and designed for starting from the alternating-current end, where necessary.

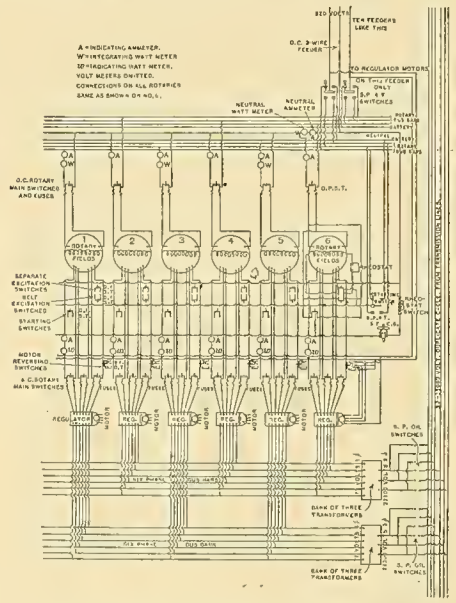


FIG. 3. ST. CROIX POWER PLANT.—WIRING DIAGRAM FOR SIX-PHASE APPARATUS AND ROTARY CONVERTERS.

The alternating-current switchboard is about 35 feet in length and eight feet in height.

On the extreme left is a relay panel, through which current is usually distributed by means of four-conductor cables, to one of the old steam-generating plants. This plant will be used as a relay station, and in case of a breakdown in the water-power transmission plant, current will be supplied from it to the sub-station. The second panel from the left is a transformer panel connecting either set of the static transformers, supplying current for alternating-current distribution to either of the two sets of four bus-bars. Each two-phase circuit is provided with two ammeters, two recording wattmeters, a four-pole oil switch and fuses. On this panel are also eight small double-pole switches, each of which controls the current to the magnets, releasing the latches of three of the 25,000-volt switches.

The panel next adjacent on the right controls the power-distributing, two-phase circuit. The five following panels each control two single-phase, alternating-current lighting circuits. Each of these panels is provided with an ammeter, automatic oil circuit-breaker and oil switch, in series with plug switches. There will be noticed a number of holes in these panels which are designed for the plug switches, permitting the plugging of any single-phase feeder on to any pair of the eight bus-bars. The double-pole plugs used are shown in the illustration lying in a pile at the foot of two of these panels.

Next come six alternating-current rotary panels, supplying current at 78 volts to the alternating-current end of the rotary converters. These panels are provided with three two-pole switches for the six-phase circuit, also indicating wattmeter and main ammeter, thus giving an indication of the power factor of the load. There is also the handle of the field rheostat, a direct-current starting switch, double-pole, double-throw field switch, synchronizing plug and lamp and a small direct-current, two-pole, double-throw switch controlling the motor actuating the six-phase inductor regulators. The inductor regulators are placed on the floor directly behind the alternating-current rotary panels.

The extreme right-hand panel contains a double-throw, direct-current switch, a starting-rheostat switch and an automatic circuit-breaker, through which is supplied and controlled the direct current from the Edison system used in separately exciting and starting the rotary converters. On this panel there are also three multipoint voltmeter switches, through the use of one of which the voltage of any of the Edison feeders or rotary-converter bus-bars at the other switchboard may be shown on the direct-current voltmeters hinged on the right of the board. The other two voltmeter switches in conjunction with the swinging alternating-current voltmeters shown on the left of the alternating-current rotary panels permit the reading of the potential of any of the alternating-current feeders or alternating-current ends of the rotary converters.

The direct-current, three-wire switchboard, about 18 feet long and eight feet high, is at right angles to the board just described. It consists of eight panels, three for the direct-current end of the rotaries and the remainder for the feeders of the Edison three-wire distributing system.

Each direct-current rotary panel controls the current from a pair of rotaries operating together on the three-wire system.

The Edison feeder panels are provided with single-pole, four-way switches of special design, which permit the throwing of any feeder on any one of four sets of bus-bars. Three of the bus-bars may be supplied at different potentials from each of the three pairs of rotaries. The fourth set of bus-bars is designed for use in connection with the storage battery, when same shall be installed. It will thus be seen that great flexibility in distributing potential is attainable, for, if necessary, the battery can be used independently of the rotaries, making a fourth and independent voltage available for feeder service.

The static transformers and rotary converters were furnished by the General Electric company. The General Incandescent Arc Light company furnished the high-tension switches and both switchboards, the latter being equipped with indicating instruments mainly manufactured by the Wagner Electric Manufacturing company.

Tests.

A report of the tests of the hydraulic and electrical apparatus might prove commonplace, but the following, relating to the overhead transmission line and underground cables, may be of interest because little data has been published with regard to the charging current of overhead lines, and nothing whatever, as far as the writer is aware, regarding high-tension cables.

The first tests made were simply to ascertain whether the cables could carry the voltage under which they were to operate. The paper cable was first tested, the voltage being gradually raised to 30,400 volts. This was on the afternoon of October 14th, which, I believe, marks the date of any attempt to carry such high potential underground. The rubber cable was successfully tested about two weeks later in the same way.

In making measurements and in the following data on the charging current of overhead lines and cables, no allowance is made for any leakage current, as exhaustive and careful tests made on high-tension lines at Telluride by Mr. R. D. Mershon prove that, with proper insulators, there is no precipitation and, with the voltages here used, any leakage current is inappreciable.

The charging current was measured by placing in the high-potential circuit, a Stanley hot-wire ammeter reading from zero to 13 amperes. The Stanley meter was compared with a Weston portable ammeter reading from zero to 15 amperes, which had just been calibrated at the Weston laboratory. The difference in readings between the two ammeters was small, but corrected readings are given in the accompanying curves. The voltage readings were taken by a newly calibrated Weston portable voltmeter, connected to the secondary of a small transformer, having a ratio of one to 200, and designed and built especially for voltmeter measurements by the Pittsburg Transformer company. The voltmeter used was compared during the tests with another portable Weston voltmeter, with which it agreed closely. It was also compared with a General Electric switchboard voltmeter, and the practical correctness of the instrument used was verified.

The alternations of the generators supplying current for the charging tests were kept constant by maintaining the speed constant, as shown by a tachometer. No measurements were made as to the wave forms of the generators.

In making all charging-current measurements, only two generators were used. For supplying the current at the generating station, where most of the tests were made, one of the 300-revolution, General Electric generators there installed, was employed, which, by reason of the source of its power, could easily be kept at a uniform speed. At St. Paul, a Westinghouse revolving-armature, 400-revolution, 375-kilowatt, 60-cycle machine was used.

Measurements on both overhead lines showed that

the charging current to either line was practically the same as that to the other. Furthermore, it was found that the charging current to one line was practically the same, whether both ends of the other line were left disconnected from everything, or whether its three conductors were tied together and connected to good ground.

From some few measurements, the charging current for the rubber cable was found to be a little more than double that of the paper cable. This result, from the standpoint of overcoming the reactance in the circuit, would make the use of a rubber cable the most desirable. The charging current for two wires of the three-phase circuit is appreciably less than when voltage is applied to all three conductors. It checks very closely with what would be expected as figured.

The following data on charging current, taken from the writer's note-book, may be convenient for reference, and it is therefore here included because it has never before been published.

CALCULATING CHARGING CURRENT.

Two parallel wires: Length one mile: 10,000 volts: Sine wave: Sixty cycles:

The current varies directly as the length of the line, the voltage and the cycles, so that the current for any given line and different voltage or cycles may be easily calculated:

Distance Between Centers of Wires.	Size of Wire—B. & S. Gauge.									
	6	5	4	3	2	1	0	2-0	3-0	4-0
	Amperes at 60 cycles.									
18"	.0313	.0317	.0324	.0332	.0339	.035	.0358	.0366	.0373	.0386
24"	.0295	.0302	.0308	.0315	0322	.0330	.0337	.0344	.0354	.0362
30"	.0285	0290	.0297	.0302	.0308	.0316	.0323	.0330	.0338	.0346
36"	.0276	0281	.0287	.0293	.0299	.0305	.0312	.0319	.0326	.0333
42"	.0269	.0274	.0280	.0285	.0291	.0296	.0303	.0310	.0316	.0324
60"	.0255	.0260	.0264	.0269	.0274	.0280	.0285	.0291	.0298	0303

It is a pleasure to state that we have never had any trouble with resonance, harmonics or any other of those "bogies" which have proved in some instances destructive to apparatus and are a cause of disquietude to the engineer of almost any long-distance transmission plant, until after the same has been put into successful operation.

This paper would be incomplete without acknowledging the credit due to the writer's associate, Professor R. C. Carpenter of Cornell University, for his assistance and co-operation in designing the mechanical and hydraulic plant. Much praise should also be given Mr. L. W. Rundlett, our resident inspector and engineer on the mechanical and hydraulic work, through whose experience, patience and faithfulness, the results of the excellent concrete work were attained. Mention must also be made of Mr. J. L. Harper, who acted as our resident inspector on the transmission line and electrical work, and who is now serving as the general superintendent of the operating station at Apple River Falls. Mr. William De la Barre of Minneapolis advised with us from his wide experience in hydraulic matters, and Mr. W. A. Gordon of our own office has materially assisted in calculations and tabulations. Messrs. H. J. Gille and Fred R. Cutcheon, superintendent and engineer, respectively, of the electrical department of the St. Paul Gas Light company, and Mr. H. L. Doherty, president of the Denver Gas and Electric company, had much to do with the design of the sub-station switchboards. It should be stated that Mr. Doherty was the first engineer to recognize and appreciate the possibilities for the power development in Wisconsin and it transmission into St. Paul, Minn.

Alden Electric Company.

The Alden Electric company, although but lately established, is already making itself felt as a dealer in general electric supplies. It has recently moved into new and commodious offices and stores at 52 and 54 West Van Buren street, Chicago, where it will be better able to take care of the rapidly growing business. The personnel of the company is well known to the electrical trade. President Fred H. Alden and Secretary and Treasurer J. Geiserowich are experienced and energetic business men, holding similar offices in the Illinois Insulated Wire company for the past four years. Carl J. Schlesinger, vice-president of the company, is also well known in electrical circles, and will prove a valuable addition to the concern. Starting in business in March, 1900, as Alden & Co., the new company was incorporated in September, while the new building was occupied a month later. A floor space of 15,000 square feet enables the company to carry a large and up-to-date stock of electrical goods in all lines. The illustrations show a portion of the storeroom and views of the offices and salesrooms. The offices of the Illinois Insulated Wire company are also at the new location.

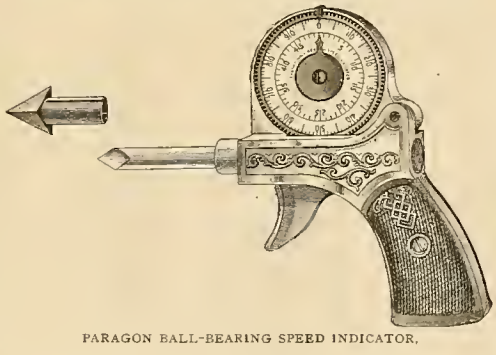
Salesroom. Offices. Storeroom.

ALDEN ELECTRIC COMPANY.

Paragon Ball-bearing Speed Indicator

The speed indicator manufactured by William T. Lintner of Gloversville, N. Y., and illustrated in the cut, possesses features that will be appreciated by all who use speed indicators.

The Paragon ball-bearing speed indicator has a pistol-form grasp by which the contact is made, and a trigger-form lever for the starting and registering dial. The spindle of this instrument may be placed in position and may be running all right, but no count will be made until the trigger is pulled. This indicator registers continuously from 0 to 5,000 revolutions per minute and then goes on and repeats, but if continuous counting is not required the register is easily and instantly turned to zero for a fresh start. It is provided with ball bearings to take up the end-thrust friction. The latter disappears as a defect and overcomes the liability of slipping at the contact point and making an incorrect record. It is also provided with worm gears to actuate the dial. No matter in which direction the shaft turns, the registering dial always turns and counts in one direction so that its recordings do not have to be read backward.



PARAGON BALL-BEARING SPEED INDICATOR.

All parts of this indicator are hardened and ground, finely nickeled and polished, making the instrument highly ornamental in appearance. The device has an extra contact point, as shown in the cut, for wide, deep centers. Special contacts, rubber faced, with pin centers, can be furnished. Mr. Lintner also has in stock contact points, with rubber-faced pin centers, for taking the speed of Wilcox & Gibbs and union special machines, also other hardened and ground shafts; concaved, rubber faced, for pointed centers; screwdriver points for slotted centers or screw heads; centers for taking the speed of Singer Manufacturing company's make of power machines; centers for taking the speed of Wheeler & Wilson Manufacturing company's make of power machines; centers for taking the speed of Standard Sewing Machine company's make of power machines, and centers for taking the speed of spinning jack spindles.

DOINGS OF SOCIETIES.

Institute Meeting in Chicago.

The one-hundred-and-forty-eighth meeting of the American Institute of Electrical Engineers was held on the evening of November 23d, at both Chicago and New York. The two papers of the evening were, "The Mechanical Forces in Dynamos Caused by Magnetic Attraction," by B. A. Behrend of Erie, Pa., and "The Plant of the St. Croix Power Company of Wisconsin," by Henry Floy of New York. At the Chicago meeting the former paper was read by title, while A. V. Abbott presented a resumé of Mr. Floy's paper, an informal discussion following. The members present then took up the question of reviving interest in the Chicago meetings, and after considerable discussion, a resolution was adopted authorizing R. H. Pierce, local honorary secretary, to appoint a committee which shall take up the work. As members of this committee, Mr. Pierce has appointed A. V. Abbott, Charles L. Brown, James Lyman, H. H. Wait and B. J. Arnold. The object of the committee will be to revive the interest of the western members, obtain new members, arrange for the holding of regular meetings and devise some means so that at every meeting there will be something of special interest to the local members. It is planned to arrange for papers by Chicago members also. Arrangements have already been made for a meeting place in the room of the Western Society of Engineers, 1741 Monadnock block, and it is hoped that meetings can be held at least once a month. Mr. Pierce also calls attention to the fact that western members not present at the meetings may participate in the discussion by sending their views in writing to him promptly.

A National Conference to Consider Strikes.

The principles of conciliation and arbitration of labor troubles, with special reference to strikes and lockouts, are to be considered and discussed at a meeting of the National Civic Federation, to be held in Chicago December 17th and 18th. The federation has invited all the best-known experts in the settlement of industrial disputes, including labor leaders, as well as employers of labor, and in the two-days' session it is expected that much valuable information and instruction can be gathered. Franklin MacVeagh will be chairman of the Chicago delegation. Among those who are expected to take part in the discussion are Carroll D. Wright, United States commissioner of labor; E. Dana Durand, secretary United States Industrial Commission; J. M. Gilbert, chairman New York State Board of Arbitration; Samuel Gompers, president American Federation of Labor; Walter Fieldhouse, secretary and treasurer Association Western Manufacturers, and Charles B. Going, managing editor Engineering Magazine.

American Society of Mechanical Engineers.

The forty-second meeting of the American Society of Mechanical Engineers will be held in New York city, December 4th to 7th. On Thursday, the 6th, the members will be the guests of Columbia University. The sessions for papers will be held in the large lecture room of Havemeyer Hall of the university buildings. Among the papers to be read are the following: "Steam Engineering of Maximum Simplicity and of Highest Thermal Efficiency," by Robert H. Thurston; "Power Plant of the Massachusetts General Hospital," by F. W. Dean; "The Construction of Contracts," by Reginald P. Bolton; "New Principle of Gas-engine Design," by Charles E. Sargent; "Heat Efficiency of the Gas Engine as Modified by Point of Ignition," by C. V. Kerr; "Power and Light for the Machine Shop and Foundry," by Forrest R. Jones.

Engine Builders' Association.

On Tuesday, December 4th, the association formed by the high-speed engine builders of the country will hold its annual meeting in New York city, at Sherry's, Fifth avenue and Forty-fourth street. The afternoon session promises to be unusually interesting, as papers will be read on "The Relation Between the Engine and the Generator," by representatives of the General Electric company and the Westinghouse company, from the viewpoints of lighting and power. Mr. Armstrong, who has given much attention to steam-engine tests, will read a paper on "The Economy of the High-speed Engine." At this session builders of high-speed engines, whether members of the association or not, will be welcome. A dinner, also at Sherry's, will be given the members at seven o'clock.

The Paris Exposition of 1900.

[*Continued from page 351.*]

teresting collection of products obtained by Moissan in his classical researches. Judging from two other large exhibits, copper is successfully deposited directly, in the form of mechanically strong tubes, simultaneously with the process of electrolytic refining. A single company in Germany refines electrically about 5,100 ounces of gold and 24,000 of silver a day.

A very large ozone apparatus was shown in operation, for sterilizing 200,000 cubic meters of water per 24 hours by the Marmier and Abraham process but a confirmation of the claims made is very desirable.

The interesting process of Goldschmidt, for obtaining very high temperatures of about 3,000 degrees C., by the combustion of aluminum mixed with metallic oxides, was well exhibited and deserves mention, although of only indirect interest to electricians. The expense of the aluminum naturally limits its application, but this seems to be more than balanced in some cases by the other advantages. It is already in commercial use for obtaining pure metallic chromium and manganese for the iron industry, and for welding rails and tubes or mending broken iron parts.

In accumulators there was shown a general tendency, though not a universal one, to use Planté positives and Faure negatives, a combination which seems to have given the least trouble. Accumulators are now the rule, and not the exception, in continental lighting and traction stations. Now that the fundamental patents have run out in this country, we ought to use them more freely here. As an electrical flywheel and a comforting reserve in a central station, the accumulator has no equal.

It is impossible, of course, from mere inspection, or from catalogue data, to judge of the success of the lightweight accumulator for transportable purposes, notably for the automobile. But from the awards of the jury, which were based on reliable knowledge of their performance, the Fulmen, the Pulvis and the Phœnix were among the best of their kind; all three are French.*

The most satisfactory development in primary batteries is that inventors—or perhaps the capitalists—seem to have at last been convinced that it is cheaper to burn coal than zinc.

A very interesting and promising method was shown in operation by its inventor, Rieder, for electrolytically engraving deep, hard-steel dies, such as are used for pressing the reliefs on coins and for embossed work in general. A porous negative of plaster-of-paris, saturated with chloride of ammonium, is lightly pressed against the steel blank, and the metal is dissolved off electrolytically by a current, wherever the negative touches it. The cost is said to be only half that of the usual hand method.

The exhibitions of instruments were very fine, chiefly from France, England and Germany, but it would take too long to enter into a discussion of them here. That a d'Arsonval galvanometer is made with a sensitiveness of 1.2×10^{-10} amperes per millimeter deflection, is of interest; it is claimed to be the highest sensitiveness yet reached with that type of instrument. Among the station and laboratory instruments which are not generally used in this country, but which are very convenient, are the phase meters of Dobrowolsky, indicating directly the difference in phase. A curious, but characteristically European, criticism of a certain world-renowned type of American instrument was that "they are bad because they are expensive."

The very general introduction of micanite, an American invention for generators and motors, is of interest.

The electric plant supplying the exhibition did not seem to be a success, judging from the very numerous stoppages and the excessive variations in the voltage.

The largest number of electrical exhibits were naturally from France. Among the foreign countries, Germany was far ahead of all others in importance, and promises to become the leading manufacturing country for electrical goods in Europe, if it is not so already. One company alone employs 14,000 hands, and ranks with our largest American company. It is of interest to us that this successful company uses American methods quite largely. The Reichsanstalt, that creditable German institution, has no doubt contributed to the rapid strides made by that country in the electrical industries, and shows what government aid can do for the industries of a country. England has already started its Electrical Standards Laboratory of the Board of Trade, a very interesting and creditable government department, which was shown to our Institute this summer during its first official visit abroad. France has its "Central Laboratory," and is considering the enlarging of its government department; Russia has a large government electrical laboratory. The United States alone, among the large countries, has practically nothing of the kind.

Switzerland follows Germany in importance. The United States and England were inadequately represented in this department for reasons already mentioned, although there were some excellent exhibits from each. The list in the catalogues cannot be taken as a guide in such a comparison, because a simple little device of no importance has the same prominence there as a large important exhibit of several thousand horsepower of machinery. Moreover, many American exhibitors who were entered in the catalogues did not exhibit. In one class alone, the number of actual exhibitors was only 40 per cent. of that in the catalogue of the United States exhibits, and many of these were quite small. It would therefore not be just to judge the state of this industry, in our country, by the exhibits or by the awards.

A characteristic difference between American and foreign practice in manufacturing, as, for instance, such goods as dynamos and motors is that here the manufacturer establishes certain well-studied and well-developed standard types and sizes of machines once for all, and then reproduces them in large numbers, making the parts interchangeable. The foreign manufacturer, on the other hand, constructs each machine according to the detailed specifications of the one ordering it. He argues that, if he should make bids with standard sizes in stock, the purchaser would accept the bid of someone else who would construct the machines exactly according to the specifications. As a matter of fact, however, it was noticeable that those companies which have adopted the American method were, as a rule, the most successful. There is also a field in and around Paris, at least, for American methods of managing and operating electric tramways, as existing practice is there very poor.

Another difference is that here the manufacturer, as a rule, devotes his whole effort to a single class of goods, and makes these in large quantities, while abroad he attempts to make a large range of widely different kinds of articles; this seems practical only when each branch is a large business in itself.

Still another difference is in the fine external finishing of even those parts of an apparatus which are concealed. Their argument is that all parts of a well-made apparatus ought to look well, and that it will then be handled with greater care and respect Here we would consider it a useless expenditure of money to polish all the concealed mechanism of arc lamps, for instance. The foreigner, however, is apt to judge our goods from his standpoint, at least until he can be convinced of their advantages.

The Jury of Awards had many delicate questions to settle, both technical and diplomatic. While mistakes are possible, it is more than likely that complaints of exhibitors can generally be traced to unworthy or inadequate exhibits, or to circumstances beyond the control of the jurors. One-half the jurors were French, and in the electrical group they were very liberal and generous to the foreign exhibitors, more so than to their own countrymen. If they erred at all, it was on the side of generosity, for which they deserve our thanks, instead of abuse. Only two of the United States jurors for the electrical group were members of the Institute.

The Electrical Congress was an international gathering of about 1,000 engineers and scientists interested in the subject of electricity, and, as a convention, it was a great success, giving an opportunity of making many acquaintances and friendships among men of the same calling in widely different parts of the world. The French deserve great credit for its organization and management. A large number of papers were read, varying in quality from very good to poor, reports of which have appeared and are appearing in the journals. The social features of the visits to the neighboring electrical installations were well arranged and very enjoyable. Our Institute was represented by all of its six delegates, three of whom were elected officers of the congress. All of the official United States delegates were members of the Institute.

As a gathering of official delegates appointed by the various governments to settle questions concerning units, this congress came very near accomplishing nothing at all. Had it not been for the efforts of two of the United States delegates, both members of our Institute, this very important feature of the congress might as well have been omitted. It was due to the convincing appeals of our member, Mr. C. O. Mailloux, that the chamber of delegates reversed its former decision to take no official action on units and names, and adopted, without a dissenting voice, the recommendations of its committee, in which our past president, Dr. Kennelly, ably represented our Institute. These adoptions were that the name of "gauss" be given to the C. G. S. unit of magnetic intensity or flux density, and "maxwell" to the C. G. S. unit of magnetic flux. The practical units will then generally be the kilogauss and the mega-maxwell. All the other propositions of the Institute were withdrawn in committee when it was found that they could not be adopted. The only other action taken by the official delegates was a unanimous expression of opinion that electrical energy should be considered as a property to be protected by law, like any other.

The reason no further official action was taken concerning names and units, as suggested by the Institute, is, in the opinion of the writer, that our propositions were new to many of the delegates, not having been discussed fully in their different countries before the meeting of the congress. At the International Congress of 1891, at Frankfort, when our Institute endeavored, through its delegates, to have the names gauss and henry adopted, the reason for the failure was the same, and in the report of our delegates' it was recommended that in future our propositions should first be thoroughly discussed in the societies and journals of the different countries, leaving to the congress only the final decision on well-understood propositions. Had this recommendation been followed in the present case, we might have accomplished still more. Any further recommendations of the Institute should be decided upon as soon as practicable, and be made the subject of international discussion in the journals and societies in preparation for the next International Congress, whenever that may be.

The first meeting which our Institute held abroad was a memorable event and bids fair to be the beginning of a series of international meetings of electrical engineers. It brought the Institute into considerable prominence abroad, increased its influence and afforded great pleasure to those of its members who attended. When it was first suggested, by a member of council some years ago, to hold a meeting this year in Paris, the proposition was met with some ridicule, but its success and the benefit the Institute derived from it show that the venture was not an unwise one, and that such meetings ought to be repeated. While we may have just pride in feeling that some branches of electrical engineering are better developed here than in other countries, and that our method of manufacturing certain classes of goods is superior, yet we should not forget that others who have worked equally hard in other countries often reach conclusions differing from ours, and which may well be worth our while to consider. Although our typically American practice of manufacturing standard types in large quantities and with interchangeable parts undoubtedly has great advantages, yet that is the very method which tends to retard development in those types, as it makes one hesitate, perhaps, too long sometimes, to make improvements. On the other hand, the typically European method of building almost every machine differently gives an excellent opportunity for developing them, but precludes wholesale manufacture at reduced cost. Such international meetings, therefore, can hardly fail to be of benefit to all who take part, as they enable one to find, through personal observation and personal intercourse, that which is the best the world over, just as our home meetings bring before us the best in our own country. If we want to manufacture the best there is, especially if we want the foreigner to buy it from us, we should have international intercourse.

In London, our sister society, the Institution of Electrical Engineers, entertained us with true English hospitality for three well-filled days with a most delightful programme, in which pleasure and instruction were harmoniously combined. It will long be remembered, by the 28 or 30 of our members who attended, as one of the most enjoyable features of the whole meeting. In Paris the official joint meeting with the British Institution, held in the National Pavilion of the United States, through the courtesy of Commissioner Peck, was well attended and was followed by receptions of both institutions, visits to objects of interest, and the Electrical Congress, making a total of two well-filled weeks of international intercourse between electrical engineers, and constituting one of the most important meetings in the history of the Institute.

The success of our first meeting abroad should encourage us to follow the excellent example of the Institution of Electrical Engineers by making official visits to the different foreign countries to study their practice and examine their work. Our foreign colleagues will then be encouraged to visit our country, as many of them have promised to do next year, on the occasion of the Pan-American Exhibition in Buffalo.

[*The end.*]

1. Trans. A. I. E. E., vol. viii., p. 546.

The Electrical Industries of Spain.

The Spanish government has just published an exhaustive report on the electrical industries of the country, which contains some interesting information about the present state of electrical matters in Spain. There are at present 443 electric-power stations in Spain, of which 12 are in the city of Madrid. Two of the latter supply power for street railways, nine furnish power for lighting purposes, while the twelfth plant, which is still under construction, and which will be the largest of all, will supply power for both purposes. Electric light is now to be found all over the city of Madrid, and its application is steadily increasing. Three companies, the Compania General Madrilena de Electricidad, the Compania Inglese de Luz Electrica and the Sociedad de Electricidad de Chambin, chiefly supply the electric light for the Spanish capital. The first two companies are in the hands of French, German and English capitalists. The Madrilena company has a capital of 10,000,000 pesetas (about $2,000,000), and in 1899 the dividend paid amounted to 23½ per cent. The third company, which is capitalized at 4,981,000 pesetas, is entirely Spanish.

There are now in Madrid a Tudor accumulator factory, two factories for the manufacture of electrical apparatus and appliances, such as insulating material, fixtures and instruments, etc., and a branch factory of a Paris company, which has a monthly output of 60,000 incandescent lamps. This company imports glass, wire and other material from France, and is now enlarging its shops. A few months ago a company was also formed, with headquarters in Madrid, for the purpose of manufacturing electro-mechanical articles and all kinds of electrical appliances. This company is capitalized at 500,000 pesetas. The report goes on to say that electricity is making steady progress throughout Spain, and that a large number of electric railways are now either under way of construction or contemplated.

All the large German electrical works, such as Siemens & Halske of Berlin, the Allgemeine com-

pany of Berlin and Schuckert & Co. of Nuremberg, have their branches and depots in Madrid. Most of the electrical machinery used so far in Spain has been imported from Germany and, to some extent, from Switzerland. Copper wire and cables are chiefly supplied by Felten & Guilleaume of Mülheim on the Rhine. The latter article is also imported to some extent from France, Great Britain and Italy. Two-thirds of all electrical appliances imported into Spain are of German origin, and one-third of French, British or Swiss origin. A large demand exists throughout the country for incandescent lamps, which are chiefly imported from Germany, France, Great Britain, the Netherlands, Sweden, Austria-Hungary and Italy. There is, however, little doubt that the large increase in the duty rate will largely reduce the imports. Formerly the duty was five centimos; it has now been raised to 25 centimos.

CORRESPONDENCE.

London Letter.

London, November 14.—The inaugural winter session of the Institution of Electrical Engineers was held on Thursday night in the hall of the Institution of Civil Engineers, Great George street. Professor John Perry occupied the chair, and special interest was given to the proceedings by the presence of Colonel Crompton of the Electrical Engineer Volunteers, who has just returned from South Africa. The gallant colonel, who was loudly cheered, exhibited a portable dynamo, inclosed in an iron case, about 14 inches deep, which had, he said, been used by General Théron, one of the Boer leaders during the war in South Africa, in the blowing up of bridges and other structures. He stated that he had, amid much difficulty, brought this trophy 8,000 miles, because he thought it would be interesting to every electrical engineer, especially when it was known to be the identical instrument with which Théron destroyed property valued at not less than $5,000,000. Mr. S. J. Swinburne, who was sitting near it, said the exploder was stamped with the name of Siemens [laughter]. Mr. Alexander Siemens assured the meeting that his firm had not produced it [loud laughter]. The dynamo, which had been pierced in the center on two sides, bore a brass plate on which appeared the name of Siemens & Halske. The president thanked Colonel Crompton for his interesting gift, and at the close of the meeting it was closely examined by many of those present. After the retiring president, Professor Silvanus Thompson, had been thanked for his services during his period of office, Professor Perry delivered the presidential address for the session.

While the Board of Trade's commission of experts is deliberating in the strictest privacy on the question of wireless telegraphy the mail boat Princess Clementine has demonstrated triumphantly its practicability. Further experiments have been made during the last week and messages have been dispatched from the steamer in midchannel to Ostend and to Dovercoat on this side. The English authorities, it may be observed, put difficulties in the way of the communication of the Belgian steamers with Dover. It is obvious that the English authorities are but mildly interested in one of the most remarkable and important discoveries of the century. Not the least important of its uses to a sea-going nation is the possibility of communication between ships and shore, yet Mr. Marconi has not been asked by the commission of experts to explain his invention. Since the first experiment the pole in connection with the signaling has been slightly raised (although it is now under 100 feet) and this has greatly facilitated the operation. The installation on the boat is fitted up in one of the private deck cabins on the starboard side, near the after smokestack. The receiving and sending wires are connected to the foremast. A spar at an angle of about 45 degrees is stayed across the top of the mast. From the highest end of this spar the collector is hung. The rate of communication is for electricity rather slow. Twenty words a minute are certainly more deliberate speech than would be congenial to anybody except a student of stenography, who is a novice in his practice. But what a boon to be able to speak at all from ship to shore, especially if the ship should be in distress. Mr. Marconi, having been able to bridge over 61 miles of space, is ambitious to do greater wonders, and talks about arranging a talk before long between England and the United States.

An important series of trials of electric automobiles was held from Tuesday to Friday of last week, in the neighborhood of Chislehurst, under the direction of the Automobile Club. The competitors were 12 in number, four being entered by the British and Foreign Electrical Vehicle company, namely, the Powerful, the Victor, the Columbia stanhope and a delivery car. Mr. E. W. Hart of Luton entered the Toujours Contente, the Presque Contente and the Tonneau; all the foregoing seven cars have the Leecoll batteries, originally designed in Chicago. There were also a Joel car with a Rosenthal battery, two Electric Motive Power company's cars, a Still Motor company's car with Ideal battery and an Electrical Undertakings car with a Leitner battery. The first day's trial was a test of distance, each car going as far as it could without recharging. The best performance was that of the Powerful, which covered 50 miles. On Wednesday the course was one of 30 miles over hilly ground, rising 680 feet in one place and 735 feet in another. The Powerful completed 28 miles, but withdrew owing to an accident caused by a shying horse. The next best was the Joel, which covered 26½ miles. On Thursday, the third day, the course was a fairly stiff one of 30 miles out and home, and the following-named cars completed the distance: The Powerful, the Still and the Electrical Undertakings car. The trials terminated on Friday with a run over a fairly level course, the object being again to show how far the vehicles could go on one charge. Unfortunately, owing to the heavy rain on Thursday night, the roads were deep in thick and greasy mud and this considerably retarded the progress of the machines. The Powerful completed 65 miles, the Still had to abandon the run at the end of 23 miles, owing to an accident to a ball-bearing. The Electric Motor Power company's car was also withdrawn at the end of 15 miles, the Joel car was withdrawn at the end of three miles, owing to punctures, and the Electrical Undertakings carriage completed 38½ miles.

W. H. B.

New York Notes.

New York, November 24.—The long-heralded trial trip of an experimental train of six cars equipped with electric motors took place last Thursday over the Second avenue elevated railroad between Forty-fourth and Ninety-second streets. The test train was operated for two hours and was declared to be a success. On one of the runs between Ninety-second and Forty-fourth streets the time, with a single stop, was only four minutes, or equivalent to a speed of 30 miles an hour. The motors were of the standard type and were made by the General Electric company. There were four motors at each end of the train of 150 horsepower each. This is four times as much power as the ordinary steam engine used on the elevated railroads can furnish. The current for the experimental train was supplied by the Metropolitan Traction company from its plant at Sixty-seventh street and Second avenue. The test was made under the supervision of W. E. Baker, general superintendent of the Manhattan Railway company. The electric trains start and stop more quickly than those run by steam. Under the present service local trains on the Sixth avenue road take 49 minutes between the Battery and One-hundred-and-fifty-fifth street, and under the electric system the trip is expected to be made in 40 minutes. The electric express trains between the same points will make the run in 25 minutes, which will be a saving of 10 minutes. The Second avenue elevated will be first electrically equipped, and the power will be furnished from a station located at Seventy-fourth street, East River. All the cars are heated and lighted by electricity. Preparations for electrically equipping the whole road have been pushed so far that it is said the rails can be laid at the rate of a mile a day, as soon as the word is given. The Second avenue line, which is to be equipped first, will require 84 motor cars. Four hundred motor cars will be used on the whole system. The engineers and firemen on the Second avenue line have received notification from the company that when electric motors replace the steam they will be discharged and re-employed as motormen, if they wish, at $2 a day. The men, of whom there are about 200, belong to the Brotherhoods of Locomotive Engineers and Locomotive Firemen, and their wages are now $3.50 and $3 a day, the regular union rate set by the two brotherhoods.

Nine merchants and restaurant keepers of Chinatown and Mott street were brought into court last Wednesday, charged with stealing several thousand dollars' worth of electric current from the Edison Electric Illuminating company. The Chinese have used electricity almost exclusively for lighting purposes, instead of gas at a cheaper figure. The police and lighting people say that by an ingenious and simple device, the meters are made to register only half of the electricity used. Even the meter at the Mott street mission falsely registered the amount of current consumed. By tampering with the meters it was charged that the Chinese customers saved from $10 to $40 a month each. Inspector Kenney, on an unexpected visit some days ago, made the discovery on which the accusation is based. It is said that the device for cheating the meter was made by an American electrician, who charged each Chinaman $10 a month for the use of the invention. The latter are vehement in their protestations of innocence, and claim that they have complained each month to the Edison company at the amount of their bills!

A strike of 15 engineers and 60 rock-drillers which began on the circle section of the Rapid Transit tunnel three days ago was settled Thursday, the demands of the strikers being granted. The engineers, who belong to the Standard Engineers' Union, struck to enforce the prevailing rate of wages of $3.50 a day and the rock-drillers struck in sympathy. The contractors for this section of the work are Naughton & Co.

President Fred H. Alden of the Alden Electric company and the Illinois Insulated Wire company of Chicago was in New York recently. Secretary and Treasurer Arthur Garrison of the Columbia Incandescent Lamp company of St. Louis, was at the Waldorf-Astoria recently for a few days.

M. L. G.

Canadian Intelligence.

Ottawa, Ont., November 24.—The Royal Electric company of Montreal is reported to be about to dispose of its manufacturing business to the Canadian General Electric company, whose headquarters are at Peterboro, Ont., for a consideration of $750,000. Such a deal has been talked of for some time, but the interested parties are reticent on the subject. The acquisition by the Canadian General Electric company of the large plant and good will of the extensive patronage of the Royal company's manufacturing business would practically give them a monopoly of the business in Canada. The Royal company would then be left with a clear hand to pursue to a successful conclusion some of the ambitious schemes which are credited to the directorate. One of the first of these is said to be the acquisition of the gas company of Montreal and the Lachine Rapids company, thus practically controlling the lighting business of Montreal. After that, it is proposed to amalgamate all the electric-railway lines on the island of Montreal under one great system.

On the night of the 16th of November about 60 feet of the dam adjoining the Chambly electric power house, at Chambly Canton, Que., was swept away. This portion of the dam contained 15 sluices, which were completely demolished. The power house proper, however, sustained no serious injury. The Royal Electric company of Montreal, which has been using the current supplied by the Chambly company for some time past, had, nevertheless, retained its steam power as an auxiliary, and it was owing to this fact that the city of Montreal has not been without light since the accident. The damage was caused by the concrete embedded around the 15 lock gates giving away, having become loosened by the tremendous pressure of water and the movement of the gates. Mr. Browne, the general manager, estimates the loss at $25,000. During the enforced idleness of the power house, steps will be taken to improve the system of transmission to the city, the change contemplated consisting of better wiring between Chambly and Montreal. The break in the dam extends for about 150 feet, out of a total length of 2,000 feet and the repairs are estimated to cost $10,000. A cofferdam will be built under the direction of a United States expert. A new permanent wall will be built in the spring, at a cost of about $28,000. At the time of the washout about 10,000 horsepower was being generated, and it will not affect former arrangements to generate 20,000 horsepower in the spring.

At Shawinigan Falls, 20 miles north of Three Rivers, Que., are the works of the Shawinigan Water and Power company, perhaps the largest electrical development in the world, outside of Niagara. These works will be completed early next spring. This great electrical development is attracting the attention of engineers all over the world. C. W. Johnson, who was the chief engineer of the works at Niagara Falls, has resigned, to become chief engineer of the Shawinigan works. He will hereafter reside in Montreal, believing that in Quebec province there are possibilities, in the way of hydraulic and electrical development, greater than anywhere else in America.

The Montreal Electric Street Railway company is about to lose one of its most efficient officers through the resignation of Duncan McDonald, superintendent, who has accepted the position of general traffic manager of the General Traction company of Paris, France. The General Traction company is said to be the largest organization of its kind in the world, and, besides having controlling interests in companies all over the French republic, has interests also in smaller concerns in Switzerland, Belgium, Egypt and other countries. In Paris, from 50 to 60 miles of electric-railway lines have already been built, and in some cases the trolley is in use on the outskirts.

W.

Gleanings from Colorado.

Denver, November 23.—A temporary injunction, on the application of the Postal Telegraph company, was recently granted in Colorado Springs, restraining the Colorado Springs Electric company from constructing a pole line in a certain alley. It is alleged that when the circuits of the defendant are in use danger will be incurred by the plaintiff's employes.

The Canon City Electric Light and Power company has applied for an injunction against the Colorado Electric Power company, asking the court to restrain the latter from operating in Canon City, in which the former supplies the local lighting. The Colorado Electric Power company now operates the power station at Canon City for supplying power and light in the Cripple Creek District. The current is carried 24 miles, over the hills. Last spring the company was granted a franchise for supplying light and power in Canon City, and the grant was indorsed at the election. The plaintiff alleges that the grant of the franchise was illegal.

The Western Construction company has been incorporated at Boulder, with a capital of $50,000, by Henry Frambach, John I. Crawford and Thomas Withers. The object of the company is to build reservoirs to store the waters of the St. Vrain River, and it is also authorized to build telephone and telegraph lines.

The deliberation with which the recent lynching of the negro at Limon, Colo., was conducted was illustrated by the work of the telegraph company. The plans of the mob were so well understood that the company was able to establish an office at a telegraph pole near the scene of the burning, and a number of operators were on hand to transact the business for the host of correspondents.

The ordinance introduced by Alderman Kelly pro-

viding that all wires in the business district of the city of Denver shall be put underground has been adopted by the City Council. It is provided that the city be divided into districts and that overhead wires disappear in each within a certain time limit. All wires are to be buried in five years. The ordinance was introduced five months ago, but it has since been in the hands of a committee and had not been discussed. The bill comes at rather an unfortunate time for the Lacombe Electric company, which has the franchise for municipal and commercial lighting and has just finished the work of setting poles from one end of the city to the other. The committee on streets, to which the measure was referred, reported unanimously in favor of the ordinance. In speaking of his bill when the vote was taken, Alderman Kelly said that it was introduced before construction was begun by the Lacombe company. He had hoped it would be passed at once, so that that corporation would have the benefit of the advance notice, but the ordinance had not been acted upon by the committee. The bill was drawn by the city attorney after an examination of the New York law, which, Mr. Kelly said, had stood the test in the courts. Mr. Kelly added that the city charter provided that the time limit for burying the wires should be five years. He thought the time should be less, and possibly the Legislature might amend the charter so that the limit would be two years or 18 months. It is not yet determined just what the upshot of the matter will be. It certainly is not expected that the excellent construction of the Lacombe company will have to come down. As a matter of fact, overhead construction has not caused much damage or inconvenience in this city. J. W. D.

Southern Developments.

Charlotte, N. C., November 23.—The Norfolk (Va.) street-railway sheds, cars and power plant were destroyed by fire. The loss is estimated at about $150,000. New cars will be provided as quickly as possible.

The City Council of Brunswick, Ga., has granted a franchise to M. Brown of Barnesville, S. C., F. D. McEowen of New York and T. W. Passailaigue of Charleston, S. C., to construct an electric street-car line.

E. F. Enslen and associates have applied for a charter to operate an electric railway in Birmingham, Ala.

A bill has been filed at Wilmington, N. C., in equity to foreclose a mortgage given by the Wilmington Street Railway company as security for $150,000 of the company's bonds. The company will have until the first Monday in December to make answer.

The Shelby (N. C.) Light and Power company has made application for a charter. The capital is $10,000. R. B. Miller will probably be president. The company will furnish electric lights for street and commercial illumination. L.

PERSONAL.

Herman Wilkiemeyer, vice-president and general manager of the Evansville (Ind.) Gas and Electric Light company, died on November 20th, in Cincinnati, at the age of 48. He was one of the best-posted men in gas matters in the country. Mr. Wilkiemeyer was a native of Newport, Ky.

Professor Henry S. Carhart of the department of electrical engineering and physics of the University of Michigan will read a paper at the annual meeting of the New York State Science Teachers' association at Rochester, N. Y., December 28th. Professor Carhart's subject will be "The Place of Physics in a Liberal Education."

Mr. J. M. Roach, president of the Union and Consolidated Traction companies of Chicago, is building a winter residence on Useppa Island, Charlotte harbor, on the west coast of Florida. The island covers only about 100 acres, but is described as one of great natural beauty. A large number of men are at present at work on the house and grounds. An acetylene-gas plant and a drainage system are being constructed.

W. E. Harrington of Camden, N. J., has recently tendered his resignation as general manager of the Camden and Suburban Railway company. Mr. Harrington has practically rebuilt the system of the Camden and Suburban company during the four years of his connection with the company. Previous to 1896 he filled positions of trust with many of the large electrical manufacturing and operating companies in the East.

ELECTRIC LIGHTING.

The Lexington (Ky.) Railway company will expend about $30,000 on improvements to its power house.

The Crossville (Tenn.) Electric Light and Power company has been incorporated, with $2,000 capital stock.

The American Light and Power Transportation company, with an authorized capital of $1,000,000, filed articles of incorporation at Newark, N. J., recently.

F. Crowe, trustee for the creditors of the Alton (Ill.) Electric and Service company, on November 18th sold at public auction the franchise and property of the company to J. H. Blessing of the firm of Gaylord, Blessing & Co. The plant will be refitted, extended and operated.

The Newburgh Light, Heat and Power company has been incorporated in New York, for $500,000, by J. L. Wilkie, W. B. Goodwin and M. Ely of New York city.

The Fox River Valley Electric Railway company will construct a temporary electric-light plant at Appleton, Wis., and in the spring, erect a permanent one.

The Dyersville (Iowa) Light and Power company of Dyersville, Iowa, has been incorporated, by W. F. Board, J. J. Dunn and J. Armstrong, with $15,000 capital stock.

Bids are being received for erecting an electric-light plant near Kutztown, Pa., to cost about $12,000, for the Keystone Electric Light, Heat and Power company.

C. H. Patterson, W. Lowe and G. Lander have filed articles of incorporation for the Glendive Electric Light and Power company of Glendive, Mont. The capital stock is $10,000.

Bids will be received, until January 3d, for a franchise for supplying electric light for illuminating purposes for Ripon, Wis. Bids may be for five, 10 and 15 years. F. W. Allen is the city clerk.

Bids will be received, until December 12th, for furnishing materials and labor for the construction of an electric-light plant in the village of Versailles, Ohio. L. C. Klipstine is the village secretary.

The City Council of Arcadia, Fla., at a recent session, gave a franchise to J. J. Head and associates, to put in an electric-light plant and telephone system. The electric-light plant will have a capacity of 600 lights.

City Electrician Ellicott of Chicago will ask for an increased appropriation for 1901. The cost to the city for 1900 for street lights will amount to $850,000. For 1901 Mr. Ellicott will ask that $970,000 be appropriated.

The stockholders of the reorganized Irwin Electric Light and Power company of Irwin, Pa., have decided to increase their bond issue from $50,000 to $120,000, the additional amount to be used for betterments and to enlarge the plant.

The electric-light plant at Deshler, Ohio, has been sold by M. S. House to F. Maurer of Bloomville, and the latter has taken possession. Mr. Maurer will overhaul the plant, add new boilers and machinery and put the plant in first-class order.

The Merchants' Electric Light, Heat and Power company of York City, Pa., has been organized by C. H. Bear, president, and T. B. Loucks, secretary. The new organization proposes to apply for a charter at once for the purpose of furnishing light, heat and power within the precincts of the city.

The Dunsbach Ferry Electric company of Halfmoon, N. Y., has been incorporated for $100,000, to furnish electricity for lighting, heat and power purposes, in Watervliet and Halfmoon. The directors are H. W. Miller, A. H. Dobson of Utica, F. W. Marsh, E. Burre and others of Bridgeport, Conn.

The Youngstown (Pa.) Electric Light and Gas company, the lighting companies of Sharon and Sharpsville, and the street-car property in Sharon and Sharpsville recently purchased by Messrs. Penhale, Whipple, Fisher and other capitalists, have been consolidated, and Randall Montgomery, manager of the Youngstown company, will be placed in charge of the lighting interests. All other properties acquired by these capitalists will be combined with a capital of $2,000,000.

Seventy-five poles, ranging in length from 35 to 50 feet, were stolen recently from the Pelham Bay Electric Light company. The company, which lights the highways of City Island and the upper section of the borough of The Bronx, New York, had distributed the poles through Pelham Manor, intending to set men to work putting them up the next day. But when the workmen arrived the poles were gone. The police assert that the thief sold the poles to another lighting company for $400, that he employed seven teams and gathered them up at night, delivering them the next day to the purchaser, and after getting his money, fled. The poles were valued at $700.

ELECTRIC RAILWAYS.

The Ionia (Mich.) Common Council has granted an electric street-railway franchise to the Howard company of Grand Rapids.

The directors of the Pennsylvania and Ohio Railway company, an electric line leading into Conneaut, Ohio, has decided to extend the tracks to Ashtabula.

The City Council of Beaumont, Texas, has granted to J. H. Kirby and others a franchise over the streets of Beaumont for an electric street-railway system.

The council of Flat Rock, Mich., has granted a franchise to the Toledo and Detroit Electric Railroad company, allowing it to build a line through the village.

The Saginaw (Mich.) Suburban Railway company recently closed a contract with the Maltby Lumber company of Bay City for 100,000 ties to be used in the construction of the road between Bay City and Flint. The work of grading the road is progressing rapidly and will be continued as long as the weather permits.

The Lancaster, Willow Street, Lampeter and Strasburg Railway company of Lancaster, Pa., has been incorporated, with $150,000 capital stock. The line will be 10 miles long.

The City Council of Marshall, Texas, has granted to A. R. Wheeler & Co. of St. Louis a 50-year franchise to build an electric street railway and operate the same over streets in that city.

The El Paso (Texas) and Juarez Traction company has completed all the arrangements to build its electric line in El Paso and suburbs. A. Mills and J. A. Happer are directors in the company.

The council of Salt Lake City, Utah, has granted permission to the Salt Lake City Railroad company to build a double-track street railway in that city, to be operated either by electricity or compressed air.

E. H. McKnight of Middletown, Ohio, who is promoting the trolley line between Troy and Dayton, says that the road will be built and in operation from Troy to Tippecanoe within the next 90 days.

The Miamisburg and Germantown (Ohio) Traction company has been granted a franchise for the construction of an electric road between the two places named. Messrs. Mays, Gwinner and others are behind the company.

The Milwaukee (Wis.) Electric Railway and Light company intends shortly to take advantage of a franchise which has been in existence for many years and to run cars out State street to the Miller brewery in Milwaukee.

The Linglestown and Blue Mountain Street Railway company of Harrisburg, Pa., has been incorporated, with $100,000 capital stock, to build an electric line from Progress to Linglestown, to connect with the Harrisburg Traction company's line.

The Alamo Heights street railway of San Antonio, Texas, was sold recently to Otto Koehler, president of the San Antonio Brewing association. Mr. Koehler announces that he will equip and remodel the entire line and service.

The City Council of Batavia, Ohio, has granted a 25-year franchise and right-of-way through the village to S. Woodward of Moscow for an electric railway, known as the Cincinnati, Dayton and Maysville electric road. It will run from Cincinnati through Madisonville, Remington, Loveland, etc., to Maysville.

The Woburn and Boston (Mass.) Street Railway company has been granted a charter to run from the railroad station in the center of Woburn, through Lexington and Arlington, to Arlington Heights, near Massachusetts avenue, 5½ miles. The capital is $75,000, and the directors are F. C. Nichols, E. F. Johnson and C. F. Remington.

The contract for driving the tubes for the Yerkes underground-railroad system of London has been let to Price & Reeves and the work of construction will be begun at once. The property rights are being secured as rapidly as possible. Shafts have been sunk along the line far into the clay, and it has been found that in no place will it be necessary to go lower than 75 feet, while the average depth will be 45 feet.

On the electric road of the South Orange and Maplewood Traction company arrangements are making to handle freight traffic. A motor car of 100 horsepower has been provided to pull the coal and freight cars, and sidings are being put in at several points. It will enable the Erie railroad to compete with the Lackawanna road in selling coal to the manufacturers of Orange Valley and other places between Orange and Maplewood, N. J.

At a recent meeting of the City Council of Detroit, Mayor Maybury sent in a communication in which he urged that body to draft a bill for the purchase of the street railways of the city, and asked the legislature to pass it. The mayor reviewed the street-railway question in the rough, stated that the time was drawing near when the city must dispose of this question once and for all, and declared himself in favor of municipal ownership and operation of street railways rather than private ownership, or municipal ownership of tracks with private operation. The council referred the matter to a committee.

The Easton (Pa.) Consolidated Electric company has accepted an offer of the Johnson syndicate, which owns the Lehigh Valley Traction company, with headquarters at Allentown, to lease the former's entire system of electric roads in Phillipsburg, N. J., and Easton, and the lines from Easton to Bethlehem and to Nazareth. In all there are about thirty miles of track. Mr. "Al." Johnson is president of the traction system, whose lines cover 115 miles and connect Bethlehem, Hellertown, Allentown, Kutztown, Catasauqua, Slatington and other points in the Lehigh Valley. This lease therefore gives the Johnson syndicate control of all electric roads in that section of Pennsylvania.

AUTOMOBILES.

At the recent automobile exhibition at the Grand Central Palace, an innovation in automobile sport was tried, in the form of a pursuit race. The com-

petitors were a steam and a gasoline runabout. The character of the machines made a flying start necessary for equity. After 10 laps the gasoline machine was declared winner. After the race an electric jaunting car, carrying four passengers and an operator, essayed a waltz. It turned and performed various fancy figures to the music of the band, and although it was not always in time, it was a pretty performance for an impromptu one.

The recent 1,000-mile motor trial at the Crystal Palace in London, England, came about through the discussion of the merits of the Decastille car, which was challenged by Moffat Ford, the managing director of an English automobile company. The French company undertook to run two carriages, one of five horsepower and the other of eight, 1,000 miles without stopping. The French drivers, muffled in thick furs, took turns every two hours. Hot bricks were tossed into the cars to keep the drivers warm, for it was bitterly cold under the glass roof of the palace. The larger machine was forced to stop after having made 312 miles, as the carburetter froze. The time was 13 hours, 36 minutes and nine seconds. The five-horsepower car completed the 1,000 miles, the time being 48 hours, four minutes and four seconds. It did not make a stop throughout the run.

PUBLICATIONS.

The Emerson Electric Manufacturing company of St. Louis has issued two bulletins on small alternating-current induction motors for single-phase currents. One bulletin (No. 3021) treats of medium and slow-speed motors, ranging in size from one-tenth to one-third actual horsepower, while the other (No. 3025) describes the advantages and characteristic features of higher-speed and less-expensive motors, ranging from one-tenth to one-sixth actual horsepower.

ELECTRICAL SECURITIES.

The first annual report of the Massachusetts Electric Companies, just issued, covers the affairs of the company up to September 30th, of this year. The report shows that the company controls fourteen New England electric railroad, power and electric companies, its holdings representing 114,374 shares. Gross earnings are given for the twelve months ended September 30th as $5,518,838, an increase over last year of $385,542; expenses were $3,650,367, an increase of $277,234. The consolidated balance sheet shows assets of $30,247,189, as against $28,751,595 in 1899. President Abbott states in the report that there has been expended on improvements and extensions during the last year $1,055,245, the larger part representing additions to the properties. Of this, $154,872 was charged to reconstruction expense account.

SOCIETIES AND SCHOOLS.

The eleventh annual meeting of the Engineering Association of the South was held at Nashville, Tenn., on November 8th. The following-named officers were elected for the ensuing year: President, Major Niles Meriwether, Memphis, Tenn.; first vice-president, W. H. Schuerman, Nashville, Tenn.; second vice-president, G. M. Ingram, Nashville, Tenn.; secretary and treasurer, H. M. Jones, Nashville, Tenn.; directors, James Geddes, E. C. Lewis and R. T. Creighton, Nashville, Tenn., G. F. Blackie, Mount Pleasant, Tenn., G. D. Fitzhugh, Birmingham, Ala., E. E. Betts, Chattanooga, Tenn., and C. S. Brown, Nashville, Tenn. The year closed with an active membership of over 100, 32 new members having been taken in during the last year. An amendment to the constitution, authorizing the establishment of local sections of the society in different cities throughout the South, was passed. Members in Birmingham, Ala., will be the first to avail themselves of the privilege.

POWER TRANSMISSION.

The work of establishing the pole line up the Little Boulder river, in Montana, for the transmission of electrical energy from Canyon Ferry on the Missouri River to Butte, is progressing quite rapidly.

The British Columbia Railway company of Victoria, Canada, is installing an electric-transmission plant, operated from Goldstream, a distance of 12½ miles. A 500-kilowatt generator is supplied by the Canadian General Electric company for lighting, shop and power purposes.

An electric company having Hanford, Cal., as its place of business is reported to have been organized with A. Guthrie of the Balfour & Guthrie company, president, and E. Kanutze, secretary. The object of the company is said to be to erect the greatest plant for the development of electric power west of the Rocky Mountains. It will be located on the San Joaquin River, 180 miles from San Francisco. The capital stock of the company is reported at $5,000,000.

A waterpower near Cornwall, Ont., on the Long Sault rapids is being developed for the generation of electrical energy. The power house will admit of a development of 4,000 horsepower, but only 1,000 horsepower will be developed at first. The electricity will be used to light the Cornwall canal and for power purposes in Cornwall. T. Pringle & Son of Montreal prepared the plans and M. P. Davis will construct the works. It is expected the plant will be completed by April 15, 1901.

Joseph L. Haines, an electrical engineer, who has been making a thorough inspection of the Chesapeake and Ohio Canal, is of the opinion that it could be converted into a source of electrical power for the use of the towns and manufacturing industries of Maryland. The canal is 184 miles long, having a fall of 600 feet, distributed among 74 locks, sufficient to generate 150,000 horsepower. A fair rental of a well-applied electrical system would be equal to millions of dollars in revenue to the state.

Apropos of the plan for power development near Altoona, Pa., recently noted in this journal, Mr. Harvey Linton, city engineer of Altoona, furnishes the Western Electrician the following additional data: "The actual working head will be 110 feet. The area of watershed is 82 square miles. These and the rainfall records are all we have from which to estimate the power. The stream-flow is remarkably large and constant in the dryest season, and it is tobe regretted that weir-measurements of the flow have not been obtained."

Industries throughout the south and east of Europe are receiving a new impetus through developments of electric power transmission. At Sinaja, the summer residence of the king of Roumania, a fine waterpower on the River Prahova has been developed, the energy from which will be transmitted 29 miles and distributed to a number of industries in the lower valley of the river. In the extensive petroleum fields in the neighborhood a considerable demand for current has arisen. A high-tension system of distribution will be used, the pressure on the main transmission circuits being 11,000 volts.

A few days ago the Snoqualmie Falls (Wash.) Power company transmitted power over a distance of 153 miles, a water rheostat being placed at the end of the circuit. It is reported now that the company has successfully operated a motor over the same circuit. All the transmission lines of the company were connected up in one continuous circuit, commencing at Snoqualmie Falls, running to Seattle, back to the falls, then to Tacoma and back again to the falls. The tests were conducted for experimental purposes only, and to show that electric transmission of power can be made commercially practical at much greater distances than has hercto-fore been contemplated.

The waterfall commission appointed in Sweden to investigate the waterpower of that country applicable to electric-power generation will report that there is in the province of Norsland a large supply. For instance, from measurements just made at the Edeförst waterfall, in the Lule, it is shown that here alone electric energy to the amount of 50,000 horsepower may be delivered annually. But in order to furnish an even supply all the year round the commission proposes to establish reservoirs on shore in various parts for storing the electric power, as in winter the volume of water is only a third of that in summer. Such storage reservoirs would also be established on other northern rivers.

MISCELLANEOUS.

The budget of the Electrical Bureau for the city of Philadelphia for 1901 has been submitted to the council's electrical committee, and the $1,162,645 asked for was not only approved, but the committee added two new items aggregating $75,000 additional, making a total of $1,237,645, as against $1,092,649.36 appropriated for the current year. The items of increase were largely for salaries, electric lights, and to install fire-alarm boxes in hospitals and institutions.

"Molten wood" is a new invention by Mr. De Gall, inspector of forests at Lemur, France, according to Consul Hanauer of Frankfort. By means of dry distillation and high pressure, the escape of developing gases is prevented, thereby reducing the wood to a molten condition. When cool the mass assumes the character of coal, yet without showing a trace of the organic structure of that mineral. This new body is hard, but can be shaped and polished at will; is impervious to water and acids, and is a non-conductor of electricity.

An ore-separating plant has been recently placed in operation in Germany, using the magnetic system, and is reported to have been very successful. The ore treated consists of galena, zinc blende, spathic iron (carbonate), black oxide of manganese and quartz. Before treatment the ore was passed through a 12-mesh screen. Three magnetic machines were employed in tandem. The tension of the current used was 65 volts, with from five to 16 amperes. The plant required the services of eight men, and handled 6,000 to 7,000 pounds of crude ore per hour. The cost per ton of material is figured at 30 cents, exclusive of crushing.

A complete system of lighting has been completed for the harbor of Aberdeen, Scotland, and the pontoon dock, which has proved so serviceable, is operated by electricity also. The repairing of vessels, for which the dock has been mainly used, can now go on by night. In the warehouses and other harbor properties electricity is now used for heating purposes, it is said. Regent bridge, which is being erected at a cost of about £50,000, is to be opened and closed by electric power. Probably the hydraulic machinery for operating another important bridge in the harbor will be driven by an electric motor. In the case of a breakdown in the hydraulic power the bridge will be provided with electric capstans at each side of the entrance. Electric signals will also be employed for regulating the traffic over the bridge.

The Paraguay Development company, incorporated with $500,000 capital under the laws of the state of New Jersey, and having headquarters in Philadelphia, has been granted by the Paraguayan government a concession to light the city of Asuncion and to run an electric railway. The concession is for 25 years, and the light and traction service must be open to the public by August 30, 1902. The representative of the company in Paraguay is Carlos R. Santos, late delegate to the Philadelphia Museum exposition. The United States consul at Asuncion says that industries are unknown in that country, and that the government would welcome and protect the development of almost anything in that line.

The management of the Chicago, Burlington and Quincy Railroad company has contracted with the Baldwin Locomotive Works for 30 new freight engines, to be delivered next March. They will be alike in construction, each having three pairs of drivers and a set of leading and trailing trucks. The driving wheels will measure 64 inches in diameter and the truck wheels 37 inches in diameter. The dimensions of the cylinders will be 24 by 24 inches. The engines will differ from the average freight-train puller in having wider and shorter fireboxes. The fireboxes will be seven feet long and six feet wide, and their heating surface, combined with that of the tubes, will be about 2,498 square feet. The weight of each engine on its drivers will be 120,000 pounds. The leading trucks will weigh 16,000 pounds and the trailing trucks 24,000 pounds. Unloaded, each tender will weigh about 38,000 pounds. It will have a capacity of 5,000 gallons of water and between nine and 10 tons of coal.

BUSINESS.

The Electric Appliance company, Chicago, wishes to state, in answer to numerous inquiries, that the Gutmann wattmeter is not made at present for direct current. The type the company is selling is for alternating current only.

The American Bridge company is furnishing from its East Berlin (Conn.) plant the steelwork for power station No. 3 for the Hartford Electric Light company at Hartford, Conn. The American company is also supplying, from its Lafayette plant, five bridges for Montgomery County, Ind.

The new style Paragon ball-bearing speed indicator, made by Wm. T. Lintner of Gloversville, N. Y., seems to have won the hearts of electrical users, not only in this country, but abroad. The Fort Wayne Electric Works has sent in a duplicate order for its testing room and the Siemens & Halske company has ordered six indicators to be expressed to Charlottenburg, Germany.

The Kentucky Electrical company, Owensboro, Ky., manufacturer of Kentucky incandescent lamps, motors and dynamos, has issued a new bulletin, containing special claims made for the Kentucky incandescent lamp, which may prove interesting to prospective lamp purchasers. The Kentucky company states that there is an unusually heavy demand for its lamp, and that it is doing a larger fall trade than it anticipated.

The Emerson Electric Manufacturing company of St. Louis, Mo., has recently issued its bulletin No. 3025, which describes a very reliable and low-priced alternating-current motor, in sizes from one-tenth to one-sixth actual horsepower. This type of motor is made with a one-half-inch shaft, and is suitable for severe and continuous operation; it is said to be a much more durable motor than the types usually placed on the market of similar capacity. A copy of the bulletin will be sent free to any address on request, and a sample of this new type of motor will be forwarded to any responsible electrical dealer or central station interested in placing this form of apparatus in operation.

The electrical trade in general, and particularly purchasers of carbon goods, will be interested to know that the Speer Carbon company of St. Marys, Pa., has greatly increased its capacity. Word has just been received from General Manager J. S. Speer to the effect that his company has now double its former capacity, and will manufacture electric-light carbon for open arc lamps and a number of other carbon specialties in addition to the fine carbon trade the Speer company has in self-lubricating generator and motor brushes. Remembering that it was only about a year ago that Mr. Speer organized the Speer Carbon company, the present condition of the company's business will be appreciated. The trade welcomed the Speer Carbon company, and business came so fast that hardly a month passed during the year in which some new machinery was not added to enable the factory to keep pace with orders. Mr. Speer recently made a very interesting exhibit at the street-railway convention at Kansas City, where the merits of his goods were highly appreciated.

The question of fencing rights-of-way of electric railways through rural districts has become nearly

as important as it has been for years with steam railroads. During the last year thousands of miles of railroad property have been fenced with the American steel woven-wire fences, and a number of traction companies have also adopted this form of fencing. The points that recommend the use of the fence are that it is proof against wind, fire, snowdrifts, and against the expansion and contraction of heat and cold. The American Steel and Wire company manufactures the fencing, and by reason of its fine facilities for making wire, is able to produce an article that is peculiarly suited for fencing. The company has a corps of trained fence builders, and will take contracts to build any amount of fencing, including furnishing the posts, all necessary appurtenances and all labor. The American Steel and Wire company solicits correspondence from all interested in fencing and will promptly furnish estimates for any quantity of fence of any height, either delivered in rolls of 40 rods, or fully erected and in place.

Business matters with Rossiter, MacGovern & Co. of New York are progressing finely. One of the representatives of that company, Manager J. W. Archie of the engineering department, recently stated that since the election the firm's mail orders had increased greatly. Rossiter, MacGovern & Co. do, without doubt, one of the largest second-hand machinery businesses in the United States, and this recent increase of orders seems simply in harmony with the indications of increased prosperity which one sees on every side in the electrical business, to say nothing of the concern's fair business policy. Frank MacGovern, of the company, has only recently returned from an extensive trip abroad in the interest of the firm. President Charles E. Dustin of the concern left a few days ago for Cuba. Mr. Dustin is accompanied by R. C. Peabody and W. S. Barstow, of the Edison Electric Illuminating company of Brooklyn. These gentlemen are respectively president, treasurer and secretary of the Standard Manganese company at El Cristo and Santiago, Cuba. It is expected that Mr. Dustin will be away from New York about a month.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 20, 1900.

661,971. Control of Electric Motors. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed March 26, 1900.

The method is one of controlling a plurality of electric motors arranged in groups by gradually changing the motors of each group from series to parallel relation through a series of steps, some of which are effected in one group of motors in advance of the corresponding changes in the other group, or groups, and while the latter are actively in circuit.

661,972. Controller for Electric Motors. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Original application filed March 26, 1900. Divided and this application filed June 5, 1900.

In this controller is combined, with a plurality of electric motors, a controller arranged to connect the motors in parallel groups, and having contacts and connections for changing the motors of each group from series to parallel relation, the contacts being differently arranged for the different groups, whereby certain circuit changes are effected successively in the different groups. Certain contacts in one group are of different length from the corresponding contacts of the other group, or groups.

661,975. Trolley. Henry S. Conghnour, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed December 12, 1899.

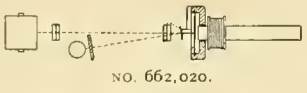
In a trolley, the combination is described of a harp, the bushing being seated in the arms of the harp, the wheel spindle journaled in the bushings, and the wheel removably secured to the spindle. The contact springs are exterior to the harp arms and have removable and renewable contact devices which bear on the end portions of the spindle. The arms have inwardly facing cup-shaped portions surrounding the contact devices and bearing against the outer faces of the harp arms.

661,986. Supporting Block or Bracket for Electric Fixtures. John W. Heizer, Chicago, Ill. Application filed December 30, 1899.

In the bracket involved in this invention for electrical fixtures a base member is shown having provision for attaching it to a support, and a fixture-carrying member, a projecting part on one of which is slidably engaging in a socket on the other member, to hold detachably the members together. The projecting part has formed therein a passage for the wires.

661,988. Telephone Receiver. Harry H. Hipwell, Allegheny, Pa., assignor to the Hipwell Manufacturing company, Allegheny, Pa. Application filed February 10, 1900.

This receiver embraces a shell having a shoulder therein, a permanent magnet, a diaphragm and a sleeve or collar fitting around the magnet adapted to engage with the shoulder for adjusting the magnet to and from the diaphragm.



NO. 662,020.

662,009. Trolley. Frank A. Merrick, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed January 18, 1900.

The trolley described has the combination with a trolley wheel and shaft, or spindle, upon which it rotates, a spring-pressed contact device secured to the wheel and engaging the shaft or spindle through the hub of the wheel.

662,020. Means for Rapidly Transmitting Telegrams. Anton Pollak and Josef Virag, Budapest, Austria-Hungary, assignors of one-half to Vereinigte Elektricitäts Actien-Gesellschaft, Budapest, Austria-Hungary, and Friedrich Silberstein, Vienna, Austria-Hungary. Application filed May 9, 1899.

As means for rapid telegraphy, the inventors claim a transmitter and a vibratory receiver, the transmitter adapted to send impulses which shall affect the receiver for a duration so nearly corresponding to its period of oscillation as to suppress substantially the supplementary oscillations thereof. Moreover, the transmitter and receiver are so synchronized that the duration of each impulse affecting the receiver corresponds to one complete oscillation thereof. (See cut.)

662,021. Method of Rapidly Transmitting Telegrams. Anton Pollak and Josef Virag, Budapest, Austria-Hungary, assignors of one-half to Vereinigte Elektricitäts Actien-Gesellschaft, Budapest, Austria-Hungary, and Friedrich Silberstein, Vienna, Austria-Hungary. Application filed December 21, 1899.

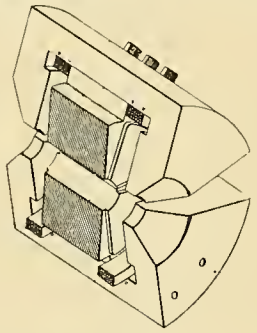
This invention relates to the method of rapidly transmitting telegrams which consists in producing a series of current impulses at the transmitting station, conducting the impulses to the receiving station, and thereby causing the impulses to vibrate a reflector reflecting a ray of light. Each impulse is cut off when the reflector in its oscillation has approached nearest to its position of rest.

662,038. Controller. Emmett W. Stull, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed December 28, 1899.

With a motor-controller drum and its blow-out coil is a movable locking device arranged in the field of the coil, with a spring acting upon the device in opposition to the coil. Means are shown for adjusting the tension of the spring.

662,039. Control of Electric Motors. Emmett W. Stull, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed June 8, 1900.

The method of controlling a plurality of electric motors consists in starting them connected all in series with each other, then connecting them in parallel groups whose individual motors are connected in series, and then connecting all of the motors in parallel. Certain of the motor elements are connected in parallel in passing from the position of full series to the position of parallel groups, and also in passing from the position of parallel groups to full parallel position.



NO. 662,042.

662,042. Dynamo-electric Machine. Francis W. Throop, Niagara Falls, N. Y. Application filed January 29, 1900. Renewed October 15, 1900.

A dynamo-electric machine is described having a shaft, a substantially radial inductor carried by the shaft, a circuit in constant direct connection with the outer and inner ends of the inductor, and magnetic poles of opposite sign disposed at the opposite sides of the plane of revolution of the inductor. A reinforcing mass of iron is carried with, but insulated from, the inductor. Several pairs of magnetic poles straddle the plane of revolution of the inductor, the several pairs of poles being disposed in circumferential series, the poles upon one side of the plane having one sign and that upon the other side having the opposite sign. (See cut.)

662,048. Electric Arc Lamp. James J. Wood, Fort Wayne, Ind., assignor to the General Electric company of New York. Application filed July 28, 1898.

A clutch feed mechanism for an arc lamp is shown, comprising an armature lever and a clutch lever, the armature lever connected to the clutch lever on one side of its fulcrum, and having a tail projection to the opposite side of its fulcrum, and adapted to serve as a movable abutment for the free end of the clutch lever. The regulating magnet or solenoid has its movable member connected to the clutch lever, and a spring is arranged to bear downwardly upon the clutch lever to overcome the momentum thereof and prevent the consequent release of the clutch after striking the arc.

662,049. Automatic Circuit-breaking Apparatus. Granville T. Woods, Monsey, N. Y. Application filed August 24, 1898.

In an electric-railway system of the character described are combined, with the sectional conductors or contacts, electromagnetic switches for controlling the flow of current thereto, an automatic circuit-breaker carried by the car and connected in the motor circuit, and a normally open test circuit. An automatic device is carried by the car. Means are provided whereby the device will be caused to interfere with the work of the car motor when a preceding switch fails to break the appropriate circuit.

662,156. Process of Gaging High Vacuums. John Waring, Hartford, Conn. Application filed June 4, 1900.

The method of gauging or measuring the tension of a confined body of gas consists in measuring the resistance of a conductor while heated in the gas. A conductor in the chamber is electrically heated, and the electrical resistance of the conductor measured while heated. The method may be applied to standardizing the vacua of incandescent lamps by gauging the resistance of the filaments while heated during the exhaustion of the lamp bulb.

662,312. Pole for Telegraphs, etc. Edward W. Serrell, New York, N. Y., assignor, by mesne assignments, to the Electric Tripartite Steel Pole company of New Jersey. Application filed December 21, 1899.

In a metal pole composed of not less than three similar equid stout metal bars with the upper ends of the metal bars offset, is a cap-block having equidistant offset openings to receive the upper ends of the bars, and to which cap-block the bars are riveted at their ends. A cover is placed over the ends of the bars and the cap-block, and a pedestal having vertical openings is shown receiving the lower spread ends of the bars. Means are provided for connecting the bars securely to the pedestal.

662,315. Sparking Igniter for Explosive Engines. Alfred J. Signor, Elkhart, Ind. Application filed February 1, 1899.

An igniter for explosive engines is described having an endwise movable and rotatable electrode, having at its inner end an outwardly extending eccentric contact point. A movable electrode has a pivotal connection extending at an angle across the axis of the rotatable electrod thereby movable in a direction from and toward the eccentric contact point. This movable electrode extends across the contact point of the rotatable electrode, so that when the rotatable electrode is moved against the movable electrode and rotated, the engaging surfaces of the electrodes are scraped and kept clean.

662,316. Magneto-electric Machine. Frederick R. Simms, London, England, and Robert Bosch, Stuttgart, Germany. Application filed July 5, 1900.

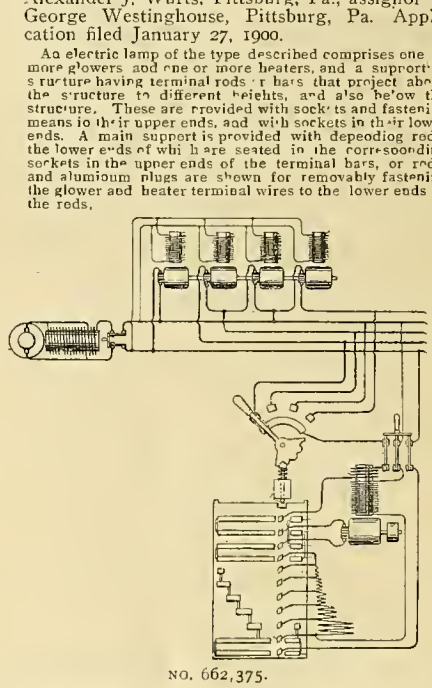
The invention relates to a magneto-electric machine having in combination with the field magnets a stationary armature and a continuously rotating segmental envelope interposed between the stationary armature and the magnets. Parallel plates are shown and a stationary armature secured to one of the plates, and a continously rotating armature supported by the opposite plate, and interposed between the armature and the magnets.

662,317. Electric Ignition Plug for Internal-combustion Engines. Frederick R. Simms, London, England. Application filed August 30, 1900.

An electric-ignition device shows in combination with an electrode, provided with a conical seat, a second electrode having a conical portion adapted to make electrical contact with the conical seat. A spring is placed normally holding the electrodes in electrical contact.

662,369. Terminal Connection for Electric Lamps. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed January 27, 1900.

An electric lamp of the type described comprises one or more glowers and one or more heaters, and a supporting structure having terminal rods or bars that project above the structure to different heights, and also below the structure. These are provided with sockets and fastening means in their upper ends, and with sockets in their lower ends. A main support is provided with depending rods, the lower ends of which are seated in the corresponding sockets in the upper ends of the terminal bars, or rods, and aluminum plugs are shown for removably fastening the glower and heater terminal wires to the lower ends of the rods.



NO. 662,375.

662,375. Multiple-voltage Controller. Gano S. Dunn, East Orange, N. J., assignor to the Crocker-Wheeler company of New Jersey. Application filed March 21, 1900.

In the controller described are shown with three or more conductors, having interconnecting means for maintaining them at different voltages, a motor, a multiple-voltage switch, and a controller between the motor and the conductors. A locking mechanism for the multiple-voltage switch is provided, which is operated by the controller, and is released only when the controller is in open position. (See cut.)

DESIGNS.

33,593. Case for Slot Telephones. William A. Foss, Cleveland, Ohio, assignor to the American Toll Telephone company, Cleveland, Ohio. Application filed June 22, 1900. Term of patent, seven years.

33,594. Telephone-pole Box. William D. Gharky, Philadelphia, Pa. Application filed September 7, 1900. Term of patent, 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, DECEMBER 8, 1900. No. 23

Boiler Explosion at Chicago and Northwestern Depot.

The explosion of a boiler in the lighting and heating plant of the Chicago and Northwestern Railroad company at Kinzie and Kingsbury streets, Chicago, on the afternoon of December 3d, caused the death of six persons, the injury of several others and the destruction of about $45,000 worth of property. This power plant supplied the electric light for the yards and depot and office buildings, steam for heating the buildings and compressed air for operating the pneumatic, interlocking-switch system for the tracks. At the time of the accident, 5:02 p. m., the station was carrying its heaviest load of the day, on account of the evening lighting service having been just thrown on.

The boiler that exploded was one of four 150-horsepower, horizontal, fire-tubular boilers that were installed in the power house about seven years ago by the L. H. Prentice company of Chicago. It was 60 inches in diameter and 16 feet long. The power house was a two-story brick structure, the second floor being used as a storehouse and workroom for the electricians. A brick wall running north and south divided the first story into the boiler room on the west and the engine and dynamo room on the east. When the boiler exploded it blew out the north wall of the building, while the boiler itself crashed through the south wall, close to the roof, killing three section men who were at work near the station, and also through the parlor car of a moving train that had just pulled out of the depot, bound for Milwaukee and the Northwest. Five passengers, among them two bridal couples, were injured, two or three seriously. One young man was walking along the sidewalk on the north side of the building and was crushed to death by the falling walls. A fireman at the plant and Hugh McGregor, foreman of the signal service for the Northwestern company, were the other two men who were killed. All the men who met death were employes of the Chicago and Northwestern company. Among those seriously injured was John Butterworth, assistant engineer of the plant. There were 15 others, including the passengers on the train, who were injured by the concussion or falling debris. A well-known electrical engineer of Chicago, with a party of friends, was on the parlor car through which the boiler was hurled.

The accident, occurring as it did just at evening, delayed the suburban trains and affected about 10,000 suburban residents who were on their way home. All the lights about the depot were instantly extinguished, and it was necessary to resort to the use of candles and oil lamps. The cutting off of the compressed-air supply made it necessary to operate all the switches in the yards by hand for several hours until a temporary compressor could be put in operation.

The electrical equipment of the station consisted of belt-driven units. There were three upright Westinghouse engines and a horizontal Ide engine. Belted to these engines were six Edison, bipolar, 110-volt dynamos, a General Electric 220-volt generator and two Thomson-Houston arc machines. The incandescent-lighting service for the offices and depot and one or two motors were operated on an Edison, three-wire, 220-volt system, while 50 arc lamps on a series circuit furnished illumination for the yards. Power was also supplied for the operation of the railroad bridge crossing the North Branch of the Chicago River just south of Kinzie street. This station was used to charge storage batteries on the railroad cars that were electrically lighted, flexible connections being made through a window to the cars on the track south of the station. Other equipment installed in the engine room included an air compressor and a white-marble switchboard installed by the Chicago Edison company about three years ago. This switchboard, remarkable as it may seem, was not injured, excepting a very slight damage to one of the ammeters. The steam gauge on it registered 100 pounds on the morning after the accident. One of the Westinghouse engines and the Ide engine were ruined, as the partition wall fell on them.

Of the accompanying illustrations, reproduced from photographs taken at 11 o'clock on the morning after the disaster, Fig. 1 gives a view of the south side of the power station, showing the path of the exploded boiler, a piece of which lies in the foreground. Fig. 2 is a view of the ruins of the station from the north side. This picture shows clearly the boiler room on the right and the engine room on the left, while a part of the unroofed second story is also seen. The engine covered with debris in the foreground of the engine room is one of the Westinghouse engines referred to above. At the time the pictures were taken workmen were busily engaged in clearing out the debris and enclosing the engine room, so that it could be put into shape for temporary operation.

As to the cause of the boiler explosion, no satisfactory reason has been assigned. W. A. Gardner, general manager of the Northwestern road, is quoted as follows, after being interviewed on Monday evening, shortly after the accident: "It was one of those unfortunate accidents which are hard to account for. At this time we are unable to theorize on the cause. We will not know what produced the explosion until after an expert examination, which will be begun to-morrow. Each of the boilers was tested to a pressure of 150 pounds, but we never used them above 90 pounds. They were inspected regularly every week by the company's men, and every month by the insurance companies. The last inspection was made on November 1st, and at that time they were found to be in perfect condition. John Butterworth, the assistant engineer, is a careful man, and had a hobby for keeping the boilers full. We are positive the explosion did not arise from lack of water. Butterworth stated to-night that he inspected the gauges three minutes before the explosion, and they showed plenty of water at that time. All of the men employed in the power house were licensed, and had been with us many years. We do not think the accident was due to their negligence. The only possible cause I can think of at this time is that there might have been a weakened or rusted plate in one of the boilers, so located that it escaped the observation of the inspectors."

As soon as possible after the accident the Chicago Edison company was asked to supply power for the lighting and power circuits, and a force of men was set to work to connect the circuits to the Edison mains. The arc-lamp service was restored about midnight, and by seven o'clock the next morning, 14 hours after the explosion, the entire lighting and power service was in operation, including power for the bridge. Temporary heating facilities were supplied by a locomotive attached to the heating mains.

Fig. 1. South Side of Power House Showing Part of Boiler Shell.

Fig. 2. North Side of Power House.

BOILER EXPLOSION AT CHICAGO AND NORTHWESTERN DEPOT.

Growth of Electrical Properties at Ottawa.

The electrical development at Ottawa, Ont., although of comparatively recent date, has been most rapid. In 1887 the Chaudiere Electric Light and Power company was organized, and was practically the beginning of the large system which now supplies Ottawa and Hull with electricity for lighting and power. The first dynamo had a capacity of 250 incandescent lights. The dynamos to be installed in the new power house of the Ottawa Electric company, now under construction, have a capacity of 15,000 lights each. In 1895 an amalgamation of the Chaudiere, the Standard and the Ottawa companies was effected, under the name of the Ottawa Electric company, whose business has developed enormously, until to-day it has installed 700 arc lights and about 100,000 incandescent lights, being a larger number per capita, it is said, than any other city in the world. The history of the Ottawa Electric Street Railway company is very modern, but its growth has not been less remarkable than that of the lighting interests of the city. Only 10 years ago the gross annual receipts of the Horse Railway company of Ottawa were $27,000, and the number of passengers carried in a year were 65,000. The receipts of the Ottawa Electric Railway company this year will be over $300,000 and the number of passengers carried will exceed 8,000,000. This electric railway began its opera-

tion with about 10 miles of track, and to-day it has 42 miles.

Evans Rotary Engine.

In the annals of steam engineering the term rotary engine has been synonymous with failure. The incentive to produce an ideal steam motor without reciprocating parts, of small size and weight, yet allowing of internal expansion and a fair economy, along with a practicable speed, has interested inventors and capitalists from the first. But the invariable failures of such engines to meet actual

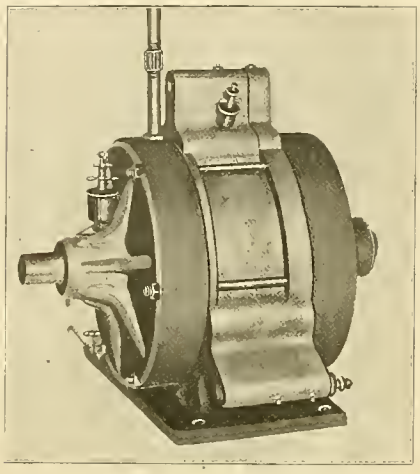


FIG. 1. EVANS ROTARY ENGINE.

working demands have produced skepticism among experts, and nothing but practical, commercial demonstration of its economy and durability will to-day interest them in the claims of a new rotary type. Mr. James M. Evans of Chicago has been engaged with this problem for a number of years, and has produced a rotary, adjustable-cut-off engine, showing in tests, extending now through several months, some remarkable results.

The latest type of this motor, shown in Fig. 1, is one designed to develop 100 horsepower on 100 pounds of steam pressure while revolving at 600 revolutions a minute. Last spring this engine was set up in the boiler room of the Hawley Down Draft Furnace company in Chicago. It was simply bolted to two stout planks and connected with a 12-inch rubber belt to a dynamo. A two-inch pipe furnished steam from the boilers and the exhaust was conducted into a coil condenser for purposes of testing steam consumption. Here the engine has been submitted to the varied tests which would be likely to substantiate or disprove the inventor's claim as to power, economy, etc. A. K. Adler, consulting mechanical engineer, C. G. Hellick, with the Chicago Telephone company, and others have examined this engine, and the reports have been almost uniformly favorable.

The 100-horsepower engine stands on a base 16 inches by 24 inches in size, the outside diameter of its chamber being 30 inches. From a dead standstill and belted to a 44-kilowatt Thomson-Houston, shunt-wound, arc dynamo, the engine was started with a steam pressure of nine pounds. At the end of 20 seconds it had built up the dynamo field to full voltage, running the generator at 1,125 revolutions a minute, and had fully lighted 30 arc lamps of 500 nominal candlepower each, the engine running 360 revolutions a minute with a registered steam pressure of 55 pounds. At full speed the engine was practically noiseless and free from vibration.

The engine, as used in this partial-load test, running with one-third cut-off, was without its governor, but the construction with cut-off and exhaust valves rotating on the main shaft, the former riding loosely thereon, allows of accurate and instant governing. This governor is self-contained and completely encased in the engine, as shown by the illustration. It depends for its action on both the centrifugal and inertia principles, and is thought to be so satisfactory that no flywheel or momentum other than that of moving parts of the engine is used. The torque diagram shown in Fig. 2 shows in a striking degree how slight are the variations in effort on the shaft at various points of its revolution.

The crank arm on the main shaft of the engine carries the rolling piston, friction being reduced to a minimum by the use of roller bearings, both on the main shaft and within this roller piston. Three radial slide gates divide the main chamber into three parts, and are pushed in or out of the chamber by means of slide pieces fitting into the annular groove on either end of the roller piston. Thus, all springs are rendered unnecessary. All parts are self-adjusting, and interchangeable. The engine has a fixed steam admission through a narrow vent at the side of each slide gate, automatic cut-off and small surface for condensation. The exhaust takes place through three similar vents on the other side of the main steam chamber. No fibrous packing is required, for there is no clearance between piston and cylinder heads.

Steam is always active in two of the three chambers, although only one chamber is open to the boiler pressure at any instant, save at the start, when two-thirds of the piston is thus acted upon. Carefully made diagrams of the resultant effort from the two active chambers of the engine show that the steam acts always (within two or three degrees) at right angles to the throw of the crank, and therefore a constant pull enables the engine to start a load from any position. A dead center is impossible. Actual test has shown that the pull on the belt is four times as strong when starting as when running at full speed, owing to the automatic adjustment of the cut-off. This engine, of 100 horsepower, will run 120 revolutions a minute, with 1½ pounds' steam pressure, or with what steam will pass through a one-fourth-inch pipe with five pounds' pressure. It will attain 400 revolutions a minute, with five pounds' pressure, and the steam line will not drop. This gives a piston speed of 567 feet a minute.

To an engineer no words concerning an engine speak so meaningly as its indicator card. The diagrams taken from this engine are of exceptional interest. In the one shown in Fig. 3, the fluctuations of the indicator spring are not suppressed, and a remarkable sharpness of the cut-off line is shown. The card reproduced is for a 100° cut-off. The abscissæ of the diagram here represent angular motion of the crank, and not absolute volumes. Hence the line of isothermal expansion is more abrupt in slope than the theoretical hyperbola, and from the method of continuously rotating the indicator drum, no return-stroke line is shown. But the back pressure at exhaust is very low.

From three diagrams, each of torque on the shaft due to one of the three steam chambers, the resultant torque diagram shown in Fig. 2 was obtained for a 100° cut-off. This cut-off corresponds very nearly to a one-third cut-off in a reciprocating engine, since from beginning of admission in one chamber to the final emptying of that chamber, the crank must rotate through 240 degrees.

The torque diagram shows the great advantage in constancy of effort held by a rotary engine of this type over any single-piston reciprocating engine. The three individual torque diagrams resemble the curves from a three-phase generator so strikingly that Mr. Evans has styled his machine a "multiphase engine."

The speed of the engine may vary, with the character and amount of its load, from 20 to 1,000 revolutions a minute. The weight of the 100-horsepower machine shown is 1,000 pounds. An economical engine of this type should find a large and immediate field. Its size and weight would allow it to be placed in many places where a larger engine would be impossible, and on almost any sort of foundation. Its cost of construction is said to be not more than 10 per cent. of that of ordinary engines; the cost of installation is very small, the expense of shipping comparatively light, and it is all ready for operation when it leaves the shop, as there is no assembling of parts after it reaches its destination.

The engine may be increased in power readily, by merely widening the piston and without increasing the stroke. Compounding is simple and will allow a balancing of parts, by placing the two pistons 180 degrees apart on the shaft.

A company known as the Evans Rotary Engine company is in process of organization, and will soon be equipped for business, with headquarters in Chicago. Its promoters are confident that the engine is well adapted for practical work.

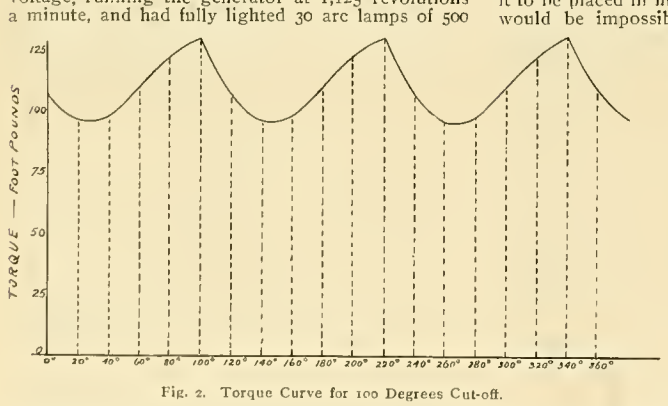


Fig. 2. Torque Curve for 100 Degrees Cut-off.

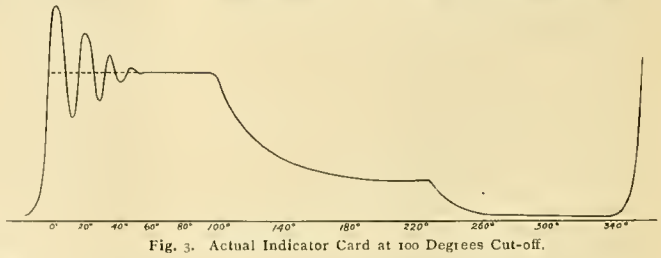


Fig. 3. Actual Indicator Card at 100 Degrees Cut-off.

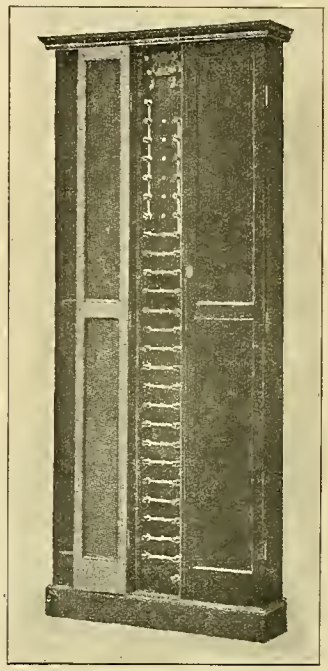
EVANS ROTARY ENGINE.

Missouri River Power Company.

The Missouri River Power company of Helena, Mont., has contracted for new machinery for the addition to its power plant at Canyon Ferry. The Westinghouse company has the contract to furnish six generators of 1,000 horsepower each, 12 transformers of 1,200 horsepower each, switchboards and a quantity of auxiliary apparatus. The generators will be connected direct to the six new waterwheels on the same shaft. The new plant will generate 6,000 horsepower and will have a total capacity of 10,000 horsepower. The company recently issued $750,000 bonds to build a pole line to Butte, for the transmission of power, and to enlarge the power plant. Local capitalists have been very anxious to secure the bonds, and it is believed that $300,000 of the issue will be placed within the state.

A 2,000-volt Storage Battery.

A storage battery with a potential of 2,000 volts is not common. Such a battery outfit is shown in the accompanying illustration. It was designed for the testing of electrical apparatus at high pressures—up to 2,000 volts in steps of 80 volts. The cells, which are of very small dimensions, are connected in sets of 40 elements and mounted on trays; these are arranged in cupboards, on either side of the



A 2,000-VOLT STORAGE BATTERY.

switchboard, as shown in the illustration, and can readily be removed for examination.

About 50 small two-way switches, says the London Electrical Review, from which this description is taken, are operated by insulating handles, and so arranged that any number of the groups can be arranged, either in series or in parallel, as desired. Suitable stops are provided, so that by no possible means can the switches be set so as to short-circuit any of the cells. A separate two-way switch at the top of the board connects the battery either to the test terminals, or through a glow lamp to the charging terminals; the battery is to be charged with all the groups in parallel, off a 100-volt circuit, and the interposition of the lamp provides at once the required resistance and an efficient safeguard against accident through throwing the battery in series on the charging circuit.

The equipment was made by Niblett, Sutherland & Marcuson of London, England, the cells used being a modified form of their patent accumulator. The special feature of the latter is its solidity of construction, the active material being held in place by thin ribbed plates of porous ware, which renders this type of cell particularly suitable for all purposes calling for portability and long life. There is practically no free liquid space, so that disintegration of the active material produced by the "wash" of the acid is eliminated, while the resistance of the cells is hardly affected.

Power Supply by Single-phase Motors.[1]

By T. P. Wilmshurst.

The principal objections which are usually urged to the distribution of electricity by alternating currents are: (1) That alternating-current is less economical than direct-current working. (2) That alternating arc lamps are inferior to direct-current lamps. (3) That single-phase motor working is impracticable. While the writer is prepared to admit that in some instances objections (1) and (2) are valid, and (3) also in a modified degree, he holds the conviction that they originate rather from unsuitable arrangements or want of appreciation of the varied requirements of electrical supply on the part of the designers, than from any inherent unsuitability of alternating currents. He is led to this conclusion from a study of the cost's analysis of various towns, from which it appears that the following results have been achieved in alternating-current stations. Full costs of 0.25d., 0.3d., and 0.32d., and works costs of 0.78d., 1.02d. and 1.16d., all on outputs of less than a million units per annum. As regards objection (2), the writer would only remark that those members of the association who visited Cheltenham during the last convention would hardly deny that the alternating-current arc lighting there left little to be desired. Coming to objection (3), the object of the paper is to show what is the present position of the single-phase motor in the struggle for existence.

In nearly every town, certainly in all manufacturing towns, there will in the future be an enormous demand for motors when the cost of supply is sufficiently low and the public appreciate the advantages of electric driving. Since the single-phase system has been adopted in nearly 100 towns in this country, the question arises, how is this demand to be met? (1) Shall we change over our whole system to direct current, as is proposed in one or two cases? (2) Shall we lay down direct-current plant and mains for the motor supply, leaving the alternating-current plant to supply current for lighting? (3) Shall we supply single-phase motors from our ordinary alternating-current plant and mains? (4) Shall we lay a special alternating-current motor network supplied from the alternating-current plant? (5) Shall we lay down multiphase plant for power supply? The writer has come to the conclusion that while cases do exist in which, by reason of abnormal frequency, excessive armature drop in the generators, or other causes, the good working of alternating-current motors is rendered difficult, in the majority of cases, under reasonably favorable conditions, the inferiority of the single-phase motor to the direct-current or three-phase motor is not sufficiently marked to justify the laying down of special plant. It is obvious that method (3) has the great merit of simplicity and low cost. It is a matter of common knowledge that, at the present time, while the proportion of motor to lighting load on direct-current circuits is small, it is still less on alternating-current circuits, and it is a matter of interest to study the causes of this. The two principal reasons appear to be the difficulty of successfully competing in cost with gas and steam engines, and the fear that the use of motors will injuriously affect the steadiness of the light. It is a self-evident truth that the more the day load can be increased the lower can the charges be made. An examination of the power charges in various towns reveals the curious fact that these charges vary from 8d. per unit down to 1d., and inasmuch as the cost of production can hardly vary within such wide limits, it would appear that the size of these charges is a measure of the appreciation by the engineer of the value of a motor load. In the case of a gas engine, a brake horsepower can be obtained for about 1d. per hour; in the case of electric motors, therefore, it is necessary to bring the cost down to 1d. to 1½d. per unit before we can hope to enter into successful competition. The second point is of vital importance, and merits careful consideration.

The principal causes which are likely to disturb the supply voltages are: (a) Bad regulation in engines, alternators and transformers; (b) the use of small generating sets and transformers; (c) defective working of the motors themselves; (d) the adoption of a high frequency. The first is a prolific source of trouble. An armature drop of 20 per cent. to 30 per cent., even on non-inductive loads, is by no means uncommonly found in this country. Why these abnormal drops of pressure have been tolerated it is difficult to say. It is obvious that the starting of a large motor on mains supplied by such a machine must cause an instantaneous drop of pressure, which no amount of switchboard manipulation can prevent. When one considers that in a direct-current station an armature drop of six per cent. is rarely exceeded, is it any wonder that alternating-current motor working on such circuits has been discouraged? A similar abnormal drop may also be found in transformers which have been designed for a lighting load only. It is quite possible that a transformer with heavy magnetic leakage may have three or four times the terminal drop on a motor load which it would have on a lamp load. It is therefore obvious that all transformers before being sent out should be tested on an inductive-load in addition to the non-inductive-load test. The writer has adopted the practice in specifying for transformers that when tested on a non-inductive load the drop shall not exceed two per cent., and not more than three per cent. when tested on a load with a power factor of 0.75. (b) The question of the size of the day-load sets is one which will right itself as the motor load increases, since the possibility of any single motor disturbing the supply will diminish as the number of motors increases, and this may therefore be classed as a temporary difficulty only. (c) The chief defects are heavy starting current and low power factors. The starting current in a single-phase motor need not necessarily be abnormal, though undoubtedly this often is the case, and it is surprising that alternating-current engineers do not more rigorously insist on the starting current of motors being kept down. It is purely a matter of what starting torque is required, and it can be brought as low as two-thirds of full-load current or less by suitable arrangements. (d) A high frequency was adopted in the early days, when it was common practice to install small transformers in houses, with a view of keeping down the iron losses, the designers losing sight of the objection to a high frequency in view of motor working. It is well known that with a low frequency, a motor has the advantage of higher frequency, higher power factor and smaller starting current.

The writer trusts that he has shown that the prejudice against the single-phase motor has its root not in any inherent defect in the motor, but in the unsuitable nature of the appliances used. It will be seen that direct-current engineers would have equal cause to complain of their motors if they tolerated the defects in their systems which alternating-current engineers accept as inevitable. Imagine a direct-current engineer being first hampered with a 25 per cent. drop in his armature, then a drop in his feeders and distributors corresponding to the drop in the feeders, distributors and transformers (the latter wound for non-inductive loads only), allowing motors to be started from rest by means of a resistance so imperfect as to pass double or treble the full-load current, and we should not be surprised at his complaining of the disturbance caused by his motors. Consider now the alternating-current engineer with the added losses caused by a power factor less than 90, and we see his difficulties in the face of unsuitable plant. The writer believes that it would be well worth while to go to the expense of re-winding alternators with these abnormal drops, to use only transformers rated on a power basis, and in extreme cases to bring down the frequency to a reasonable value. Exception has been taken to the single-phase motor owing to its alleged inability to start against a load. This allegation is quite unfounded, as this condition can be complied with, but at the expense, of course, of starting current. It appears to the writer that this point has been labored too much, as there are few cases in which a fast-and-loose pulley cannot be arranged. Moreover, this defect has not prevented the enormous use of gas engines, which, so far from being able to start against a load, have actually to be pulled round by hand before they will start at all! Even in the case of lifts, there is a wide sphere of utility for single-phase motors. The writer has a lift worked by a single-phase motor on the Derby mains which is perfectly satisfactory. Although the motor starts light, the lift is working at full speed within seven seconds of the motor being switched on. A short description may be of interest. Fig. 1 is a plan of the cage. The motor and gearing are fixed on the top of the cage and move with it. The motor, a four-horsepower, Langdon-Davies, is switched on inside the cage and quickly runs up to speed, simply driving its own spindle and spindle (B), and also the bevel wheels (C_1), (C_2), (C_3); the two latter are at present loose on their spindle. The starting lever inside the cage when pulled over brings a friction cone to bear on the inner surface of the shoulder on bevel wheels (C_2) and (C_3). This throws shafts (D) and (E) into gear and causes the lift to rise or fall, at will. The time necessary to start the lift, i. e., seven seconds, is sufficiently small to justify the contention that the single-phase motor can be used for lift purposes in a great variety of cases.

A few notes as to what is actually being done on supply systems with single-phase motors may not be out of place. For purposes of comparison, it is a matter of interest to note what is being done in a city where the direct-current-motor business is vigorously pushed. In Bradford the low charges and easy terms of hire have resulted in a considerable motor load being obtained. Up to the end of June, 1899, there were 307 motors connected to the mains, and the proportion of units sold for power to total units sold was about 17 per cent. It is doubtful if this result has been equaled in any other town in the country. It will perhaps be somewhat of a surprise to some members of the association to find that on the continent the above results have been far eclipsed by the use of single-phase motors. In the city of Frankfort, on March 31, 1899, there were single-phase motors of an aggregate of no less than 4,532 brake horsepower connected to the mains, while the proportion of power units sold to total units sold was no less than 58 per cent., the figures being for power, 1,851,268 units, and for light, 1,342,399 units; total, 3,193,667 units sold. The largest motors are of 750 brake horsepower, of which there are three. They are of the synchronous type and are coupled to direct-current generators, and are used for driving the trams. With the exception of these, all the motors are of the induction type, the largest of which are of 90 brake horsepower. The larger motors are run from separate transformers, fed from the nearest feeders, while the smaller sizes are taken direct from the low-tension network, while the steadiness of the light leaves nothing to be desired. The generating sets are as follows: Two of 1,500 indicated horsepower and four of 750 indicated horsepower. The frequency is 45 periods and the armature drop six per cent. The charges for power are equivalent to 2d. per unit, with discounts up to 25 per cent. The corporation of Derby has within the last few months commenced letting out single-phase motors on hire, with gratifying results. At the present time motors equivalent to about 200 brake horsepower have been connected of various sizes up to 30 brake horsepower, and the units sold for power during the year have amounted to about 12 per cent. of the total units sold. The charges vary from 3d. to 1d. per unit, according to the length of time the motor is used.

A few words may now be said on the chief characteristics of the modern single-phase motor. The only practical motors on the market are of the synchronous and the induction type. The synchronous motor requires its field to be excited by a direct current. It is not usually self-starting, and this defect precludes its adoption for any but large sizes. It has an extremely high efficiency and power factor, and it runs at a synchronous speed. The induction motor, which is almost exclusively used, has been greatly improved in recent years. A few years ago the maximum efficiency was not expected to be more than 60 per cent. to 65 per cent., with a power factor of about the same value, while the starting current, even when the motor started light, was often two or three times the full current. Thanks, however, to the good work of Tesla, Brown, Langdon-Davies, and others, very marked improvements have been effected within the last two or three years.

The following table gives a good idea of the efficiencies of modern single-phase motors, as com-

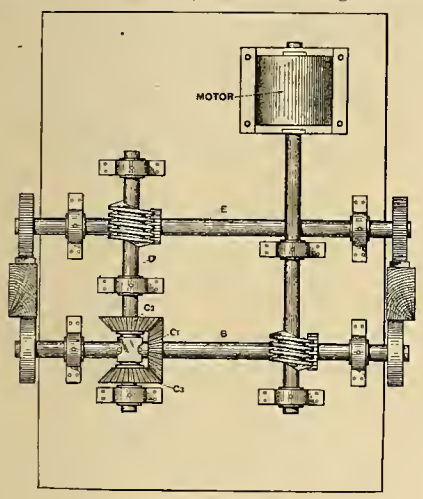


Fig. 1. Elevator Gearing.

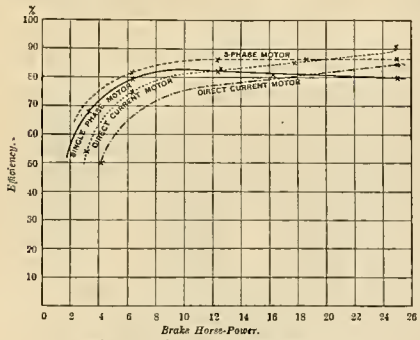


Fig. 2. Diagram of Efficiencies.

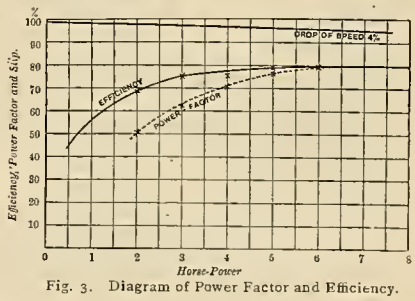


Fig. 3. Diagram of Power Factor and Efficiency.

POWER SUPPLY BY SINGLE-PHASE MOTORS.

1. Paper read before the Municipal Electrical association at Huddersfield, England. Mr. Wilmshurst is borough electrical engineer at Derby, England.

pared with direct-current and three-phase motors. All the tests are made from motors actually at work, the single-phase motors being on the Derby mains. The motors were all made by leading firms, and though the figures do not necessarily represent the highest attainable results, they are a fair sample of good modern practice:

Type of motor.	Brake Horse power.	Efficiency. Full Load.	Half Load.	Quarter Load.	Eighth Load.
		Per Cent	Per Cent	Per Cent	Per Cent
Direct current.....	4	78	68	53	..
Direct current.....	3	84	77	59	35
Single phase.....	2	78	76	62	..
Single phase.....	6	80	76	62	46
Three phase.....	10	83.5	82	72	55
Single phase.....	12	75	78	68	54
Single phase.....	25	80	83	80	68
Three phase.....	25	87	86	82	72
Direct current.....	25	91	83	75	54
Direct current.....	25	86	78	66	..

Fig. 2 shows the efficiencies of the above-mentioned four motors of 25 brake horsepower plotted together, for ease of comparison. The interesting fact to be noted in both the diagram and the tables is that, while the efficiency at full load in the direct-current motors is the higher, the single-phase motors have the advantage at low loads, and it is probable that where the work to be done by a motor varies considerably, as, for instance, in a machine shop, the average efficiency of the single-phase motor is quite as high as, if not higher than, in the direct-current motor. Fig. 3, a diagram of the power factor and efficiency of the above six-horsepower motor, shows that while there is still room for considerable improvement in the power factors, the modern motors exhibit considerable advancement during recent years.

In conclusion, the writer would urge that while the single-phase motor still leaves much to be desired in the matter of power factor, starting current, starting torque and facility of running at variable speeds, yet the absence of commutators, with their attendant troubles, giving such simplicity in working, together with the high average efficiency, render it eminently suitable for general distribution work. As is shown in the table, the polyphase motor outstrips both its competitors in point of efficiency. The writer would suggest that should a transformer or other appliance be placed on the market which, without moving parts, would convert a single-phase into a polyphase current, in the same manner that a two-phase can be converted into a three-phase current, in this direction may lie the solution of the motor problem. With the increase in size of our stations, the engineers of direct-current works are more and more realizing the advantages of alternating currents for generation and transmission. The improvements in modern alternating-current motors have gone a long way to lessen the force of the objection to alternating currents for distribution purposes as well, and the writer's experience justifies him in the opinion that the alternating-current motor (either single or polyphase) is quite capable of satisfying all ordinary demands for power from the mains of public-supply undertakings.

The River Forest (Ill.) Board of Trustees rejected the Chicago, River Forest and Western ordinance at a meeting held recently. The company proposed to connect with the Lake street elevated road and to sell tickets good between the village and any station on the Lake street line at the rate of 12 for $1. The opposition party held that another road was not needed, and that the quiet and beauty of the village would be marred by another trolley line.

Rotary Converters and Motor-generators.

By Frank C. Perkins.

Part I.

Probably the most important use of rotary converters and motor-generators at the present time is for transforming alternating currents into direct currents. On account of the ease with which alternating currents may be transformed from low potentials to high potentials for long-distance lines this system has rapidly come to the front for light and power transmission. The rotary transformer and motor-generator have, however, found their way into these installations and have been of great value in perfecting the polyphase alternating system of power transmission. This is from the fact that direct current is frequently desirable at the point of distribution and must be supplied from some form of transforming apparatus.

For certain classes of work direct current has proven itself the better form for the utilization of the energy. Most engineers consider direct current incomparably the best for street-railway work, for electrolytic work, storage-battery manipulation and for street arc-lighting systems. The rotary converter and the motor-generator have supplied the missing link between the polyphase alternating power-transmission system and the direct-current distribution. The polyphase system is undoubtedly the most practical means of transmitting energy over great distances and is very essential in the distribution of energy for light, heat and power over a large area from a single power station.

The rotary converter solves the problem of concentrating a number of large generating units and distributing from this power station, through sub-stations for street-railway, light and general power work. The power station by this system may be placed at any distance from the center of distribution, which cannot be done when the central station is designed for generating continuous currents. This allows the location of the power house to be most favorable for cheap land and for generating the power with the highest efficiency, and the best for the supply of water and fuel for the boilers.

Modern central-station practice has been quite different since the advent of the rotary converter. It is possible now to locate simply a sub-station where a complete power house was previously required, thus reducing the first cost of installation, as well as the expense of operation. It is also possible to place the sub-station at any point in the area of distribution, or on a railway line, the rotary converters requiring but little attention and the building being small and inexpensive.

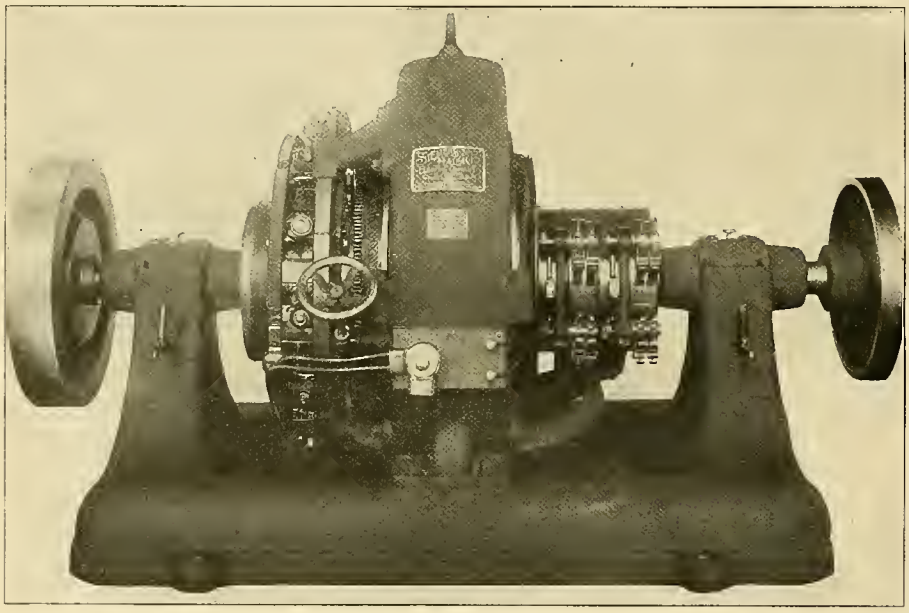


FIG. 1. ROTARY CONVERTERS AND MOTOR-GENERATORS.—SIEMENS & HALSKE ALTERNATING-DIRECT-CURRENT ROTARY.

Rotary Used as Motor and Direct-current Generator Combined.

The rotary converter, when connected to the alternating-current circuit, may be made to give out mechanical power from a pulley on the shaft, and at the same time deliver from its commutator a continuous current. Such a machine is represented in Fig. 1, which shows a Siemens & Halske rotary converter.

As an example of the great facility with which the rotary converter may be utilized for the above purposes, it may be well to mention the installation at Pratt & Letchworth company's shops at Black Rock, N. Y. It was desired not only to discard the steam engine and use Niagara power in its place, but a direct current of 250 volts was needed for operating the motors for the electric cranes and other motors about the shops. The necessity of operating a new dynamo was obviated by installing an alternating-direct rotary converter of the General Electric type. By this means, from the 250-kilowatt rotary converter, a direct current of about 800 amperes at 250 volts could be used for supplying the shop circuit, while a pulley attached to the rotary

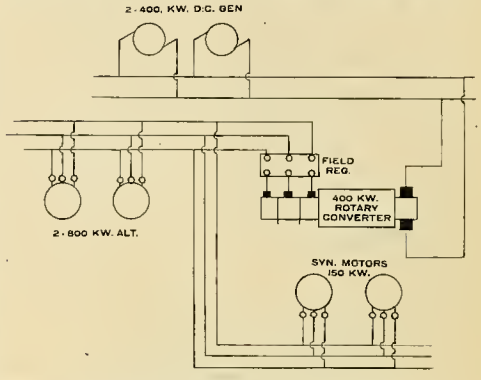


FIG. 4. ROTARY CONVERTERS AND MOTOR-GENERATORS.—CONNECTIONS FOR ROTARY TRANSFORMING IN EITHER DIRECTION.

converter supplied 100 horsepower for operating the main shafting, thus doing away with both engine and direct-current generator. This alternating-direct rotary converter operates at 250 revolutions a minute and receives its three-phase current at 170 volts and at a frequency of 25 cycles from the Niagara power circuit, after having been reduced in pressure by static step-down transformers, from 11,000 volts to 2,200 volts and again reduced to 170 volts.

Rotary Used as Motor and Alternating-current Generator Combined.

The rotary converter, when connected to the direct-current circuit, may be made to give out mechanical power from a pulley on the shaft and at the same time deliver from its collecting rings an alternating current. When a rotary converter is supplied with direct current and gives from its collector rings an alternating current, the speed of the rotary does not remain constant, as is the case when the rotary receives its current from the alternating-current circuit, and the speed is fixed by the frequency of the alternator. A rotary converter which is driven from a continuous-current circuit has the same speed and operates under the same law as a direct-current motor. The speed varies as the strength of the current varies through the field and by the reaction of the armature current upon the field.

A rotary converter is liable under these conditions to reach a very high speed unless arrangements are made to prevent it. Westinghouse rotaries for delivering alternating current are supplied with a special exciter, which is driven by the rotary itself, its speed varying as the speed of the rotary varies. The exciter is sometimes belt-driven, sometimes operated by an induction motor, obtaining its current from the rotary, and sometimes is directly connected to the shaft of the rotary.

The exciter has a field which is not saturated, and hence a very small increase in speed raises its voltage greatly. If the rotary should increase in speed the exciter speed is also increased and the current the exciter sends to the rotary field strengthens it to such an extent as to prevent a further increase of speed. In this way the speed is automatically kept within a small range. The rotary converter, when arranged in this way, is very desirable for use in a direct-current station for supplying either electric motors or lights at a distance with current. These rotaries are also of great convenience for changing a direct current from a storage battery into alternating current, to help out on the peak of a lighting load.

Rotaries Used as Direct-current Generators.

The rotary converter, when driven by a pulley on its extended shaft from any prime mover, may be utilized to deliver a continuous current from its commutator. On building the Real Estate Exchange in Buffalo a short time ago, a complete plant was desired for operating the lights in the office building. Instead of installing direct-current dynamos, it was thought best to prepare for using the Niagara power, which it was known at that time would be delivered in Buffalo as an alternating current; hence rotary converters were installed for supplying the necessary direct current. These rotary

converters were driven from high-speed automatic engines by belting to pulleys on the rotary converters. It was intended that these machines should be used as rotary converters as soon as the Niagara power was available, the engines being held in reserve in case of trouble.

ROTARIES USED AS DOUBLE CURRENT GENERATORS.

The rotary converter, when driven by a pulley on its extended shaft from any prime mover, as engine or turbine, may be utilized to deliver both continuous currents and alternating currents at the same time. This use is practically the same as that of the double-current generators now being installed in many places for developing both multiphase currents and continuous currents simultaneously. This machine forms a link between these two kinds of current. An example of its uses is the Chicago Edison company's Harrison street station in Chicago, where the double-current generators are used to furnish

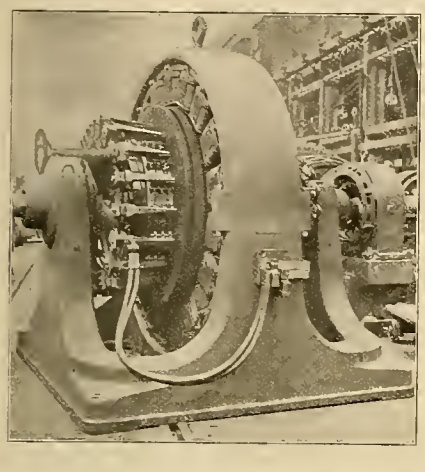


FIG. 3. ROTARY CONVERTERS AND MOTOR-GENERATORS.—500-KILOWATT WESTINGHOUSE ROTARY WITH STARTING MOTOR.

either continuous current for the immediate surrounding territory or multiphase current for supplying the districts at greater distance, or both at the same time.

ROTARIES USED AS ALTERNATING-CURRENT GENERATORS.

The rotary converter, when driven by a pulley on its extended shaft from any prime mover, may also be utilized to deliver an alternating current from its collector rings. It is understood that some of the more prominent existing central stations when requiring more energy are installing rotary converters driven by steam engines and supplying alternating currents to their incandescent load, with the idea that they will ultimately find it to their advantage to install a complete polyphase alternating-current system, and will then use these machines as rotaries, thus avoiding the necessity of again buying new machines.

ROTARIES TRANSFORMING DIRECT TO ALTERNATING CURRENT.

The rotary converter, when receiving current from a direct-current circuit, may be utilized to deliver an alternating current from its collector rings. Very often at a large direct-current central station it is desirable to supply energy at a distance for light, railway or power work, and the rotary converter comes into important use for supplying multiphase current for the transmission, and again at the sub-station for changing back into direct current. These multiphase currents, after leaving the rotary converter, are raised to high potentials by static step-up transformers for use on the line, and again reduced by step-down transformers to a moderate voltage at the sub-station. In this manner a great saving in copper is effected, and at the same time the building of a second station is avoided. The Edison stations in New York and other cities are good examples, as well as the central power station of the Union Railroad company of Providence, R. I.

At this latter power house 5,000 horsepower is generated at 565 volts, continuous current. To supply the new extension to Buttonwoods, a rotary sub-station has been placed at Riverview, 14 miles away. At the central station the direct current is changed to an alternating current by the use of rotary converters receiving the energy as direct current and delivering the current to static step-up transformers as alternating current. Here it is raised in potential to 10,000 volts, and conducted to the sub-station, where it is lowered by step-down transformers and transformed by rotary converters again from an alternating to a direct current for the railway-feeder service.

At the central station two 300-kilowatt Westinghouse rotaries are used to supply a two-phase alternating current at 400 volts, with a frequency of 60 cycles a second, the speed of the rotary being 600 revolutions a minute. At the sub-station at Riverview two Westinghouse rotary converters of 250 kilowatts are operated to supply a direct current to the trolley wires in both directions, through No. 0000 feeder wires. Another sub-station will be erected at River Point, 12 miles from Providence, where other rotary converters will be installed for similarly supplying direct current.

ROTARIES TRANSFORMING ALTERNATING TO DIRECT CURRENT.

The rotary converter, when receiving current from an alternating circuit, may be utilized to deliver a direct current from its commutator. At Los Angeles, Cal., there is an installation of rotary converters which is of particular interest as an example of the extensive use of this class of apparatus in connection with polyphase transmission systems. The San Gabriel Electric company has a very complete polyphase installation and the alternating-direct rotary converters form a very important part of the equipment. This part of the installation consists of one 400-kilowatt machine and three 250-kilowatt rotaries of the type manufactured by the Westinghouse Electric and Manufacturing company of Pittsburg. These machines are shown in Fig. 2. Small Tesla motors are used to start the machines, as rotary converters are started under the same conditions as synchronous motors, which, it is well known, develop a satisfactory torque only after having been brought up to normal speed. The motors are directly connected to the extended shafts of the rotary converters, the armatures of both machines being built up on the same shaft. A 500-kilowatt converter of this description, provided with a starting motor, is shown in Fig. 3, the direct-current side being in the foreground.

ROTARY TRANSFORMING IN EITHER DIRECTION.

The alternating-direct rotary converter may be installed so as to be perfectly reversible, receiving an alternating current and delivering a direct current, or receiving a direct current and delivering a multiphase alternating current. Mr. Hans Sigismund Meyer, in an article in the Electrotechnische Zeitschrift, mentions the Cleveland electric-light and power station as having a plant arranged in this way. A diagram of the connections of the machines is given in Fig. 4 (page 364). A 400-kilowatt rotary converter connects the continuous-current to the alternating-current circuits. It is connected up in parallel, on one side with two direct-current generators, each of 400 kilowatts' capacity, and on the other side with two alternators, each of 800 kilowatts' capacity. The rotary may be energized by the multiphase current and used to supply the continuous-current circuits, or it may be operated from the direct-current side and feed the multiphase circuits.

ROTARIES IN MINES.

The rotary converter is rapidly being introduced for use in mines, both in Europe and America, as polyphase alternating-current systems are being largely installed for furnishing light and power for operating extensive mines. While it is thoroughly practical to use this current for operating incandescent lamps in the mines, as well as induction motors for various purposes, still it is almost as necessary to have a direct current at hand in various parts of the mine for operating electric mine locomotives and various other apparatus. In order to supply the necessary direct current for the mining locomotives rotary converters are installed in sub-stations in various points in the mine and a low-potential, 125-volt or 250-volt trolley system may be used and still have a good economy in copper and efficiency, while otherwise a 500-volt trolley system would be necessary, which is not at all desirable, on account of the limited space for trolley wires and feeders. It is also considered a great disadvantage to use 500-volt motors for electric traction in mines, on account of the liability of miners to be injured by coming in contact with the trolleys while standing on the track.

[To be continued.]

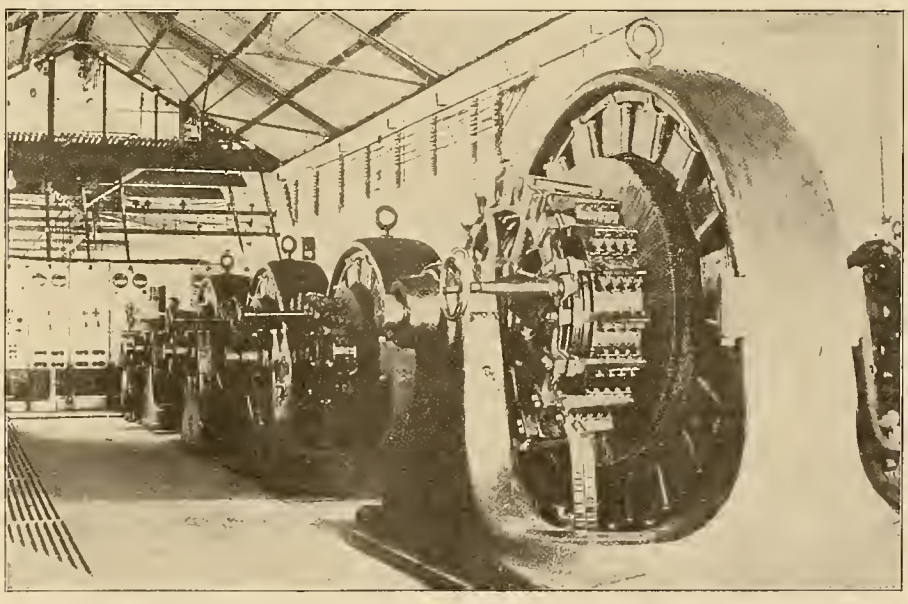


FIG. 2. ROTARY CONVERTERS AND MOTOR-GENERATORS.—FOUR ROTARIES IN SAN GABRIEL POWER HOUSE.

Large Central-station Company in New York State.

The Westchester Lighting company of White Plains, N. Y., which was organized on November 5th, with $2,500,000 capital stock, has increased its capital to $12,500,000, and it is said the company proposes to absorb all the gas and electric-light, heat and power companies in Westchester County. The property of the following-named concerns will probably be turned over to the Westchester Lighting company: East Chester Electric company, Port Chester Electric Lighting company, Larchmont Electric Light company, Huguenot Electric Light, Heat and Power company, Pelham Electric Light and Power company, Mount Kisco Lighting company, Westchester Gas and Coke company, New York Suburban Gas company, White Plains Lighting company, Hudson River Gas and Electric company, Municipal Gas company of Yonkers, Yonkers Gas Light company and the Westchester Gas Light company of Yonkers. It is said the new corporation means to erect several extensive plants throughout the county as soon as it obtains new franchises and rights in the towns of White Plains, Yonkers, Mount Vernon, New Rochelle, Pelham, Port Chester, Rye, Harrison, Mamaroneck, Tarrytown and Peekskill. The directors of the new organization comprise Charles H. Werner, Louis B. Grant, Richard F. McKinney, M. J. Werner, Charles M. Hemingway, N. D. Daboll, Henry A. Kenworthy, Charles W. Squires, W. W. Scrugham and Reginald H. Giles. W. W. Scrugham is president and B. W. Stillwell is secretary of the company.

The Huguenot Electric Light, Heat and Power company, which, it is reported, the Westchester company is trying to buy out, has filed a certificate of extension of business and power and rights in Westchester. Among other things it proposes to manufacture gas for supplying light in every township of Westchester, also to supply steam to consumers from a central station, through pipes and conduits, and electricity for power. The capital stock is fixed at $50,000 and the directors comprise John J. Crennan of New Rochelle, F. A. Stratton and C. H. Werner of New York. The principal office of the company is in New Rochelle.

Consulting Engineer J. B. Nelson of Indianapolis has handed his completed plans and specifications to the council committee on the electric-light plant of Richmond, Ind. The establishment and equipment of the plant will cost $150,000. The plant will be erected at once.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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We begin in this issue a four-part serial on "Rotary Converters and Motor-generators," written by Mr. Frank C. Perkins of Buffalo and generously illustrated by diagrams and pictures. By reason of the great extension of alternating-current transmission within the last few years the class of apparatus described by Mr. Perkins has come into widespread prominence, and we are confident that the readers of the Western Electrician will welcome this article and follow it to the end with attention.

In numerous divisions of his subject Mr. Perkins considers the various applications in which rotaries have been found useful. In the portion of the article given in this issue the author considers rotary converters as direct or alternating-current generators, as generators and motors combined, as double-current generators, and as adapted to a number of different uses that have come within his observation. In the succeeding sections the adaptation of the rotary converter for electrolytic purposes where large currents of low potential are required, the use of motor-generators and rotary converters for boosters and exciters, and the application of rotaries for electric-railway operation, are taken up. In this last field, where many branches or long lines have to be operated from a central power station, involving the use of alternating-current power transmission, the economy and usefulness of the rotary converter have been already demonstrated.

A substantial verdict for damages, just sustained by the Court of Appeals of the state of New York, shows that street-railway companies have more reasons than one for a watchful supervision of the motorman's use of the controller. Mary Dochtermann, after a prolonged litigation, has been successful in the Court of Appeals in her action to recover damages from the Brooklyn Heights Railroad company for personal injuries received by her while a passenger upon one of its trolley cars. Her story, on the trial in Brooklyn, nearly three years ago, was that she signaled the car, which stopped; that the motorman beckoned to her to enter it by the front platform, opening the gate for the purpose of giving her entrance; that she got upon the platform, and that just as she was stepping in, or had stepped into the body of the car, and before she was able to sit down, the car started with a violent jerk, by which she was thrown down and severely injured. The car started, she said, with great force. A verdict given in the plaintiff's favor for $4,000 was set aside by the court, but the Appellate Division of the Second Department directed a reversal. The court held, by Justice Cullen, that the rule that the jar or jerk of an electric car when it is started in motion is not evidence of negligence was applicable only within certain limitations, and where a woman passenger was injured as the result of the car being started before she had taken her seat, the jury might properly find that such action constituted a want of even ordinary care. The Court of Appeals has affirmed the order and directed judgment for the plaintiff on the verdict.

The lesson to be drawn from this decision is apparent. Careful, well-drilled motormen not only save their employers money in the consumption of current, but also in the avoidance of damage suits.

Detroit is pointed out as the model of municipal ownership in electric lighting, but it draws the line at a municipal telephone plant and will have none of it. The reasons advanced for this rather unexpected timidity are the following:

There is no reason, in the opinion of your committee [the committee on charter and city legislation of the Common Council], why the taxpayers of the city of Detroit should assume a liability of hundreds of thousands of dollars for the benefit of 7,000 or 8,000 telephone subscribers, or users of telephones.

The municipal ownership and operation of telephones would be entirely different from municipal lighting or waterworks, as the whole people receive the benefit from well-lighted streets, and the city water supply is a necessity to every citizen, whereas, in the case of municipal telephone system all the taxpayers of the city of Detroit would assume the total liability of the expense of the telephone system for the benefit of comparatively few telephone subscribers and users. In case of an annual deficit, which would not be improbable, the taxpayers of Detroit would again be called up to pay the same, thus making the people who do not use telephones pay a part of the expense for those who do, all of which is legislation in the interest of the few at the expense of the many.

Again, the municipal telephone system could be operated only within the limits of the city of Detroit and would have no connection with lines outside of the city, which would be a serious drawback.

Such wisdom was hardly to be expected from Detroit aldermen, to whom the mere sound of the words "municipal ownership" is as the delightful harmony of some grand, sweet song. But may it not be, after all, that there is another reason, not given—a reason due to the hard, cold facts of some years of actual experience with a municipally owned and operated electric-light plant? There is an old adage that sets forth the wholesome fear that abides within the breast of the burned child.

It is but a few years since Professor Roentgen gave to the world the wonderful results that might be obtained by the use of what he was pleased to call the X-ray. Since that time the applications of the Roentgen ray have been many, although chiefly in medicine and surgery. The latest announcement comes from a Dr. Kienbock of Vienna. He asserts that the growth of hair may be promoted by the use of X-rays, and to prove his assertion he introduced to the Society of Physicians of Vienna a man, aged 26 years, part of whose head had been bald for years. The physician had applied the Roentgen rays on six occasions, 15 minutes at a time, in the course of two months, with the result, he said, that hair had grown thickly on the parts treated, the rest of his head remaining bald. The society is said to have been interested in the alleged discovery and discussed the matter at some length. However, the members were not convinced that Dr. Kienbock's assertion was well founded and urged him to try again. The verification of this reported discovery will be awaited with bated breath by all bald-headed men. Vienna is now the center of the hopes of the shiny-pated the world over. The X-ray has been regarded hitherto as a depilatory, rather than a hair renewer, but who shall say that it does not act on the principle enunciated by the renowned Hahnemann? Evidently the man whose hirsute adornment has departed must submit his head to the tube to find out.

President McKinley, in his annual message to Congress on Monday, renewed the recommendation made in his special message of February 10, 1899, as to the necessity for cable communication between the United States and Hawaii, with extension to Manila. Since then, as the president observes, circumstances have strikingly emphasized the need of a transpacific cable. Surveys have shown the entire feasibility of a chain of cables which, at each stopping place, shall touch on American territory, so that the system shall be under our own complete control. "Manila once within telegraphic reach," says the president, "connection with the systems of the Asiatic coast would open increased and profitable opportunities for a more direct cable route from our shores to the Orient than is now afforded by the transatlantic, continental and transasian lines. I urge attention to this important matter." It is to be hoped that the president's advice will be heeded by the law-making body. An American cable across the Pacific is badly needed, and if the public-ownership and private-ownership advocates can only compose their differences work may be begun early next year.

Another feature of the president's message of especial interest to the readers of the Western Electrician related to patents. Mr. McKinley gave the figures of the Patent Office work for the year ended June 30th. There were 26,540 letters patent granted, including reissues and designs, during that period, and 1,660 trademarks, 682 labels and 93 prints were registered. The number of patents which expired was 19,988. The total receipts for patents were $1,358,228.35. The expenditures were $1,247,827.58, showing a surplus of $110,400.77. The question of more uniform and equitable laws for the protection of patents and trademarks in the various civilized countries of the world also received the president's attention. A conference will be held at Brussels next week under the convention for the protection of industrial property, concluded at Paris, March 20, 1883, to which delegates from this country have been appointed. Mr. McKinley's observations on this subject are brief, but they show that he has been well advised as to the need of reform: "Any lessening of the difficulties that our inventors encounter in obtaining patents abroad for their inventions, and that our farmers, manufacturers and merchants may have in the protection of their trademarks, is worthy of careful consideration, and your attention will be called to the results of the conference at the proper time." There certainly should be a lessening of difficulties in obtaining and enjoying foreign patents, and all American inventors and patent lawyers will hope that the Brussels conference will achieve some lasting benefit in this direction.

Electrical Education.

By W. H. Radcliffe.

There comes a time, sooner or later, in almost every boy's life when he asks himself, or someone else asks him, in what line of business he expects to engage to make his mark in the world. This question is, perhaps, the first serious one that confronts him, and as his entire after-life depends in a great measure on the answer, he should thoroughly consider his case before arriving at a definite conclusion.

In the majority of cases, that profession in which he feels himself the most interested, both technically and practically, is the one in which he will make the greatest success.

This rule holds true, as just stated, in the majority of cases. There are exceptions; for instance, when a young man can see a greater chance for advancement in a certain direction than in another, due to the influence of friends or relatives, it may be his best policy to sacrifice other considerations. In the latter case, however, his success does not always depend entirely upon himself, and in many instances it is a question as to whether he is making his own mark in the world or others are making it for him. Be that as it may; suppose a young man, having thoroughly considered the different means whereby he may employ his talents to advantage, decides that the electrical profession is the one of his choice. Even at this step he has not definitely determined his course, for at the present time no man can with justice to himself and his calling serve the entire electrical profession. There is competition in all lines, but in this, the Age of Electricity, it is only natural that its keenest phase is to be found in the practice of the prevailing trade. Consequently, it is best that the future electrician or electrical engineer select, as soon after his choice of the profession as possible, the direct line of electrical work in which he desires to engage. He will then have some definite end in view and may systematically train himself for the best that that branch affords. Competition will thus, to a certain extent, be averted, for there is and always will be sufficient room and reward at the head of each individual branch to satisfy all who reach it.

In order to aid in selecting the direct line of work in the electrical profession, the following subdivisions are presented:

Electric lighting.
Electric railways.
Telephony.
Telegraphy.

In order to become thoroughly proficient in the first two of these branches, a solid foundation in arithmetic, algebra, geometry and trigonometry is necessary, and if alternating currents form an important part, calculus should be included. Physics, mechanics, geometrical and mechanical drawing and chemistry should be thoroughly mastered in either case, after which the study of the principles of electricity, its production, measurement, and application to the one branch or the other, should follow. This training can best be obtained in a technical school, supplemented afterward with practical experience in some electric-light or power station.

The length of time required to become a thorough electrical engineer depends altogether on the ability of the person. As in other sciences, those naturally inclined require less time and achieve a more marked success than those whose abilities lie in other directions.

The electrical courses in most technical schools require four years' study. The first year's work lays a foundation in mathematics and general physics. A large portion of the second year's work is in advanced mathematics and magnetic measurements. The third year's work is devoted largely to direct-current measurements and direct-current machinery, while in the fourth year the theory and measurement of alternating currents and the principles of alternating-current machinery are taken up. It is possible by entering an electrical course on advanced standing, that is, by passing examinations in some of the prescribed subjects upon entrance, to complete the course and receive a degree in three years. This, however, requires exceptional ability on the part of the student. If, on account of time or money, the young man feels unable to spend four years at a technical school, it is possible for him to enter as a "special student" and, by performing conscientious work, cover the ground sufficiently well in three years.

Degrees are not granted to special students, but this should not discourage the young man. The degree, in itself, is far from being a passport to business success, as many a college youth finds to his dismay, after graduation. As to the practical experience following the technical training, most young men find two years of service sufficient to acquaint them with the general details in either of the first two branches.

Take now the case of the young man wishing to perfect himself in electric lighting or railway work, but who has not the wherewithal to spend even three years at a technical school. He may have been fortunate enough to work himself into some central station as "oiler" or assistant dynamo-tender, but there he sticks like a fixture, unable to rise to a higher position for lack of sufficient knowledge to carry him through. His salary, moreover, is scarcely enough to keep the average man in cigarettes. What must he do to be saved? This question could not have been answered a dozen years ago, but to-day he may, by means of correspondence schools, start at the foot of the ladder and climb upward step by step, his progress depending altogether on his ability and the number of spare moments he is able to devote to his studies. Under ordinary conditions, he will complete his course with the correspondence schools in about three years. The expense thus incurred will range between one-tenth and one-fortieth that necessary for an electrical course in a technical school, depending upon whether the student is a resident or not of the town in which the technical school is located.

Night schools and other free institutions may also be mentioned as alternatives to the technical schools of the country for those to whom time and money are of vital importance. It will thus be seen that anyone with a determination to succeed in the electrical profession will not be greatly handicapped by the conditions and circumstances in which he may have been placed.

In the third branch of the electrical profession, namely, telephony, practically the same foundation in mathematics, physics and principles of electricity as is required in electric-light and railway work is necessary in order to become thoroughly proficient. Still it may be said that in telephony one can, with an ordinary training, attain a higher degree of success than usually is possible in either of the first two branches. In other words, there seems to be more chance for advancement and less competition in this particular line at the present time.

In telegraphy another field is open for those who do not care to penetrate into the innermost chambers of the science. If desired, this branch may be taken up in connection with telephone work. In many schools of the second class, special courses in telephonic and telegraphic work are laid out, these courses being especially adapted to meet the requirements of the practical worker. In technical schools, however, no attempt has been made to specialize work along these lines, their particular aim being, as already noted, to lay a foundation for the practical work which is supposed to be taken up afterward. It is largely owing to this fact that the highly educated technical young man often finds it difficult to obtain even a fair remuneration for his services, immediately after graduation. Indeed, his less fortunate brother who has made the practical part of a branch his special study often snatches a prize from him at this time. Nevertheless, with patience and perseverance exerted along practical lines for a few years, even though poorly remunerated, the technically educated young man may reasonably look forward to an assured success in whichever branch he may have selected.

Within the last decade and a half electricity has been applied on a commercial scale to many of the trades and sciences, among which may be mentioned surgery, heating, ventilation, signaling, welding, plating, phonography, chemistry, separation of metals, dentistry, warfare, blasting, drilling, dyeing, canalboat propulsion, medicinal purposes, elevator work, navigation and horseless carriages. A more or less extended field is open to the electrician or engineer in any one of these sub-branches. In many of them, however, advancement cannot be expected along this line, as electricity is used merely as a means for their development. Thus, in welding, phonography, chemistry and the separation of metals, electricity is used only as a source of power. It follows, therefore, that a person, no matter how skilled he may be in the science of electricity, cannot expect advancement in a business in which electricity is merely playing a subordinate part, unless he possesses some knowledge of the details in that business. As a matter of fact, advancement along such a line would naturally come to one who, already thoroughly versed in the business itself, had made electricity a study of subsidiary importance.

The efficiency of man as a human machine, converting the energy of food into mechanical and other forms of energy, has been determined to be about 20 per cent. Were it not for the fact that man is blest with the power of knowledge, he would, indeed, be a lamentable object. Still, there are many such to be found in the machine shops and factories of our land—men who, though capable of acquiring the power of knowledge, become each day more and more as the machines which they attend. On the other hand, there are those possessing the necessary qualifications for a successful career who are burying their talents in napkins—men technically trained in the electrical profession, most of them Micawbers, waiting for something to turn up, thinking, perhaps, that since they have no relative in a ten-million-dollar electric trust, their case is hopeless. Thus we see the two extreme classes of men—the former, possessing no inspiration to rise higher; the latter too much inspiration to stoop lower. The one class, perhaps, is deserving of as much pity as the other.

Robert Louis Stevenson has a story of a man who lived all summer on the benches of a park in Sydney rather than "go in for manual labor." At the same time, the railroads were begging for men willing to handle a pick and shovel. It is a great deal better and more honorable to be a wireman and do something than to be an electrical contractor perpetually out of a job.

It may not be amiss in closing this article to mention a few of the axioms worth remembering when in search of employment.

First, find the job. This is best accomplished by yourself. Others may offer their services, but rest assured that if there is anything of value they will deem it a personal insult not to consider it at first for themselves. Do not, by any means, wait for the job to find you; it is far better to take the chance previously mentioned. Second, do not be too particular as to the nature of the job. Remember the old proverb, "A bird in the hand is worth two in a bush." You will find it much easier to give up a job you do not like than to find one you do like; consequently, get the refusal of whatever is offered until you have had sufficient time to consider it well. Third, know more about performing the job than anyone else. It is well to investigate the nature of the work beforehand, and if it is such as to require skill in some particular direction, to become thoroughly acquainted with every detail before offering your services. It is often possible in this way to score a point over your competitors who have not investigated the matter and, perhaps, understand the work only in a general way.

Decline of Electrical Stocks in Germany.

In his annual report for 1900 F. H. Mason, the United States consul-general at Berlin, reviews the general industrial and financial situation in the German empire. He notes that in several branches of iron and steel manufacture the point of highest prosperity has been passed; production has overtaken the demands of both home and foreign trade, and in the face of a falling metal market, conservative managers have begun during the last three months to shorten sail. Most of the works are still busy upon orders booked several months ago; but with the exception of shipbuilding, locomotives, gas engines and certain forms of electrical machinery, the demand has slackened, and deliveries which a year ago could not be promised under four or five months are now made in as many weeks. There is now a serious stringency in the money market of Germany. It is well known that German banks finance industrial and commercial enterprises to an extent unknown in any other country, and it is estimated by the Moniteur Industriel that German investments of various kinds in foreign countries now amount to not less than 7,500,000,000 marks ($1,785,000,000), distributed throughout Turkey, Africa, China, Mexico, South America, Canada and the United States. There are invested in the 150 German stock companies which manufacture electrical machinery and equipments more than $200,000,000, or nearly four times the amount of such investments in 1896. To this may be added 450,000,000 marks, or more than $100,000,000, invested in electric tramways, lighting and power plants during the same period. The average dividends paid by the electric manufacturing companies in 1899 was 9.3 per cent.; but nothing could prevail against the downward tendency of industrial investments, and electrical stocks have shared in the general drop which has taken place during the last six months. As a measure of this decline, there is herewith given the market values of the stocks of several leading companies on the first of January, June and October, 1900, respectively:

Companies.	January 1st.	June 1st.	October 1st.
Siemens & Halske	178	171	159
Schuckert & Co	227 6	213.4	185.4
Helios	167.75	155.6	127
Union Electrical company	171 3	137.5	134
Berlin Electrical Works	216.5	204.8	192.5

These are all companies of the highest responsibility, admirably managed, and stocked with orders for months to come.

P. W. Tuttle and C. W. Goodrich of Geneva, Ohio, and others, promoters of an electric-railway line from Geneva to Meadville, have been granted a franchise through Harpersfield, Austinburg, Jefferson, Denmark and Pierpont.

DEVELOPMENT OF THE TELEPHONE FIELD.

Extensions of the Erie Company.

The Erie Telegraph and Telephone company, at a recent meeting of its board of directors, voted to expend a large sum of money within the next year, in improving the service and extending the lines of the Michigan Telephone company in Michigan, and it is understood that about 50 new lines will be built and half as many reconstructed between now and the last of December, 1901. Within the last 12 months the Michigan company has, it is said, practically doubled its list of subscribers. There are now over 42,000 Bell instruments in use in the state. In western Michigan the company's growth has been remarkable, as it has quadrupled the number of its subscribers within the last two years. The company has built four new circuits between Grand Rapids and Grand Haven and Muskegon since the beginning of this year, three to Traverse City, Petoskey and Mackinaw City, three to Kalamazoo, two to Allegan, three to Charlotte, four between Grand Rapids and Lansing and six between Lansing and Detroit, three to Ionia and Owosso, two to Ludington and Manistee and two to Frankfort, Thomsonville and Cadillac, and there are numerous others either already in operation or now being built throughout the state. More than 500 miles of pole lines have been constructed in the upper peninsula, reaching a majority of the important towns in that section. New buildings have been erected at Lansing, Port Huron, Bay City, Kalamazoo and Marquette. Branch exchanges have been erected in Detroit and others are in process of construction. The company is also building a new exchange at Battle Creek. Of the 16,100 miles of pole lines owned by the Erie company, more than 4,000 miles are in Michigan.

Directors and stockholders of the Wisconsin Telephone company, a part of the Erie system, met last week at the general offices in Milwaukee, at which meeting it was announced that the company would spend $1,000,000, and possibly more, in extending its system and improving its service during the coming year. The stockholders decided to increase the capital stock of the company from $2,000,000 to $5,000,000, and the board of directors gave its sanction to the executive committee's spending the sum named in improvements. The work planned includes the extension of the underground system to accommodate 15,000 subscribers, the completion of buildings in the state and the extension and improvement of the toll system. The new stock will be offered to the old stockholders at par, and the general manager anticipates no difficulty in disposing of it.

President Charles J. Glidden of the Erie company says that the company will hardly reach a development of sufficient capacity to enable the operation of 150,000 telephone stations by the close of the year, from the fact that it has been impossible to secure switching material to take care of the desired growth. The increase for 1900, however, will be in the neighborhood of 36,000 subscribers, carrying the total up to 142,000, with a waiting list of 5,000. The 150,000 mark will be reached about April 1, 1901, with switchboard and underground facilities to add another 50,000 subscribers without any serious delay and at a much less cost.

The Telephone Strike in Texas.

The differences existing between the Southwestern Telegraph and Telephone company at Dallas, Texas, and its striking electrical workers have been adjusted and the men are again at work. After having been on a strike for 10 days, the telephone company offered to compromise by raising the men's wages to $2.50 a day of nine hours. The men, although demanding $3 a day, accepted this compromise.

The telephone strike at San Antonio, Texas, resulted in a riot on November 29th, between striking electricians and a batch of non-union linemen, under protection of a squad of police. A patrolman and a striker were killed, the president of the Brotherhood of Electrical Workers was shot through the arm, a non-union lineman was beaten almost to death, and several others were more or less injured. The non-union lineman did the killing and wounding. He is in jail, charged with murder. Eighteen arrests have resulted from the trouble. A number of special deputy sheriffs were sworn in to guard the hotels, where Vice-president Pettingill of the telephone company and several non-union linemen were staying, and also the county jail.

Rights of Minnesota Companies.

Judge Lochren has handed down a decision in the case of the City of Duluth against the Duluth Telephone company, in which he holds that a telephone company securing a franchise on the streets of a city thereby secures a perpetual franchise by reason of vested rights under the law of Minnesota. The court holds that streets are highways and the telephone company cannot be deprived of the right to do business in the city. The case will be appealed to higher courts. The counsel for the telephone company, in the case of the city of Minneapolis against the Northwestern Telephone Exchange company, states that the ruling will hold good in that case, while the city attorney of Minneapolis believes that it will have no bearing.

Situation in Toronto.

The city aldermen of Toronto, Ont., have asked telephone users in the city to sign an agreement to subscribe for three years to a municipal telephone system if installed there. The Bell Telephone company has sent a letter to local subscribers, which says: "A municipal system would mean that business men must have two telephones, at a cost of $80, instead of one at $45. This has been the result wherever rival telephone companies existed. The municipal service would be local, purely, and business men in Toronto are in daily communication by telephone with all parts of Ontario, Quebec and the United States. We are convinced that Toronto cannot afford to isolate herself from 35,000 telephone stations in Ontario and Quebec alone." It is pointed out that the Bell company has been trying to get legislation to increase its rates; that, being a monopoly in Canada, an employe, discharged by the company must seek employment at telephony out of the country, and that the company neither buys goods nor manufactures in that country, and that its telephone service is far from satisfactory.

Stock of the T. T. C. Company.

The New York Times, in its issue of November 29th, had this interesting financial item: "Telephone, Telegraph and Cable was weak. It sold at the opening at 4½, but during the afternoon was offered down, and at the close was offered at 4, with 3⅝ the best bid. At yesterday's price the stock was selling at 40 per cent. of the cash value of the stock, as represented by the payments already made on the stock. In explanation of the present weakness it was said that another call on the stock might be made in the near future. At the office of the company it was stated that nothing was known of any intention to make another call. The directors of the company, however, have held several meetings within the past few days, and it is stated that they have under special consideration the financial situation of the company. It may be, therefore, that another call is likely to be made, although thus far no official statement in regard to the matter has been made."

Telephone Dispatching for the Northern Pacific.

The Northern Pacific Railroad company, it is announced, has decided to supplement, by a long-distance telephone system, the present telegraphic method of communicating between its general offices in St. Paul, Minn., and its stations. The plan is to place each station on a division in direct telephonic communication with the division headquarters, and the several division headquarters are to be connected with the general offices by long-distance lines. In this way much necessary information of importance to the traffic and operating departments, which, on account of the limitations of the telegraph system, must now be sent by mail, can in the future be telephoned at once. The new service is expected to result in a considerable saving and it will be extended so as to do away with the old system wherever practicable.

EXTENSIONS AND IMPROVEMENTS.

Orlando, Fla., has a local and long-distance telephone system which has recently been greatly extended.

It is reported that the Winchester Telephone company of Winchester, Va., will build a new line from Shepherdstown, W. Va., to Summit Point, W. Va., via Kearneysville, Lectown and Middleway.

A telephone line has been constructed between Killian and Columbia, S. C., and the extension of the line to connect with Winnsboro, Chester and Charlotte is contemplated by the Carolina Firebrick Works.

Telephone communication has been established between Aguacaliente de Baca, Sinaloa, Mexico, and Choix, Fuerte and Topolobampo, making a complete system throughout the district. This gives these towns direct communication with the United States.

President Caldwell of the Cumberland Telephone company, which recently absorbed the East Tennessee system, states that the Cumberland company has also purchased the Tri-state Telegraph and Telephone company's entire plant, and the plants of the North Alabama and Georgia Telephone and Telegraph companies, and the North Alabama and Georgia Telephone company, all operating principally in the states of Alabama and Georgia.

The railroad commission of Georgia, in its annual letter to the governor, recommends that the telephone companies of the state be placed under the supervision of the commission, as are the telegraph and railroad companies.

GENERAL TELEPHONE NEWS.

The Cumberland Telephone company of New Orleans has obtained a franchise to establish a system in Opelousas, La.

A company will be organized for the establishment of a telephone system from Natchez, Miss., to Newelton and St. Joseph, La.

The Independent Telephone company made an application for a franchise at a recent meeting of the City Council in Cripple Creek.

The Waxhaw (N. C.) Telephone company has been incorporated, for construction of long-distance service to Charlotte. W. J. King is the manager.

The El Dorado Springs (Mo.) Telephone company has been incorporated, with a capital stock of $10,000, by C. A. Ross, Frank W. Hiatt and A. P. Nichols.

The Gaston Telephone company of Stanley, N. C., has been incorporated, with a capital stock of $10,000, by M. C. Hunter, E. L. Pegram, Jr., and C. D. Homesley.

The Quick Telephone company has been incorporated at Harrisonville, Mo., with a capital stock of $20,000, by Shem Zook, Isaac Zook, Maurice Quick, P. H. Wirt and others.

The Island Telephone company of Charleston, S. C., has been commissioned, with authorized capital of $4,000, to establish lines between Charleston and some of the neighboring islands.

The Citizens' Telephone and Construction company of Nashville, Tenn., has been chartered, with a capital stock of $10,000, by H. A. Campbell, W. H. Wiggerman, A. W. McMackin and others.

The Rock County Farmers' Telephone company, to operate specially in Rock County, Wis., has filed articles of association. The capital stock is $10,000, and the incorporators are Richard Valentine, C. S. Jackman and W. H. Palmer.

The Vermilion County Telephone company of Danville, Ill., has been incorporated, with a capital stock of $60,000, to operate a telephone system. The incorporators are Charles F. Haworth, William Henderson and John Fletcher.

Damages of $4,500 have been awarded to a physician of Petersburg, W. Va., who sued the Petersburg and Franklin Telephone company for injuries received. The plaintiff had been thrown from his horse after the animal's feet had become entangled in some of the telephone wires. The entire telephone system is probably not worth over $1,000, but the court's judgment is collectable, as the stockholders, including the judge who sat in the case, the plaintiff's attorney, and other lawyers interested, and the plaintiff's partner, are said to be mostly wealthy men.

MANUFACTURERS AND DEALERS.

The latest and most novel constructions in telephones manufactured by the Central Telephone and Electric company of St. Louis are illustrated and described in a 1901 catalogue recently issued. The pamphlet shows wall and desk instruments, test telephones, switchboards, drops, etc.

The National Automatic Telephone company of Chicago suffered a severe loss by fire recently. The stock was almost completely ruined, the damage amounting to $10,000 or more, of which only $4,000 is covered by insurance. However, the company expects to be doing business again shortly.

The many friends of William Hauptman, well known in telephone circles through his connection with the Modern Telephone and Supply company, Chicago, will be interested to know that he is now connected with the sales department of the American Electric Telephone company, in the capacity of traveling salesman. Mr. Hauptman is a practical telephone man, and his friends predict for him a successful career.

The American Electric Fuse company of Chicago is issuing a little pamphlet showing the way in which fuses, fuse blocks, lightning arresters, connectors and other specialties manufactured by the company are made, and also the manner in which they should be used. The company says this is the only thing of this sort that has ever been issued in the history of the telephone business, and that it is a very valuable book for any telephone man to have. It has been compiled with great care and will be of assistance in a great many cases in locating the source of trouble and in preventing loss and damage which otherwise might result. It will be sent free to anyone desiring a copy. The American Electric Fuse company has recently adopted a new rule by which the company guarantees for one year everything which it manufactures, offering to pay all expenses of shipment or other charges in case any goods are found to be in any manner defective. The company has a limited number of second-hand telephones on hand of standard makes which it can sell at a very reasonable price and which are said to be just as good as new.

Ohio Notes.

Probably the most important event in telephone circles in this state within the last week is the granting of a franchise to the Stark County Telephone company by the city of Canton. This was done at a meeting of the City Council last week, and coupled with the granting of the electric-railway franchise to Thomas L. Childs, marks a great advance in electrical matters in Stark County. The Bell Telephone company made a hard fight against the passage of this ordinance, but failed. The charges for instruments are limited to $24 per year for residences and $36 per year for business houses, all instruments to be connected up with the long-distance wires. The poles are to be set in accordance with the instructions of the city engineer, and no wires are to be nearer to the ground than 30 feet. Hon. R. S. Shields, who is interested in this company, said that as soon as the preliminaries are completed, the company will be organized and a first-class exchange will be put in.

The Columbiana County Telephone company has built its lines up to the city limits of Alliance, and asked the council for a franchise for a plant in the town. Some time ago this movement was started, and because of some irregularity, the first ordinance was not good. The company had seven friends in the council, however, and at the beginning of the meeting recently they were all present. One of them was called away. It required the full seven to pass the measure, but the meeting was allowed to go on without this man. When the remaining friends of the measure saw that the chairman would recognize no motion to adjourn or anything else, five of them left the room after the motion for final passage had been put. The chairman counted them present, however, according to Speaker Reed's rules, he said, and the vote was taken, one in favor and five against. President S. C. Thayer was very much disappointed at the manner in which he was defeated in securing the franchise, especially since he had about 90 business men ready to take the service as soon as the plant was established. This will likely not end the matter, as he is not a man to be taken back by such a thing as this. If the law giving the probate judge authority to act is sustained in the second hearing in the Supreme Court, he will have one more opportunity.

F. E. Lester of the Massillon Telephone company says that his company will soon begin the construction of a toll line from that place to Canton to connect with the Stark County system when it is built. He says that it will be owned by his company, and that the tolls will be less than those charged by other lines. This company also expects to connect with Youngstown and some other points. It would have connected with Alliance had the Columbiana County company been granted a franchise there.

The Harrison Telephone company, incorporated recently, has been granted a 20-year franchise by the Village Council of Harrison. The material for the plant has already been purchased, and it is stated that it will be in operation within two months. R. C. Crampton, who has been with the Bell company at Blenchester, will be the manager of the Harrison system.

The storm which passed over this state a few days ago did much damage to the telephone and telegraph lines. In some places they were rendered entirely useless and in others the wires were down and the service was very bad for a day or two until repairs could be made. At Niles the cable of the Warren and Niles Telephone company broke and fell to the ground. The wires of the Bell company also suffered at Niles and Warren, but not so badly. At Chagrin Falls the 75-foot poles of the local telephone company fell and the switchboard was burned out, rendering the plant useless and crippling the electric railway, as its trolley wires were pulled down. The People's Telephone company at Akron suffered loss by wires being torn down and poles broken. The Central Union had the same experience there, as did the Postal and Western Union Telegraph companies. Damages are also reported at many other points in the state, but this section suffered perhaps more than any other, as it seemed to be directly in the path of the high winds.

The Western Union Telegraph company's office at Portsmouth has been moved from Market street to the Newman building on West Second street.

President S. C. Thayer of the Columbiana County Telephone company has published an open letter to his patrons who use the long-distance lines, in which he says that if they expect prompt service at the central office they must confine the use of their instruments to their own homes or business houses; that the company cannot give good service where the telephones are made public property in the neighborhood where they are located, and that hereafter when anyone calls he will be asked if he is a subscriber, and if he is not the regular toll rates will be charged up to the telephone that calls. In this way he hopes to confine the use of the instruments to those who pay for them and get rid of complaints arising from the constant use of the lines by those who are not subscribers.

The Postal Telegraph company has leased the basement and top floor of the Mercantile Bank building at Cleveland, and when they are put in shape the offices will be moved from the Perry-Payne building to the new location. The basement, which is only a little below the street level, will be used for offices and the top floor will be used for the operating room. The building will be altered and fitted up with the latest devices for the rapid dispatch of business.

It is stated that the United States Telephone company and the Pittsburg and Allegheny Telephone company have signed a contract for long-distance service that will give the Independent companies of Cleveland and other Ohio cities an outlet east and the eastern company connection west, that will prove of great advantage to both. The Cuyahoga Telephone company is directly interested in the matter. The contract is for 99 years.

A movement is on foot at Middletown to organize an Independent telephone company. It seems that the people there are not satisfied with the service they are getting. An ordinance is being prepared to be presented to the Town Council asking for a franchise.

The Swanton Telephone company of Swanton, Fulton County, has been incorporated, with a capital stock of $10,000, by P. J. Lenhart, F. A. Strempel, F. J. Spencer, Charles F. Stolzer and H. T. Brigman. They will build a line connecting towns in Fulton and Lucas counties, with connections with Toledo.

The Farmers and Merchants' Telephone company of Warsaw, Coshocton County, has increased its capital stock from $5,000 to $15,000. J. P. Darling is the president and S. C. Kissner, secretary.

O. M. C.

Telephone News from the Northwest.

A new switchboard has been received for the exchange at St. Peter, Minn.

A telephone line is being built between Watertown and Mayer, Minn.

A local system will be completed for Tyndall, S. D., in a few weeks.

The Wisconsin Telephone company has removed its instruments at La Crosse, Wis., from the express companies' offices. About two years ago, when the fight was strongest with the local company, the express companies ordered out the Wisconsin instruments. The company thereupon offered to let them remain free, rather than have them taken out.

The Wisconsin Telephone company's new line between La Crosse and Eau Claire, Wis., will be completed and in operation by January 1st.

A general meeting of a number of the Independent telephone companies of Minnesota was held in Minneapolis lately to determine on an equitable method of distributing tolls, where a message passes over more than one company's line.

The People's Telephone company of Scotland, S. D., has been incorporated, with $3,000 capital stock.

The American Telephone and Telegraph company is adding three new circuits to its line from Tomah, Wis., to La Crosse.

The Oakland (Iowa) Telephone company has completed a line to Carson.

The Standard Telephone company of Waukon, Iowa, will declare its usual dividend of 10 per cent. the first of the year.

The telephone exchange at Bancroft, Iowa, is being overhauled and improved.

The Iowa Telephone company's wires at Manson, Iowa, recently sagged from the weight of sleet until they crossed with the electric-light wires, burning out several instruments.

The Dubuque (Iowa) Telephone company will declare a 20 per cent. dividend.

The Standard Telephone company has completed the work of rebuilding its exchange at Dyersville, Iowa.

The Hedrick Telephone company is building a toll line to Ottumwa, Iowa, where it will connect with the Ottumwa Telephone company.

C. R. Potter, who has been in charge of the Creston (Iowa) office of the Iowa Telephone company, has been transferred to Red Oak, Iowa. He is succeeded by Frank Schuyler of Des Moines.

A telephone line is to be built from Riley, Wis., to the Madison road, where it will connect with the Madison and Mount Horeb line.

The exchange at Warren, Minn., was recently damaged by fire.

Ege & Caniff, owners of the telephone system at Centerville, S. D., contemplate extending lines into the country.

W. S. Burroughs will establish an exchange at Bridgewater, S. D., if sufficient patronage can be secured.

The local exchange for Red Lake Falls, Minn., is being equipped and will soon be in operation.

It is suggested in Spokane, Wash., to put in telephones for the use of night policemen in the outskirts, who now have to go off their beats to report or to summon assistance.

The Pacific States Telephone company contemplates extending a line from North Yakima, Wash., to Prosser, and perhaps to Pasco.

Musser Bros. of Des Moines expect to have their new exchange at Atlantic, Iowa, completed by December 10th.

R.

The American Telephone and Telegraph company makes the announcement that it will, on January 15, 1901, issue 80,000 more shares of stock at par, $100 per share, making $8,000,000, to complete the issue authorized earlier in the present calendar year. On the stock exchange in Boston on November 24th American Telephone and Telegraph stock was quoted at $160 a share.

DOINGS OF SOCIETIES.

Illinois State Electric Association.

The first annual meeting of the Illinois State Electric association was held at Champaign, Ill., on November 27th. The meeting was called to order at 10 a. m. by President Gerlach, in the Engineering Hall of the University of Illinois. President Draper of the University presented an address of welcome, describing the work of the institution. A business meeting followed, at which the following-named officers were elected:

President—J. D. Gerlach, Chester.
Vice-president—E. B. Hillman, Barry.
Secretary—H. E. Chubbuck, Quincy.
Treasurer—D. Davis, Litchfield.
Executive Committee—J. H. Baker, Sullivan; W. B. McKinley, Champaign; R. L. Allen, Joliet; J. F. Porter, Alton; W. E. McCullough, Beardstown.

In the afternoon Prof. A. P. Carmen of the University of Illinois delivered a lecture before the association on "High-potential Phenomena." The lecture was illustrated with apparatus. Visits were then made to the laboratories and shops of the University.

The closing feature of the meeting was a banquet at the Hotel Beardsley at 8 p. m. Professor Aldrich of the University made a very good address, after which, instead of the usual responses to toasts, papers were read as follows: "Meters vs. Flat Rates," by C. E. Hay of Springfield, with discussion by A. H. Pinkel, W. E. McCullough and others; "Enclosed Long-burning Arc Lamps," by W. J. Ferris of Monmouth, with discussion by J. S. Daily and S. E. Burckman; "Desirability of Moderate-sized Cities Operating Day Power Circuits," by H. J. Pepper of Champaign, with discussion by A. K. Stiles, H. J. Frith and C. H. Langford; "Should Stations Furnish Free Incandescent-lamp Renewals?" by C. A. Vallette of Edwardsville, with discussion by D. Davis and G. D. Locke; "Minimum Monthly Charges and Meter Rent," by J. S. Daily of Chillicothe, with discussion by B. G. Smith and E. B. Hillman.

W. A. Martin of Quincy exhibited a number of blanks and forms of different kinds. The paper by Mr. Ferris was of an especially interesting character, and received much attention. The meeting drew a larger attendance than was expected, about 70 companies being represented, and was, in all other respects, very satisfactory. Rock Island has been mentioned as the place for the next annual meeting, which is to be held on the fourth Tuesday of November, 1901.

Roentgen Society of the United States.

The programme for the first annual meeting of the Roentgen Society of the United States has been announced. The meeting is to be held at the Grand Central Palace, New York city, December 13th and 14th. At the opening session on Thursday morning committees will report, officers will be elected and other business transacted. At the succeeding sessions of the convention the following papers will be presented: "The Development of the X-ray Plate," by Dr. J. N. Scott, Kansas City, Mo.; "Application of Roentgen Rays to Dentistry," by Dr. C. Edmund Kells, Jr., New Orleans, La.; "The First Legal Victory of the X-ray Shadow as Seen by the Iowa Jury," by Dr. F. Wesley Sells, Murray, Iowa; "A Review of Cases of X-ray 'Burns,'" by Dr. E. A. Florentine, Saginaw, Mich.; "X-light Apparatus for Physicians in the Country," by Dr. William Rollins, Boston, Mass.; "On Diagnosticating Ostitis, Osteomyelitis and Osteosarcoma by the Roentgen Rays," by Dr. Carl Beck, New York city; "The Monell Position Finder for Centering Skiagrams," by Dr. S. H. Monell, New York city; "Skiagraphy in Oral and Dental Surgery," illustrated, by Weston A. Price, Cleveland, Ohio; "Practical Work with the Static Machine and Vacuum Tube," by Dr. J. M. G. Beard, Fruita, Colo.; "X-ray in Lupus Vulgaris," by Dr. Jos. Hoffmann, Vienna, Austria; "The Electrochemic Action of the X-ray in Tuberculosis," by Dr. J. Rudis-Jicinsky, Cedar Rapids, Iowa; "Demonstration of the Mount Bleyer Electro-arc Chromolinne for the Treatment of Tuberculosis by Colored Light Rays," by Dr. J. Mount Bleyer, New York city; "Indications for General Franklinization," report, by Professor A. Tripier, M. D., Paris, France; "How to Print the X-ray Picture for Details," by Dr. John T. Pitkin, Buffalo, N. Y.; "Standard Pictures in Skiagraphy and How They May be Secured," by Dr. L. A. Weigel, Rochester, N. Y.; "The Monell X-light Standardizing Gauge and Fluoroscope Test," Dr. S. H. Monell, New York city; "The Technique of the X-ray Work," by Dr. Mihran K. Kassabian, Philadelphia, Pa.; "Stereoscopic Skiagraphy," by Dr. L. A. Weigel, Rochester, N. Y.; "General Observations on Crookes Tubes," by H. Westbury, Harrison, N. J.; "Amplifying and Parallelizing X-rays," by Professor Elmer Gates, Chevy Chase, Md.; "Stereoskiagraphy," Dr. G. P. Girdwood, Montreal, Canada; "Demonstration of Skiagraphs of Injuries

at the Elbow Joint, at Time of Injury and the Gradual Repair of Same, Successive Skiagraphs," by Dr. A. H. Schwab, Brooklyn, N. Y.; "Technique of Skiagraphy," by W. C. Fuchs, Chicago, Ill.; "A Demonstration of Electrolytic Interrupters," by E. W. Caldwell, New York city; "The Monell Distortion Landmark for X-ray Negatives," by Dr. S. H. Monell, New York city.

A large room has been engaged for the exhibits of apparatus, tubes, fluorometers, fluoroscopes, plates, coils, motors, X-ray accessories and skiagraphs of actual cases. Dr. Heber Robarts, editor of the American X-ray Journal, of St. Louis, is president of the association and Dr. J. Rudis-Jicinsky of Cedar Rapids, Iowa, is secretary and treasurer. The chairman of the committee of arrangements is Dr. S. H. Monell, 47 West Twenty-seventh street, New York city.

Institute Meeting in New York.

At the New York meeting of the American Institute of Electrical Engineers on November 23d B. A. Behrend of Erie, Pa., presented his paper, "The Mechanical Forces in Dynamos Caused by Magnetic Attraction." The author exhibited a few lantern slides of the machines from which the data in his paper were derived, also a very excellent portrait of Helmholtz. Henry Floy of New York city also presented his paper on "The Plant of the St. Croix Power Company of Wisconsin." The papers were discussed by Messrs. Behrend, Billberg, Dunn, Henshaw, Hering, Mailloux, Pope, Rice, Sheldon, Thompson, Wheeler and Wolcott. At the meeting of the executive committee in the afternoon, the following-named associate members were elected: George Porter Baldwin, San Francisco, Cal.; Warren James Bailou, Woonsocket, R. I.; V. G. Converse, Pittsburg, Pa.; Mikail Andrejevitch de Chatelain, St. Petersburg, Russia; Edward Andrew Deeds, Dayton, Ohio; George Hafer, Jr., Cincinnati, Ohio; James Cezanne Kelsey, Minneapolis, Minn.; Harry Russell Leyden, Hamilton, Ont.; Christopher Meyer Lowther, East Orange, N. J.; George Henry Sethman, Denver, Colo.; Frank W. Springen, Minneapolis, Minn.; Philip Kossuth Stern, New York city; Nathaniel Marion Snyder, Gering, Neb.; George Alexander Walkem, Vancouver, B. C.; Leon Byron Woodworth, Johannesburg, Transvaal. The following-named associate members were transferred to full membership: W. A. Layman, St. Louis, Mo.; Ferd. Schwedtmann, St. Louis, Mo.; Louis J. B. Wall, Perth, Western Australia.

Hamill-Baldwin Wedding in Baltimore.

The marriage of Miss Maria Woodward Baldwin, daughter of Mr. and Mrs. William H. Baldwin, to Mr. Samuel McClintock Hamill of Schenectady, N. Y., formerly of Trenton, N. J., and Cleveland, Ohio, was celebrated at Grace Church, Baltimore, on the afternoon of November 27th. The ceremony was performed by Bishop Paret, assisted by the Rev. Dr. Arthur C. Powell, the pastor. The bride was attended by her brother, Mr. Frank Baldwin, and her sister, Miss Sara Baldwin, as maid of honor. Mr. A. Butler Duncan of New York was the best man. The ushers were Messrs. Robert Emmett, William Woodward and Carroll Baldwin of New York, Mr. Horace Devereux of Colorado Springs, Mr. Barker Gummere of Trenton, N. J., Messrs. Gist Blair and Blair Lee of Washington, and Mr. Summerfield Baldwin of Baltimore. At the residence of the bride's parents a reception was held, after which Mr. and Mrs. Hamill went North on a wedding tour. They will live at Schenectady. Mr. Hamill is a very well-known electrical man, being at present president of the Siemens & Halske Electric company and occupying a prominent position in the General Electric company. He was for a long time connected with the Brush Electric company of Cleveland.

Electrical Production of Phosphorus.

Heretofore phosphorus has been manufactured from bones, being, it is said, the only elementary substance for the preparation of which animal substances are employed. It never occurs uncombined in nature, but is found as phosphate of lime in such minerals as coprolite, phosphorite and apatite. Lately, however, after experiments extending over nearly a year, the Anglo-American Chemical company of Long Island City has demonstrated that phosphorus can be recovered from phosphate rock by means of the electric arc. Two furnaces have been designed by Dr. F. J. Machalske for the reduction of the rock. They are of the crucible type, with an upper electrode eight feet long and four inches in diameter. It is said that about 150 pounds of the phosphate rock can be smelted in 15 minutes, with a consumption of 80 horsepower. The phosphorus vapor set free is condensed under water, and the residual slag is run off in a molten condition. Formerly phosphate rock was mixed with sulphuric acid and used as a fertilizer, one ton of such a mixture selling for about $15. A ton of phosphate rock, however, is said to contain about 200 pounds of phosphorus available by the process described above.

Belden Series Direct-current Enclosed Arcs.

The manufacturer of the Belden system of arc lamps asserts that the lamps possess the three important points of simplicity, durability and refinement of design, and are also characterized by the best of workmanship, long life of carbon and minimum amount of deposit of ashes. The Belden enclosed-arc lamp for series direct-current circuits has a number of valuable features. Its mechanism is very simple and light, but at the same time very powerful, due to the peculiar construction of magnets and armature. The lamp will burn a minimum of 125 hours with one single 12 by one-half-inch carbon and a maximum of 225 hours.

The cut-out of this series arc lamp is called a walking-beam cut-out. The walking beam is pivoted at its center, and when the current is off the gravity of the one end cuts the lamp out, and when the current enters the series magnets the opposite end is drawn down, and after the arc is sprung, should anything cause the arc to lengthen, the lamp is cut out as follows: The lengthening of arc strengthens the shunt magnet and pulls the rocking beam down. This is said to be the best form of cut-out yet introduced, as it does away with all moving cables or wires.

The lamp can be disassembled and reassembled without the necessity of realignment. The clutch is so constructed that vibration or jarring of the lamp cannot cause the upper carbon to slip; it is placed on the inside of the lower end of the carbon tube so that the swaying of the lamp cannot trip it.

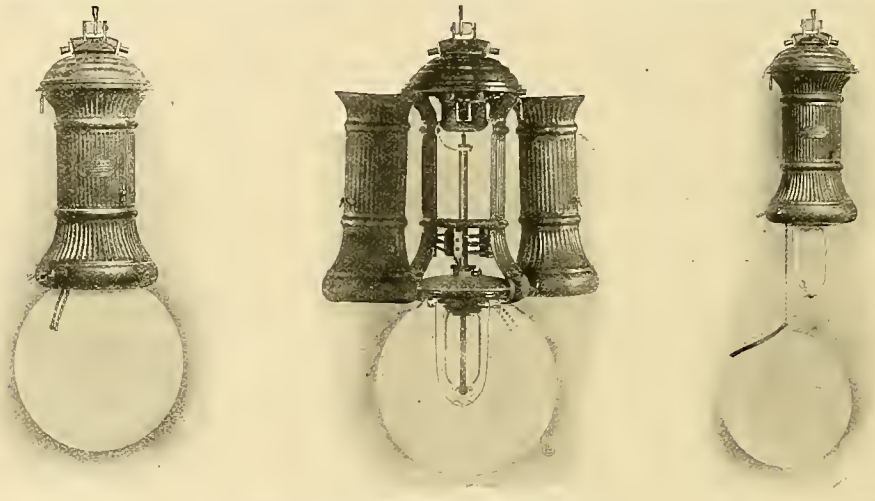
The actuating magnets and mechanism are self-contained, and are connected to the lamp frame with two screws and set at a 45-degree angle. The wire of the magnets is wound on stamped-metal spools which have a stationary core with protruding pole-pieces. The armature is drawn down over these pole-pieces and has an air gap of one-eighth inch, so that friction is practically eliminated. The armature is pivoted so as to give it a walking-beam motion, and as the armature is pulled down the opposite end (which has the carbon tube attached) raises until the proper arc is formed. The upper carbon is on the inside of the carbon tube and the copper cable that carries the current to it only has a movement of the length of the arc, thus eliminating any sluggish movement. By lifting the carbon tube its gravity overcomes any slight friction, and it will respond quickly to any changes of current.

The lamp case is its own frame, and, as may be noticed by the accompanying illustration, is made of four upright stampings, the two side sections being stationary and the other two being doors. The operating mechanism is fastened to a ring (which forms a part of the case) by two screws. By removing these screws the entire mechanism can be removed as one piece and a new one quickly substituted.

It is asserted that this lamp can be trimmed more easily than an open-arc lamp. The inner globe is solid at the bottom, and is removed by releasing a spring; then the carbons are removed by turning one thumb nut. Both carbons pass through the lower holder, so that a carbon cannot be placed in the lamp if not the proper size. In other words, the lower holder is 0.002 inch smaller than the gas cap, so that if the upper carbon passes through the lower holder it is sure to work freely in the gas cap. The upper carbon is merely pushed up until it enters the clamp on the inside of the carbon tube, which always insures a perfect electric path, and is operated by the clutch at the lower end of the carbon tube.

There are no sliding contacts to corrode or cause trouble. The current is carried to upper carbon by means of a flexible cable. The light is claimed to be absolutely steady. The long, steady, powerful pull of the magnets does away with all flickering and jumping of the light. The case is made weather-proof and will withstand any kind of a storm without a flicker. One of the rigorous tests of the lamp was to turn a three-fourth-inch stream of water at 60 pounds' pressure on the lamp while burning.

The lamp, which is manufactured by the Belden-Larwill Electric and Manufacturing company, Fort Wayne, Ind., is of artistic design and is also of short length, which allows it to be used on low ceilings.



Lamp Ready for Use. Case Opened Showing Four Sections. Globe Lowered for Trimming.

BELDEN SERIES DIRECT-CURRENT ENCLOSED ARCS.

Denver Tramway Not a Railroad.

The decision of Judge Palmer in the well-known case of the Denver Consolidated Tramway company against the Board of County Commissioners of Arapahoe County was handed down in Denver on November 26th. The action was brought to prevent the defendants from selling the company's property for the payment of taxes. As a result of the court's decision, the company is now indebted to the county over $84,000. The case will undoubtedly be appealed by the Tramway company to the Court of Appeals.

The suit followed the assessment in 1896 which taxed the franchise of the company. This tax amounts to nearly $10,000 a year. The company bases its objection to the county assessor's assessment of the franchise on the ground that it should be regarded as a railroad company, and that its property should be valued not by the county officer, but by the State Board of Equalization. The latter in its valuation does not assess a franchise as an item for taxation. The court finds against the company on all points.

As to the contention of the company that it is a railroad company under the statute, Judge Palmer says: "The position of plaintiff must be that it was the intent of the Legislature to include in the words 'railway companies' all companies operating railways in this state, regardless as to whether it was an ordinary railway company or a street-railway company. If such was the intent of the Legislature in enacting this law, then it would be proper for our State Board of Equalization to make a valuation of the company's property and return the same to the county assessor for assessment. If street railways were not intended to be included in the term 'railway companies,' then the State Board of Equalization had no jurisdiction in placing a valuation upon the plaintiff's property and returning the same to the assessor, and such act would be null and void.

"When we read the provisions of the act of the Legislature as a whole, we cannot arrive at any other conclusion than that they indicate that a particular kind of road is intended, such railroads as according to popular usage the word 'railroad' without any qualifying or explanatory prefix is generally understood as referring exclusively to ordinary commercial railroads used for the transportation of both passengers and freight, railroads which have termini, a place of beginning and a place of ending, having depots for the reception and discharge of passengers and freight, station houses, locomotives, sleeping cars and palace cars."

As opposed to the view of the plaintiffs, the court says: "The answer of the defendants alleges that the plaintiff is a corporation organized for the sole purpose of running and operating a street railway, and we think it will not be contended that the plaintiff company is operating and maintaining any railroad system other than a street-railroad system; we do not think that the fact that a part of the track on that portion of the system running on the boundary line between Arapahoe and Jefferson counties and is in said Jefferson County, affects the legal character of the company. It is unnecessary to point out the difference in the manner of operation and equipment between the two systems, as they are matters of common knowledge."

Judge Palmer quotes from opinions of the Supreme Court to show that a distinction has been made between railroads and street railways and the opinion concludes as follows:

"It must be evident that the act was not intended to apply to a street-railway company.

"It is a well-settled rule of statutory construction that all words and phrases used in a statute shall be understood and construed according to the improved

and common usage of the language, and that some meaning should be given to every word used. This rule is expressly recognized by our statute and declared to be the law of this state.—Mills' Ann. Stats., sec. 4185.

"From the views we have expressed, and which are supported by the authorities, it follows that we are of the opinion that the injunction heretofore issued in this case cannot stand and it is accordingly ordered that it be dissolved."

Montauk Wire for Fire Protection at Hoboken Piers.

Following the recent terrible fire at its Hoboken docks, the North German Lloyd Steamship company has prepared plans for the construction of new piers and terminals which will give the company docking facilities superior to those of any transatlantic line touching New York, and unsurpassed in any part of the world.

The general plan contemplates the construction of a solid granite sea wall along the entire 900 feet of water front owned by the company. On this sea wall or stone bulkhead a building 850 feet in length and 130 feet wide will be built of steel and concrete. The entire building, two stories high, will be practically non-combustible, as no wood will enter into its construction. The lower floor will be used for the stowing of cargo, while the upper floor will be used for passenger traffic.

From the central building will extend into the river three large piers, from which the steamers will sail. The piers will be protected from fire by a concrete floor, covered by planking. The piers will all be double-decked, the under side of the upper floor, which is carried on steel trusses, being protected by fireproofing. Each pier shed on both floors will be divided into three compartments by efficient fire walls with double automatic fire doors.

As an additional protection against fire, the automatic-sprinkler system, especially designed to meet the requirements of the locality, will be introduced on all floors of the bulkhead building and of the pier sheds. In addition to this, there will be an independent system of fire mains and hydrants, extending all through the buildings.

As a further protection, the entire structures will be provided with the Montauk fire-detecting wires, with loose coils and reels of the same wire to be laid over stored merchandise. This is a great compliment to the Montauk Multiphase Cable company.

These improvements, as planned by the North German Lloyd, will insure the safety of its property and the security and comfort of passengers, as far as human ingenuity can do so.

Assessed Valuations of Chicago Corporations.

The Illinois State Board of Equalization met in Springfield on December 3d and fixed the assessed values of the capital stock of corporations in the state. The value fixed upon for the corporations in Chicago was $2.435.000, as compared with $1.400,000 last year. The Chicago Teachers' Federation has been making strenuous efforts to have the assessed value of the Chicago corporations placed at $53.600.000, but its work was evidently of no avail. Following is the assessment on some of Chicago's franchise corporations:

	Capital Stock.	Assessed Value of Tangible Property.	Assessed Value of Capital Stock
Chicago City Railway company	$13,000,000	$1,822,499	$700,000
Chicago Union Traction company	32,000,000	2,690,630	600,000
Chicago Consolidated Traction company	15,000,000	377,813	100,000
Chicago Electric Traction company	.....	10,000	10,000
Chicago General Railway company	10,000,000	30,311	20,000
South Chicago City Railway company	1,603,800	185,322	50,000
General Electric Railway company	5,000,000	5,000	5,000
People's Gas Light and Coke company	28,668,800	3 865,893	450,000
Chicago Telephone company	5,000,000	999,734	175,000
Chicago Edison company	5,971,100	954,019	325,000
Calumet Electric Street Railway company	.....	50,000	50,000
American Telephone and Telegraph company	100.000	118,755	.....
Central Union Telephone Company	6,605,300	2,900,202	150,000

Electrical Opportunities in Calcutta.

Consul-general R. F. Patterson of Calcutta, India, says that electricity is now beginning to be extensively used in Calcutta for various purposes, such as lighting, fans to take the place of punkhas that were pulled by coolies, for driving machinery, etc., and that there is an opening there for the sale of electrical machinery and goods, which American manufacturers should take advantage of. Mr. Patterson says: "I would advise correspondence with Messrs. Kilburn & Co. here, who have an electrical plant, and are furnishing electricity and electrical machinery and goods; also with the following-named firms in Calcutta, who are dealers in such machinery and goods, viz., Osler & Co., Octavius Steel & Co. and the Calcutta General Electrical company. All machinery is now entered duty free in India, but there is a duty of five per cent. ad valorem on goods. There is a direct line of steamships between New York and Calcutta, but a cheaper freight on machinery and goods not required for immediate use would be by sailing vessels via the Cape."

CORRESPONDENCE.

London Letter.

London, November 20.—The New Waterloo and City (Baker street) railway will be the most far-reaching of any of the underground electric railways in London, inasmuch as it will not only tap all the existing underground railways in London, but will also connect four important trunk lines, namely, the Southeastern at Charing Cross, Southwestern at Waterloo, the Great Central at Marylebone, and the Great Western at Paddington, where the terminus will be. The new railway will be almost on the same scale as the "Twopenny Tube," although I believe it will have more stations. The line is badly needed, and when it does come into actuality it will cause quite as much stir as did the Central London railway.

The work of sinking shafts along the line of the new "tube" from Charing Cross to Hampstead has been begun, more than 200 men being at work. Mr. Yerkes will ask Parliament to amend his charter so as to permit the building of four tunnels, each 16 feet in diameter, instead of two tunnels each 11 feet six inches in diameter, as at present provided for. It is his intention, too, to have his tube radiate in branches under Hampstead Heath and the country to the north for long distances, and then to have comfortable workmen's cottages and buildings constructed whose rents shall be low and their conveniences unusual for that class of dwelling. In the early morning and evening workmen's trains will be run on the express line between the heart of London and the residential district, the fares to be as low as they can reasonably be made.

Great dissatisfaction is felt at the way the streets of central London have been broken up for the purpose of perfecting the new system of Postoffice telephones. To get the new cables into position has been a very difficult business at many points, so complicated is the tangle of cables and pipes of one sort or another already in occupation of the limited space, with the added necessity for closing down the work at several points in order to make way for two great processions we have had during the last fortnight. It was hoped at one time that a small part of the center of the system might have been available for use at the beginning of the New Year. But delays, from one cause or another, will necessitate the postponement of the opening until the end of May, or possibly the beginning of June. The contract has now been placed for the Bloomsbury section of the work—the section lying to the north of the Strand as far as the Euston road and lying between Hatton Garden in the east and Regent street in the west. The great switchboard to be set up in the building now occupied by the Savings Bank Department, which I have already described, is well in hand, and house room is now available for the central exchange whenever required.

An engineer named Pickworth, said to be an American, was killed on Friday by an electric shock at the Metropolitan Electric Supply company's station. Pickworth appears to have taken hold of switches with both hands and the electric current passed right through the man's body. Death was instantaneous. Forgetfulness on Pickworth's part is believed to be the explanation of his handling two switches at once.

It is said that numbers of obscure electricians are spending "laborious days and nights devoid of ease" in the hope of winning fame and fortune by improving upon Marconi. They have their work cut out. Though wireless telegraphy is so far mostly devoted to marine use, it is interesting to learn that the chief of the London Fire Brigade has an installation of wireless telegraph at work between two suburban stations miles apart. Despite the intervention of masonry and smoke, the Hertzian waves outclass X-rays in penetrating obstructions. Marconi is lying low at present, hard at work among his batteries, where he receives no interviewers or curious people who might have a weakness for plagiarizing ideas.

The enormous popularity of the Paris "tube" is shown by the fact that the number of passengers carried from the opening of the line on July 19th to October 31st was 13,000,000. It may be pointed out that while the London "tube" conveys between 90,000 and 100,000 persons a day, the Paris railway has on certain days established a record of 170,000 people.

W. H. B.

New York Notes.

New York, December 1.—At a meeting of the Rapid Transit commissioners, held on Thursday, a resolution was adopted formally abandoning the plan for pipe galleries as a part of the subway railroad. The plans of the commission were opposed by the heads of the city departments affected, and Contractor John B. McDonald also opposed them on the ground that his contract was for the construction of the subway, and that the additional cost of the pipe galleries would be an added burden on him. The commission's plans called for pipe galleries to contain the sewer pipes, water mains and gas mains, which will be relaid in building the subway between the City Hall terminal station and Great Jones street. The estimated cost of the galleries was $400,000, and work on them was begun and then suspended a month ago.

The Metropolitan Street Railroad company is contemplating a plan to run storage-battery cars from Sixth and Eighth avenues through Center street and up Center street past the Brooklyn bridge. The Chamber street, Houston street and Bleecker street lines will be fitted with the storage-battery cars in the next few weeks. The Fourteenth street line will be in operation before the first of the year. The Belt line and one or two others will be the only horse cars left after a few months. The work of equipping the Broadway, Lexington and Columbus avenue lines with the underground-conduit system has been completed, but the cable cars will be run until next spring, as it has not been considered advisable to test the new arrangement in the winter. President Vreeland of the Metropolitan company and the passenger agents of the various railway and steamboat lines are interested in a discussion of the advisability of starting an inter-railroad street railroad in town for the benefit of passengers arriving here by one railroad or steamboat route and wishing to make close connections in order to depart by another. The service under discussion is expected to eradicate wholly the annoyances of transferring from one line to another, and to reduce the time of intramural traveling probably one-half.

The Court of Appeals handed down an important decision at Albany, on November 27th, fixing the value of the property of the Manhattan Railway company which is subject to taxation at $9,492,307. This is the termination of a litigation that was begun in 1894, when the company's property was assessed at $17,860,712. A new escalator, or moving stairway, was put in operation this week at the Twenty-third street and Sixth avenue station of the Manhattan elevated road.

Subscriptions will be received on December 7th by Kuhn, Loeb & Co. for $10,000,000 Third Avenue Railroad company first consolidated mortgage four per cent. 100-year gold bonds. These are part of a total authorized issue of $50,000,000, of which $13,443,000 are reserved to retire the outstanding bonds of all other issues of the Third Avenue Railroad company and its controlled lines. Principal and interest are unconditionally guaranteed by the Metropolitan Street Railroad company. The new bonds will ultimately become a first lien on all of the company's properties, including the controlled companies. The fixed charges of the Third Avenue company and its controlled companies, inclusive of the issue of $35,000,000 of the new bonds authorized, amount to $2,005,689, which will be reduced $165,000 by the replacement of the existing funded debt with the new four per cent. bonds. It is estimated that after the completion of the electrical equipment now in progress and with the economies resulting from the close connection with the Metropolitan the annual net earnings of the Third Avenue will be at least $3,000,000. Application will be made to list these Third Avenue bonds on the New York Stock Exchange. The subscription price is 104½ and accrued interest. Bonds awarded are to be paid for on December 14th.

The Arlington Copper company has been organized, with a capital of $2,500,000, to develop an old copper mine at Arlington, N. J. This mine is said to be one of the oldest in the country, the first shaft having been sunk in 1750. Experts have given their opinion that there is 5,000,000 tons of ore in sight. The new company owns about 150 acres of land, all of which is underlaid with copper ore. The following-named gentlemen are officers of the company: President, William McKensie of Passaic, N. J.; secretary, William C. Eakins; general manager, Charles L. Dignowity.

The Board of Health accuses the Staten Island Electric Power company of a misdemeanor in creating noises in the operation of its plant, which disturb the sleep of residents in the vicinity of the power house, and the company has been notified to appear for trial in the Court of Special Sessions in the borough of Richmond. Counsel said if the company was convicted and the plant had to shut down, the trolley cars would cease running, as they got their power from the company. It was also said that the entire borough would be in darkness, as the company supplied the electric lights. Counsel said that the company could not operate its plant without noises.

M. L. G.

New England News.

Boston, December 1.—Following the example of the roads in the eastern part of the state of Massachusetts, the lines centering in Worcester, known as the "heart of the commonwealth," are also to be united in one big company, not so heavily capitalized as the Massachusetts Electric Companies and the Boston Elevated company, to be sure, but making up quite an important railway centralization. Its stock will be only the aggregate amount of the capital stock now issued by the several companies in the deal, or $2,129,400. Into the corporation will be merged the Worcester and Marlboro, the Worcester Consolidated, the Leominster and Clinton, the Worcester and Suburban, the Fitchburg and Suburban, the Leominster and Hudson and the Worcester and Clinton lines. The Massachusetts railroad commissioners will be asked to sanction the project and the new directors slated are: Oliver Ames of Boston, A. George Bullock of Worcester, Samuel Carr of Boston, T. Jefferson Coolidge of Boston, Francis H. Dewey of Worcester, Otis E. Putnam of Worcester, Hon. Stephen Salisbury of Worcester, G. Henry Whitcomb of Worcester and Colonel Samuel E. Winslow of Worcester.

At the recent annual meeting of the Massachusetts

Electric Companies in Boston, the big consolidated railway system which embraces the principal electric-railway lines of Massachusetts along the coast line, north and south of Boston, the stockholders elected the following-named trustees, to serve for the three years next ensuing: S. Endicott Peabody, Everett W. Burdett, E. Rollins Morse, Philip L. Saltonstall and Philip Dexter. Mr. Dexter succeeds S. Reed Anthony, who declined to serve again. The stockholders voted to amend the declaration of trust by changing the time of the annual meeting to the third Wednesday of November. It was also voted to authorize the sale of 3,000 shares of Nashua Railway company stock by the trustees. President Abbott announced to the stockholders some important matters that have been acted upon by the Massachusetts railroad commissioners since the annual report was made up for presentation to them, the principal ones being as follows: Approval of the lease of the Nashua company to the Lowell and Suburban Railway company; assent to the consolidation of the Lowell and Suburban and Lowell, Lawrence and Haverhill; assent to the issue of 10,160 shares of Lynn and Boston stock at $130 a share, the proceeds to be applied to the retirement of certain coupon notes, to the purchase of additional equipment and to certain alterations and improvements in the power stations of the Lynn and Boston company and authorization of the issue of 3,636 shares of Brockton street-railway stock at $110 a share. The railroad commissioners have also given their assent to the consolidation of the Brockton company with the South Shore and Boston and West Roxbury and Roslindale companies, so that within a short time the 14 companies will be reduced to 11, six north and five south of Boston. B.

Canadian Intelligence.

Ottawa, Ont., December 1.—J. A. Shibley, the Napanee (Ont.) millionaire, has made an offer for the purchase of the street-railway system of the city of Kingston, Ont., which is likely to be accepted by the present owners.

The Ontario Department of Public Works has been urged to install its own electric-lighting plant. Such a plant would cost $15,000, but it is claimed that it would result in a saving of $2,000 per annum.

New headgates in connection with the works of the Brantford Electric and Operating company of Brantford, Ont., will be built at a cost of $7,500.

The town of Perth, Ont., has engaged William Kennedy of Montreal to design a power system for the electric-light plant of that town.

W. Temple of Philadelphia, Pa., was in Ottawa recently, and his visit, it is said, was in connection with the establishment, at Deschenes, near Ottawa, of a factory for the manufacture of electrical apparatus.

The Town Council of Thessalon, Ont., has just taken tenders for the supply of an electric-lighting plant of 1,000 lights. A by-law to raise the necessary funds for the purpose of installing an electric-light plant has been passed.

The property owners of the town of Woodstock, Ont., have voted on a by-law to authorize the expenditure of $30,000 on the purchase and improvement of the electric-light plant of that town. The result was a decisive victory for the advocates of municipal ownership, the by-law being carried by 245 majority.

George Hodder and J. D. King have reported to the Town Council of Port Arthur, Ont., in regard to the development of the Current River waterpower for electric-light and street-railway purposes. The total cost is estimated at about $30,000, and includes $15,000 for dam, excavations, flumes, waterwheels and addition to power house, $6,000 for electric-light plant and $2,000 for a power generator. It is recommended that a by-law be submitted to the ratepayers of the town to raise the necessary funds.

It is officially announced that the Canada Cycle and Motor company has acquired the control of the National Cycle and Automobile company, with head office at Toronto, Ont. It is further announced that an agreement with the American Bicycle company secures to the big Canadian company its motor-vehicle rights for Canada, and also all its future inventions and devices and methods of manufacture. As the American Bicycle company is going extensively into the manufacturing of motor vehicles, having set aside three of its factories for that purpose, it will be seen that the agreement is one of considerable importance.

Dean, Shipley & Co. of New York recently proposed to purchase the electric-light and street-railway franchises of the city of Belleville, Ont. The scheme was laid before the City Council, and, after an all-night session, the council decided to accept the terms proposed by the firm and give it the franchises asked for. The firm will acquire the electric street-railway franchise for 20 years, with the option of a renewal for another term of 20 years, subject to the readjustment of rates every 10 years. The firm also acquires the electric-light franchise for 40 years, as well as the gas company's plant, with renewal of franchise for 50 years. The purchasers have undertaken to reduce the cost of street lighting to $65 per lamp per year; to extend the electric railway; to lower gas rates 25 cents per 1,000 feet (viz., to $2), and to supply 1,000 horsepower for manufacturing purposes to the city at a schedule of prices laid down. The firm has been granted exemption from all city taxes, except school tax, for a period of 15 years. Bonds will be issued by the firm for $450,000 to carry out its scheme. Mr. Shipley states that, having examined the waterpower of the Trent River, his company proposes to secure control of the electric-lighting plant of the town of Trenton, Ont., certain waterpowers at Trenton, and to ask from the town a franchise for 40 years for lighting it, and will also provide electricity for other purposes. The firm is also negotiating for power at Campbellford, Ont.

A. V. W.

From the Buckeye State.

Columbus, Ohio, December 1.—The Economy Electric company of Warren, Ohio, has the new plant about completed. The building on West Market street is 30 by 80 feet in ground dimensions and is two stories in height. The principal business at the beginning will be the restoring of burned-out lamps by a process which has proven a success in many severe tests. The fact that the lamps will be paid for or a rebate allowed to those who wish to turn in old lamps will insure a good business from the start. J. W. Holloway of Syracuse, N. Y., will be the manager of the new company.

Will Christy of Akron is negotiating for the purchase of the Elgin City, Carpentersville and Aurora (Ill.) railway, which now extends from Carpentersville to Geneva. He also holds a franchise to enter Elgin from Chicago by way of Wheaton.

The Sandusky, Norwalk and Southern Railway company, incorporated last week, will operate in conjunction with the Sandusky, Milan and Norwalk railway and will extend the line from its present terminus, Norwalk, to Mansfield.

Guy M. Gest of Cincinnati has been awarded the contract for building the conduit system for the Western Union Telegraph company at Memphis, Tenn. There were a large number of contractors striving for the business, but Mr. Gest's plans seemed to be best adapted to the needs of the company and were adopted by the management. Mr. Gest has just completed a conduit system in that city for the Bell Telephone company. The city has required all the telegraph and telephone companies operating there to use the conduit system, and Mr. Gest will have built two of them when this one is completed.

Kerlin Bros. have sold the plant of the Tiffin Light and Fuel company to a company made up of Tiffin men, the consideration being estimated at $75,000. William H. Dore will be president and general manager of the new company, Edward Simon, Toledo, secretary and treasurer, and Frank Henderson, Tiffin, president.

The Youngstown and Sharon Street Railway company has filed notice with the secretary of state that the stockholders have voted to increase the capital stock from $200,000 to $600,000. Caleb B. Wick is president of the road and M. A. Norris, secretary.

The Citizens' Street Railway company of Mansfield has made arrangements for extensive improvements in the power plant, which will be required to furnish power to the Shelby extension when it is completed. Two 400-horsepower generators, an 800-horsepower Corliss engine, two new 500-horsepower boilers and some other machinery will be added to that already in use in the railroad department. A power generator and two new electric-light machines will also be installed, which will add greatly to the capacity of these departments.

The Lima and Findlay Electric Railway company was incorporated last Tuesday, with a capital stock of $200,000, to build a line from Lima to Findlay, a distance of nearly 30 miles. It will almost parallel the Wheeling and Lake Erie railroad. Work is already going forward on the grading, which will be completed as soon as possible. Rails will be laid in the early spring. The line will pass through Cridersville, Wapakoneta, St. Marys, Minster and some other towns. The incorporators are Theo. D. Robb, J. D. S. Neely, Louis Koch, Frank Sieber and A. Miller.

The Cleveland Construction company of Akron, Ohio, was incorporated this week by Will Christy, J. R. Nutt, W. E. Davies, R. E. Inskeep and D. W. Pell. The capital stock is placed at $100,000. The company has been in business for some years and has constructed a number of important electric railways. The main feature of the business will be the construction of railway, light plants and telephone systems. It will also promote and handle properties.

Frederick Maurer has sold his light plant at Bloomville to Frederick Geiger. The consideration is said to be $15,000.

William Sheridon of Toledo is promoting a line from Lima to Indian Lake, a distance of 22 miles. He claims that it is ably financed, and that most of the contracts for material have been awarded.

The state association of county auditors, at a session held in Columbus a few days ago, put itself on record as being in favor of taxing corporate franchises in order to raise the amount of money for public purposes. The auditors also took the stand that machinery and power houses should be taxed as real estate and that street railways should be taxed as chattels and returned by the annual board of equalization rather than have values fixed by the decennial board.

William R. Hattersley, a young business man of Toledo, is promoting an electric line from that city to Defiance, to follow the line of the Wabash road. This matter has been kept quiet, but from the fact that an application had been made for a franchise in Defiance, the story got out. Mr. Hattersley said he preferred not to name any of the other men interested in the matter, but that a company would soon be incorporated, with a capital of $2,000,000, to build the line. It is proposed to begin the construction of the road in the spring.

The Fostoria Incandescent Lamp company of Fostoria has partially closed down in order to install some new machinery. It has added inner globes for arc lamps to its lines.

George H. Chamberlain of Elyria is securing the right-of-way for an electric line from Elyria to Grafton, and it is said that it will be built the coming year. The connection between this line and the Cleveland, Elyria and Western, will be very close, and the latter company will likely furnish the power to operate the new line.

A report from Marietta is to the effect that a company of local capitalists has been formed there to build an electric line from that place to Lowell, 20 miles up the Muskingum River.

Articles of consolidation have been filed in the office of the secretary of state by the Youngstown Gas and Electric company and the Merchants' Light, Heat and Power company, both of Youngstown. The name of the new company is the Youngstown Consolidated Gas and Electric company, and the capital stock is placed at $955,000. To holders of stock of the Youngstown Gas and Electric company, two shares of the new company will be issued for each of the old. There are 4,500 shares of the old stock, representing a capital of $450,000; hence 9,000 shares of new stock will be issued. For stock of the second company an even exchange will be made. This company has 550 shares of $100 each, making a total of $55,000. The directors are Randall Montgomery, Myron H. Norris, Harry G. Hamilton and Willis H. Park of Youngstown; Martin A. Devitt, Chicago; George Penhale, New York; Harlan W. Whipple, East Orange, N. J. The officers are as follows: President, Randall Montgomery; vice-president, Harlan W. Whipple; secretary and treasurer, P. T. Culwell, Youngstown. The principal office will be at Youngstown.

President Thomas Walsh of the Akron and Cuyahoga Falls Rapid Transit company has announced the sale of that road to a syndicate made up of the following-named persons: Andrew Radel, Bridgeport, N. J.; Judge Gottfried Kreuger, H. A. Doremus and William Sheerer, Newark, N. J., and E. H. Radel, Orange, N. J. The purchase price is $500,000. The new owners of the road have taken possession and will make some very pronounced improvements, including a large power house at Akron, double track on the Barberton line and the addition of 50 new cars. The road is 20 miles in length, with lines extending from Akron to Cuyahoga Falls, Kent and Barberton.

The Millcreek Valley Electric Railway company has made application to the commissioners of Hamilton County to double-track its road for several miles.

An agreement has been reached between the Akron Realty company and the Northern Ohio Traction company by which the latter is to build a double-track line from Akron to Barberton. The realty company agrees to donate the right-of-way, and a handsome boulevard, 100 feet wide, will be constructed the entire distance, with the hope that the two towns may eventually be connected and form one city.

A three-cornered fight is on at Steubenville over the lighting privilege. The Steubenville Gas and Electric company has an ordinance before the council now, but both the Steubenville and Mingo Electric Railway company and a syndicate of Wheeling, W. Va., capitalists are after the franchise.

William Miller, chief electrician of the Bellevue (Ohio) Light and Power company, has resigned and is succeeded by W. H. Covill.

The Little Miami Traction company of Xenia was incorporated a few days ago, with a capital stock of $50,000, to build an electrical line from Xenia to Cincinnati. John P. Martin, the well-known electric-railway man of Xenia, has been instrumental in the organization of the company, and this is the beginning of a plan which he has been maturing for some time. The other incorporators of the company are Charles J. Christee and W. E. Nutton of Cincinnati, Charles Orr, Rufus P. Ranney and R. L. Andrews of Cleveland and Warren D. Riddell of Xenia. As now planned, the road will extend from Xenia to Cincinnati, passing through Springfield, Wilmington, Lebanon, Dayton, Middletown, Loveland and some other smaller towns. The charter will allow the road to carry passengers, express, freight, baggage and packages. The line is about 16 miles shorter than that of the Pennsylvania railroad from Xenia to Cincinnati, and the territory that it traverses is quite as good, both in farming and manufacturing.

The commissioners of Stark County have at last granted Thomas L. Childs a franchise to build an electric line along the Canton and Akron road, between Canton and the line between Stark and Summit counties. The road will likely pass over a private right-of-way in Summit County, as Mr. Childs wishes to reach Blue Pond, a terminus of the Akron, Bedford and Cleveland road, and in this way make connection with Cleveland. A company, with a capital stock of $500,000, will soon be incorporated by Mr. Childs, and Judge Kohler of Akron, Hon. John C. Welty and Charles A. Kolp of Canton, and William B. Hoover of New Berlin.

The franchise provides that the road shall be completed by October 1st of next year, but Mr. Childs says it will be in operation by June 1st. It is the intention to begin work at the first of the year. The consents of the property owners have all been secured and all will be ready as soon as the company is incorporated.

There is quite a little uncertainty as to what company will get the franchise south from Columbus through Franklin County now. J. W. Wilson of Dayton has asked for a franchise for two or three different routes, one to Washington Court House and the other to Chillicothe. The Scioto Valley Traction company still seeks to get a franchise in some way, and the Chillicothe, Mount Sterling and Columbus Electric Railway company is not dead, even if it has had a setback.

An interesting contest will be settled at Sandusky and Norwalk the coming week. The Sandusky and Interurban and the Cleveland, Elyria and Western railway companies each seek a route through Erie and Huron counties, in order to complete connections between Cleveland and Sandusky. One company, the Sandusky and Interurban, favors Lorain, and the other company will go through Elyria, so they have succeeded in getting up a rivalry between the two towns. A portion of the distance the companies ask for a franchise along the same route, but at other places it is over a different route.

The City Council of Lisbon has granted H. G. Foltz a franchise to construct an electric railway on certain streets in that place. It is in the interest of a New York syndicate. It is also stated that work will be begun on the line between Lisbon and Salem within a short time.

The Board of Trade of Columbus is making an endeavor to have the electric arches on High street, that city, maintained for another year. They have been kept up both by subscriptions and appropriations from the city treasury for several years. They form one of the features of attraction in the city at night.

The Toledo, Fremont and Norwalk and the Sandusky, Milan and Norwalk companies have reached an agreement by which they will both enter Norwalk over the former's tracks. It is stated that the Toledo road will have cars running into Monroeville within three or four weeks.

The Toledo Traction company has completed the Stickney avenue extension in Toledo, about two miles in length. It is by this line that the Toledo, Fremont and Norwalk line will enter the city.

The Montgomery County commissioners have renewed the franchise of the Dayton, Covington and Troy Electric Railway company, which expires on January 1st.

The Dayton, Springfield and Urbana Electric Railway company has opened a winter pavilion at Tecumseh Park, near Springfield.

A case of interest was decided in the courts at Toledo a few days ago. Some time back a lady boarded a street car there and had no change. She handed the conductor a 20-dollar bill, which he could not change. He asked her to get off and get the money changed. She did so, but later brought suit against the road for $5,000. The court decided for the defendant.

A movement is on foot at Springfield to organize a lighting and power company to compete with the Springfield Light and Power company. It is in the hands of a committee of the Commercial Club.

C. H. Struble has been granted a franchise by the commissioners of Mahoning County to lay gas mains, water pipes and erect poles to carry power and light wires at Struthers. He, with other capitalists, proposes to erect a gas and electric-light plant at that place. O. M. C.

Northwestern Notations.

Minneapolis, December 1.—The Minneapolis fire department has just completed its new alarm system. The headquarters have been removed from Third avenue North and Second street to the new city-hall building. The Gamewell company superintended the work. The equipment of the new office is worth $16,000.

The power from the Apple River plant at Somerset, Wis., was shut off unexpectedly from the St. Paul system recently. The company thereupon fired up its boilers, and in 20 minutes had power on from the St. Paul power house. As soon as the lights went out, everyone who had a telephone rushed to the instrument to learn how long it would be. But the telephone exchange was incapacitated, as the lights were out in the central office, and the flash-lamps were without power.

The street-railway company of Council Bluffs, Iowa, is securing all the laborers available and is still without as large a force as is wanted.

The Pella Light company of Pella, Iowa, has ordered a 120-horsepower Corliss engine, and will soon be able to render an all-night service and furnish power for small motors.

The Des Moines (Iowa) Edison Light company has filed a mortgage for $750,000 covering its entire property.

The City Hall and Courthouse Commission of St. Paul contemplates installing a lighting plant for the building. Testimony was taken from people having experience with light from the local company and also from private plants. All tended to show that it would be a saving venture.

The council of Jamestown, N. D., has refused the application of the Hughes Electric company of Fargo, N. D., for a lighting-plant franchise. The council will frame a franchise which will be acceptable and submit it to all companies desiring to build a plant.

The Tacoma-Seattle Electric Railway company is preparing for vigorous work on the construction of a line between those cities. The right-of-way is being completed.

The Twin City Rapid Transit company will discontinue the construction of short, single-truck cars, and all made hereafter will be for double trucks. In St. Paul the Seventh street line will be equipped with the longer cars, and next the Grand and Lafayette lines.

Electricians of Duluth, Minn., will appeal to the coming Legislature to extend the provisions of the law governing the class of trade to include that county. At present it applies to only counties having 125,000 population. They want it changed to 75,000 population.

This is to be the last year that the street cars of Des Moines, Iowa, are to be heated with stoves. The company proposes hereafter to fit its cars with electric heaters.

It is reported at Des Moines, Iowa, that an eastern syndicate has been formed to build a railway from Des Moines to Newton, Iowa, using either electricity or compressed air. L. H. Hanna of Cleveland, Ohio, and J. C. Rockefeller, also of Cleveland, are understood to be interested. The cost of the proposed line has been placed at $750,000.

The hearing before the attorney-general of Wisconsin on the application to have suit entered to annul the franchise of the Duluth-Superior Traction company, in West Superior, Wis., has been deferred until December 22d.

Every physician and surgeon in the cities of Duluth and Superior has received a circular letter from the street-railway company in which the company states that it has its own physicians to attend to all cases of accident. When these are not within call, the company calls on the nearest surgeon, but desires that he shall simply apply such remedies for the relief of suffering or temporary aid, pending the arrival of the company's physician. Many of the physicians are indignant over the circular, and others do not take it so seriously.

The Winnebago Traction company has applied to the council of Neenah, Wis., for permission to suspend the operation of the local car in that city, on the ground that it does not make expenses. The company is willing to take care of local traffic on its interurban line henceforth.

The Fox River Valley Electric Railway company will not operate cars on its interurban line between Appleton, Wis., and Neenah after six o'clock for the present. The necessity for this change is owing to lack of power and the transferring the machinery to the new power house.

The Sioux City (Iowa) Traction company shows gross receipts for the year ended May 31, 1900, of $180,215, and operating expenses, including taxes and insurance, of $107,050, leaving a profit of $79,105. After deducting one year's interest on $750,000 bonds, the surplus earnings remaining amount to $41,664.

Herbert W. Lacy wants $10,000 from the St. Paul City Railway company, for an alleged assault in being ejected from a car. Lacy carried two live turkeys on a car, but when he sought to transfer to another line the birds were objected to and he was ordered off the car.

After five years of darkness due to a heavy indebtedness, the council of South Bend, Wash., has again contracted for street lighting.

Thomas Kirk is an applicant at Walla Walla, Wash., for a franchise to string wires into the city for the purpose of supplying electric power.

The Seattle Electric company is making improvements on its system in Seattle, Wash., extending the Pike street line, rebuilding the old First avenue cable for electric and placing a counterweight on Queen Anne hill, to enable cars to get up that grade.

There has been comparatively little trouble in Minneapolis with the water mains, from electrolysis. The gas mains are not so deep as the water mains and hence the gas company has caught the most of the truant current.

Granite Falls, Minn., has just begun using the power of its new waterpower system for operating the electric-light plant. The council had been paying about $3,000 a year for coal to operate the plant, and concluded to utilize a waterpower a half mile out. The light plant does not use over half the power developed.

Walla Walla, Wash., is taking bids, until December 17th, for furnishing street lighting for two years—not less than 75 lamps, with the privilege of 100—of 1,200 candlepower.

The council of Butte, Mont., has granted the Butte Electric Railway company the right to carry ore from the Stewart mine to the Butte Reduction Works, between 8 p. m. and 10 a. m.

The Britt Light and Power company of Britt, Iowa, has changed ownership. Mr. Walker has sold his stock to Charles H. Brown. The plant will hereafter be in charge of Mr. Goodman, late of Leon, Iowa.

The board of water commissioners of St. Paul has notified the city-railway, telephone and other companies that any further attempts to make electrical connections with the water mains would be vigorously prosecuted. They were also notified to disconnect all present wires. The board will make a survey of all damage done to date by reason of electrolysis, and get it in shape for evidence, in case the matter reaches the courts.

Oskaloosa, Iowa, will vote on December 17th on granting a franchise for an electric-light and street-car system to the Oskaloosa Street Railway and Land company.

The street-railway company of Tacoma, Wash., has accepted the new franchise tendered by the council, providing for a change of route for the Delin street line, and will at once proceed to change its tracks from the Delin street hill.

The District Court at Fargo, N. D., holds that a contract for lighting is not void because no levy was made to meet the expense involved. The case was that against the Fargo Gas and Electric company.

The council of Princeton, Minn., contemplates putting in storage batteries to enable the light plant to furnish street light all night and yet shut down the power at midnight.

The Twin City Rapid Transit company's gross earnings from its lines in St. Paul and Minneapolis for October were $240,793, an increase of $11,584. The net earnings were $131,291, an increase of $7,965. The surplus is $63,035, an increase of $10,689.

F. D. Pearne of LeMars, Iowa, has invented a telegraph typewriter which, it is said, will enable a man to write on the machine connected with wires, and the matter will be reproduced over the wires in another city.

The Commercial Light and Power company of Duluth, Minn., which has been in the hands of a receiver, has been authorized by the court to issue certificates sufficient to pay off its indebtedness. K.

Gleanings from Colorado.

Denver, November 29.—At a recent meeting, the City Council of Cripple Creek, by a unanimous vote, authorized the mayor to enter into a contract with the Gold Belt Electric company for supplying arc lights for a period of three years at a monthly price of $13.50 a lamp. The company now furnishes lights at $15.45 a month, and the contract has a year to run. Mr. Stern, manager of the company, explained that the reduction was proposed inasmuch as the company desired to treat the city fairly and extend to it the benefit of the lower rates it had recently given to private consumers. At the new rate the city could be provided with 12 additional lights, which were greatly needed, at no increase in expense. He thought that when the cost of fuel and labor in the Cripple Creek District was taken into consideration, the new rate was lower than the average price paid by cities in the country.

The Supreme Court has denied the application of the Canon City Electric Light and Power company for an injunction restraining the Colorado Electric Power company from distributing electricity for light and power in Canon City, under a franchise which was alleged to be illegal.

The City Council of Santa Fe, N. M., at a recent meeting voted to guarantee five per cent. interest on a $100,000 bond issue of the company, composed mainly of Colorado Springs capitalists, organized to build an electric railway in the city. J. W. D.

PERSONAL.

George L. Carrington, who was president of the Albert Lea Electric company of Albert Lea, Minn., died on November 24th.

Thomas D. Lockwood, the well-known advisory electrician of the American Bell Telephone company, is spending a few days in Chicago.

Frank L. Dame, general superintendent of the Tacoma Railway and Power company of Tacoma, Wash., has resigned his position, and will remove to Marshfield, Mass.

Arthur Lockwood, a son of T. D. Lockwood, formerly in the New York office of the Western Electric company, has removed to Chicago, and is now connected with the home office of the company named.

Hon. Cushman K. Davis, United States senator from Minnesota, died at his home in St. Paul on November 27th, after an illness of two months. Senator Davis as a boy was a proficient telegraph operator in Wisconsin.

J. D. Gerlach, manager and purchasing agent of the Chester Light, Water and Ice company of Chester, Ill., was a recent Chicago visitor. Mr. Gerlach has recently been re-elected president of the Illinois State Electric association.

Rev. Father Felix Marian Lepore, besides his duties as Catholic priest and editor of La Nazione at Denver, finds time to perfect many inventions. It is said that he now has patents pending for an electric automatic switch, especially intended for electric railways.

Mr. Herbert E. Goodman, manager of the Goodman Manufacturing company of Chicago, was the victim of a painful accident last week. Mr. Goodman was at the Vintondale colliery, near Johnstown, Pa., and entered the mine to inspect an electric drill that his company had installed. A wagon used to haul coal to the mouth of the mine broke away from its cable, and Mr. Goodman, in trying to get away from in front of the car, was caught by the drill. He was taken to the Johnstown Memorial Hospital, where it was necessary to amputate one

leg. Mr. Goodman is well known among electrical men in the West, and has many warm friends who will hear of his misfortune with regret.

John M. Klein, of the John M. Klein Electrical Works of San Francisco, Cal., is in Chicago for a few days. Mr. Klein is an old-time electrical man, having worked for the Western Union Telegraph company in New York from 1869 to 1875. Since that period he has been in San Francisco in the electrical supply and manufacturing business. Mr. Klein expects to spend the holidays in New York.

A London cable dispatch, under date of December 2d, says that D. H. Louderback, agent in England for Charles T. Yerkes, has resigned his position, owing to the serious illness of his wife. It is reported that since Mr. Louderback went to London in November he has been offered the chairmanship of another local underground railway at a salary of $20,000 a year, and with the privilege of retaining his position at the head of the Yerkes company.

Mr. Asa M. Mattice has been appointed chief engineer of the Westinghouse Electric and Manufacturing company and will enter upon his duties during the present month. Mr. Mattice was for 10 years, up to a year ago, principal assistant to E. D. Levitt of Cambridgeport, Mass., and has been actively connected with the design of all the large machinery coming from Mr. Levitt's office during that time. During the last year he has been remodeling the Cocheco cotton mills at Dover, N. H. Mr. Mattice is an engineer graduate of the Naval Academy, of the class of '74, of which class Mr. B. H. Warren, vice-president of the Westinghouse Electric and Manufacturing company, is also a member. He was assistant to Admiral Melville at the beginning of the new navy, and had an important part in the design of the machinery of the Maine, San Francisco and other early ships. The Westinghouse company is to be congratulated on the additional strength which he will give to its already strong engineering staff.

ELECTRIC LIGHTING.

An electric-lighting plant is projected for the town of Gretna, Neb.

Plank Bros. are erecting an electric-light plant in Quincy, Ohio.

R. A. Hart of Baton Rouge, La., desires prices on a small electric-light plant.

The Story City (Iowa) Electric Light and Power company has been incorporated.

An electric-light plant is being erected by the city of Thief River Falls, Minn.

The Wabash (Ind.) water and electric-light plants will be consolidated on January 1st next.

A company has been organized to build and equip an electric-light plant at Jerseyville, Ill.

The city of Crowley, La., has purchased and will enlarge the electric-light plant of Henry Widmer.

The lighting plant of Franklin, La., is to be extended. The city will issue $20,000 of bonds for the purpose.

The city of Dillon, S. C., contemplates the installation of a complete system of electric lights, water and sewerage.

A franchise was granted to T. J. Kirk and others by the city of Walla Walla, Wash., to supply the city with electric lights.

The Consigners' Favorite Box company of Chattanooga, Tenn., is in the market for a 60-light plant. Address Box 239, Chattanooga, Tenn.

The town of Wilber, Neb., has entered into a contract with J. T. Burke of Omaha for the construction of an electric-light plant, to cost about $5,000.

The citizens of Crossville, Tenn., will form a company, with $1,000 capital, for the establishment of an electric-light plant. O. W. Moore should be addressed.

The town of Orlando, Fla., the center of the central South Florida pineapple-raising industry, is arranging to have an electric-light plant installed during 1901.

The Fruitvale (Cal.) Light, Heat and Power company has been incorporated for $100,000, by A. N. Frost, C. H. Fehnemann and J. H. W. Riley, to generate and transmit electric energy.

The Laurel (Miss.) Light and Power company will build an electric-light plant in that town. The capital stock is $10,000 and the incorporators are F. W. Pettibone, F. Gardiner and A. Flanagin.

The South Boston Electric Light and Power company of South Boston, Va., with $200,000 capital stock, has been chartered to maintain and operate an electric-light plant, by R. W. Lawson, J. J. Lawson and R. S. Barbour.

The measure providing for the erection of an electric-light plant at the Chain of Rocks, near St. Louis, Mo., and also to furnish power to illuminate the waterworks and water towers and operate an electric railroad from Humboldt avenue to the Chain of Rocks, introduced by Delegate C. F. Kelly, has been passed by the House of Delegates of St. Louis.

The recent accident to the machinery of the electric plant at Havre de Grace, Md., kept the town in total darkness for two nights. As a result of the accident it is proposed to duplicate the plant and guard against similar troubles in the future.

According to the report recently published of the work of the electric-light plant of Ocala, Fla., there were installed during the year 575 incandescent lamps, and the receipts for the year amounted to $3,049.72, which is more than $1,000 in excess of the expenses, interest on bonds, allowances for depreciation of plant, etc.

The Toccoa Falls Light and Power company has been organized at Toccoa, Ga., with E. P. Simpson, president, and L. A. Simpson, vice-president and secretary, for the establishment of an electric-light plant and oil mill. The company will develop the power at Toccoa Falls. The capital stock is $50,000.

The plant of the Citizens' Light and Power company of Rochester, N. Y., was wrecked by fire on November 25th. The blaze at first threatened little damage, but owing to the action of the water upon the electric connections, many smaller fires started in different parts of the plant. The Washington Flour Mills caught fire from the blaze and were entirely consumed. The fire originated in the framework of the rope-transmission system of the electric company's plant. The power on three generators was suddenly cut off for some unaccountable reason, allowing the waterwheels to run away. The ropes parted, and, becoming entangled in the woodwork, started the conflagration. The loss on the electric plant is about $60,000, fully insured.

ELECTRIC RAILWAYS.

The People's Railway company of Wilmington, Del., will erect a power house at a cost of $40,000.

The commissioners of Marion County, Ind., have granted a franchise to the proposed Greencastle electric railway.

The Toledo, Adrian and Jackson Railway company, with offices at Toledo, has been incorporated, with a capital stock of $70,000.

The Pontiac and Flint Electric Railway company has been incorporated, under the laws of Michigan. The authorized capital is $50,000.

The Cuyahoga County commissioners have granted the Cleveland, Berea and Oberlin electric railroad a franchise for 25 years.

It is reported that the Boston street-railway syndicate may acquire control of the consolidated street-railway properties of the Washington (D. C.) Traction company.

The Terminal Street Railway company of Erie, Pa., has been incorporated, to build a trolley line in the city of Erie. The capital stock is $7,500, and C. S. Strong was elected president.

The Spartanburg (S. C.) Street Railway, Gas and Electric company has been incorporated, with $400,000 capital stock. The incorporators are F. H. Knox, J. C. Norcross and T. C. Steedman.

The Board of Supervisors of Lincoln, Ill., have received notice that H. S. Beckemeyer of Mount Pulaski will ask for a franchise to build and equip an electric road between Lincoln and Mount Pulaski.

W. R. Hattersley is at the head of a company organized to build an electric road from Toledo to Defiance, via Waterville, Florida, Grand Rapids, Liberty, Napoleon and Jewell. The company has $2,000,000 to invest.

An electric road is to be built connecting New Albany and Sellerburg, via Jeffersonville, Ind. A survey has been completed, and the line will be built by L. Schneck of Seymour, J. S. Stotsenburg of New Albany and others.

At the next meeting of the Board of Supervisors of Elgin, Ill., the Rockford and Belvidere Electric Railway company will present a petition for a franchise. The company has now secured all its right-of-way up to Belvidere city limits.

The indications are that in the near future St. Augustine, Fla., will have a belt railroad around the city, operated by electricity, and also an electric road to South Beach, the most popular seaside resort of St. Augustine. Atlanta capitalists are interesting themselves in these enterprises.

C. V. Kilvert of Manchester, England, was in Cincinnati a few days ago, and in conversation he said that his city was the first in the United Kingdom to adopt the American street-car system, and that within 18 months the horse car would not be seen there.

The proposed trolley line through Greenwich, Conn., is meeting strong opposition from wealthy property owners. At a town meeting recently they asserted that the trolley will injure the town and declared that public convenience and necessity do not require it. If the warden and burgesses decide to grant the right-of-way the matter will be taken to the courts. The company, however, is making every effort to get the rails down before the General Assembly meets, for the repeal of the charter can then be asked for.

The stockholders of the Youngstown (Ohio) and Sharon Street Railway company at a meeting held last week effected a reorganization. The capital stock was increased from $200,000 to $600,000, and Colonel C. B. Wick was elected president.

The Newcastle and Beaver Falls Street Railway company is to build 16 miles of line to connect Newcastle, Pa., with Beaver Falls and other towns The directors are W. S. Foltz, J. N. Marvin and G. Greer. The company is incorporated for $100,000.

The Indianapolis and Greenfield electric road will be extended to Knightstown, Ind. E. J. Binford and L. McDonald of Greenfield, representing the line, have been granted a franchise, giving them the privilege to lay tracks along the National road through Henry County.

The construction of the Columbia-Montour electric railroad, in Pennsylvania, in the near future, is said to be an assured fact. At a recent meeting in Bloomsburg, Pa., the necessary capital was subscribed and the road, when completed, will connect Riverside, Danville, Bloomsburg, Espy, Berwick and Nescopeck.

J. W. Van Cleave of New York city, promoter of the Interstate Railway company, has applied to the council of Niles, Mich., for a franchise to run an electric line through that city. The terminus will be at St. Joseph, and the line will run from South Bend, Ind., through Niles, Buchanan, Berrien Springs and Benton Harbor, Mich.

There will be two bills providing for a subway in Washington street, Boston, before the next Massachusetts Legislature. Both bills will agree upon practically all points except that of ownership. The Boston Elevated Railway company still adheres to its desire to own and control the new subway, which shall be built at its own expense. The other bill provides for construction and lease by the city.

The South Haven Construction company is to begin work at once on a trolley line between South Haven, Mich., and Paw Paw Lake, terminating at St. Joseph. The new company will be incorporated in a few days, it is said, under the name of the South Haven, Paw Paw Lake and St. Joseph Electric Street Railway company. The following electric lines are proposed for construction: The Indiana street railway to operate between South Bend and St. Joseph, the Holland and East Shore line and the South Haven, Paw Paw Lake and St. Joseph line.

The elevated railroads in Chicago in November made less than their customary percentages of monthly increase over the business of the corresponding month last year. The South Side Elevated Railroad company's increase figures 2.9 per cent. and the Metropolitan's 1.13 per cent. The Northwestern elevated continues to do good business, the daily average number of fares collected during November being 53,411. According to the generally accepted figures, the road can pay its preferred dividend with an average of 50,000 passengers a day. The South Side company carried 72,057 passengers and the Metropolitan 89,822 during the month.

A new electric street-railway line to Ravenswood, Ill., is proposed for construction by the Citizens' Electric Street Railway company of Chicago, and it is announced that it will be a feeder for the Northwestern Elevated Railroad company. It is said the new company may bring its cars downtown over the elevated company's tracks: It is expected that work on the Ravenswood branch will be begun next spring, and that before next winter the new electric line and the elevated road will land people living in the Twenty-seventh Ward in the center of the business district. The Ravenswood branch will probably stop at Evanston and Foster avenues on Lincoln avenue.

AUTOMOBILES.

The New York Central Railroad company has instituted an automobile service in New York city for the transfer of passengers between depots or to residences.

The automobile exhibition at the Grand Central Palace in New York closed on November 24th, with the largest crowd in attendance of the whole week. As a whole the show is regarded as a great success.

The automobile show which will open in Washington, D. C., on December 10th, promises to be a society event, as well as an interesting exhibition of machines. The races will take place in the beautiful country drives around Washington and also on the smooth asphalt streets.

TELEGRAPH.

A bill is to come before the Indiana Legislature at its January session providing for a reduction of the charge for messages within the state from 25 cents to 15 cents for the first 10 words.

The Utah Messenger and Signal company of Salt Lake City has been reorganized and the capital stock increased from $20,000 to $60,000. The name was changed to the Utah District Telegraph company, with G. S. Holmes as president and B. B.

Brooks, secretary and treasurer. Two thousand boxes are now distributed through the city.

The laying of a third telegraph cable between the Netherlands and England, from Zandvoort to Lowestoft, was commenced on October 8th. The cable comprises four wires, which will extend all the way from London to Rotterdam and Amsterdam. The cable will greatly accelerate the telegraph traffic between the Netherlands and England, and will also expedite the receipt of American cablegrams for the Low Countries via London, as one of the wires will be immediatcly connected with the cables of the Anglo-American Telegraph company at London, thus making cabling to the United States possible without the intervention of the London office.

PUBLICATIONS.

"That Devil! Doubt" is the unique title of a pamphlet containing desk and ceiling-fan and motor testimonials, that has recently been issued by the Emerson Electric Manufacturing company of St. Louis.

The Power Publishing company has issued the first number of the Power Quarterly. This first issue, which is 8 by 11 inches in size, is called a gas-engine edition. It contains 67 pages of valuable information on gas engines, well illustrated by pictures of engines and parts, diagrams, etc.

The Grand Rapids Herald of Grand Rapids, Mich., on November 25th, published a twentieth century and semi-centennial number. The issue contained a sketch of the growth of the city and brief descriptions of the leading industries. Among the latter were given accounts of the Edison Light company, the Grand Rapids Electric Light and Power company, the Grand Rapids Electric company, the M. B. Wheeler Electric company and the Citizens' Telephone company.

ELECTRICAL SECURITIES.

The Massachusetts Electric Companies has declared a dividend of 2½ per cent. on the $15,056,900 preferred stock, payable January 1st, to stock of record December 15th.

The net earnings of the Chicago and Milwaukee Electric Railway company from January 1st to October 31st were $121,284, as against $69,617 in the same period last year.

The Chicago City railway has declared the regular quarterly dividend of three per cent., payable December 31st, to stockholders of record December 15th. Books close from December 16th to December 20th, inclusive.

The Electric Storage Battery company has declared a cash dividend of six per cent. on its preferred stock, being the accumulations of this stock to January 1, 1901. The policy will be to maintain a regular rate of six per cent. per annum.

The report of the American Railways company shows its ownership of $500,000 of the preferred stock of Chicago Union Traction and $250,000 of common taken in the underwriting. The total par value of stocks owned is $3,817,500 and of the bonds owned $598,748; total, $4,416,248, which cost $3,397,313. A statement of earnings to June 30th shows gross receipts to be $603,606, with operating expenses of $320,513. Taxes and interest amount to $101,701, leaving a surplus of $181,392.

SOCIETIES AND SCHOOLS.

"Salaried Positions for Learners" is the title of a pamphlet issued by the International Correspondence Schools, Scranton, Pa. It tells how a young man can become a mechanical or electrical engineer or architect and support himself while learning. It contains photographs of a score or more students who have obtained better positions as a result of their studies, and some specimen drawing plates showing the remarkable progress made by students.

The following-named gentlemen, residing in New York city and vicinity, were elected members of the New York Electrical society, at its meeting held on November 16th: H. S. Arnold, C. F. Splitdorf, H. G. Osburn, G. H. Hill, J. S. Humbert, Harry B. Naylor, Charles Arthur Hanna, W. W. Morse, David H. Darrin, M. R. Hutchison, C. Howard Parmly, E. M. Archibald, C. W. Obert, Robert A. Fliess, Howard Richards, Jr., and Edward R. Knowles.

Professor F. C. Caldwell of the Ohio State University delivered an illustrated lecture before the Engineers' Club of Columbus, Ohio, recently. His subject was "The Storage of Electricity and Its Application to Practical Work." The lecture was supplemented by an examination of the machinery at the Edison Electric Light company's plant.

A general announcement for 1901-1902 of the department of engineering has been issued by the University of Michigan, Ann Arbor, Mich. The pamphlet contains a list of the engineering faculty, the requirements for admission, an account of the work of the department, facilities for instruction, courses of instruction, requirements for graduation, etc. A list of the addresses of the graduates of the department for the years 1899 and 1900 is given at the close of the book.

The following thesis subjects have been approved for the senior electrical engineering students in the College of Engineering of the University of Illinois: "Investigation of the Wave Forms of Alternators and Synchronous Converters," "Behavior of a Rotor in a Three-phase Field," "An Experimental Study of Phase Transformers," "Behavior of a Rotor in a Two-phase Field." "Conditions Affecting the Rated Performance of Wattmeters," "Line Regulation in Polyphase Transmission," "Performance of a 10-kilowatt Synchronous Converter."

Efforts toward the organization of an association of electrical meter experts are said to be meeting with good success. Favorable replies have been received from several meter men expressing their willingness to assist in the movement. Ben. W. Clark of the Edison Illuminating company, Detroit, Mich., is interested in the movement, and will be pleased to hear from all others similarly interested. It is proposed to meet conjointly with the annual meeting of the National Electric Light association next summer and effect a permanent organization.

The Cornell Society of Mechanical Engineers is a new society, formed by the students at Sibley College, Cornell University, this fall. The object of the society is to promote the interests of mechanical engineering among its members, to bring the latest phases of engineering practice to their notice, and to drill them in the methods of the larger societies. It has a membership of about 60 and has been very successful thus far in its work. Several interesting papers have been presented before it, including one on "Steam Turbines," by Dr. R. H. Thurston, director of Sibley College.

The first annual stein dinner given by the Technical Club of Chicago to its members and guests was held at the clubrooms on the evening of November 26th. There were 140 in attendance and the affair was pronounced a decided success. Although the club membership numbers 450, this was the largest gathering that had attended any of its social events. As a result of the dinner the club is richer to the extent of over 100 ornamental and costly steins, which will be displayed in the rooms. The guest of honor was Dr. P. J. H. Farrell, who served as surgeon of the First California Infantry in the Philippine Islands. Dr. Farrell was the first commissioner sent by the United States government to treat with Aguinaldo.

MISCELLANEOUS.

Following the decision of the higher courts, the Cowles company of Cleveland applied to the United States Circuit Court for the Western Division of Pennsylvania for an injunction to close the works of the Carborundum company at Niagara Falls. Judge Joseph Buffington refused the injunction, provided that the defendant company file a bond to secure damages to the complainant, the amount of the bond to be fixed at the discretion of the court. Although in Judge Buffington's decision he directed that an accounting be made by reason of the alleged infringement of one of the Cowles patents, he went on to say: "To grant an injunction would mean the stopping of the manufacture of carborundum and result, most likely, in serious damage to the defendant company, the sole maker of carborundum. The defendant cannot make carborundum without infringing a Cowles patent, and the plaintiff cannot make carborundum, as the defendant has the exclusive rights. An injunction would do the complainant no good, but would take away the only means by which he can get damages."

TRADE NEWS.

The Low Water Electric Alarm company of Detroit has been incorporated, with $10,000 capital.

The Electric Equipment company of New York city has been incorporated, with a capital stock of $5,000. The directors are C. J. Klien and C. L. Sefert of New York city, and H. E. Wadsworth of Brooklyn.

The H. A. Fisher Manufacturing company has been organized at Kittery, Mass., to deal in electrical goods, with a capital stock of $10,000. The president is Dallas W. Cobb, and the treasurer, John E. Fuller, both of Mansfield, Mass.

The contract for furnishing the United States engineer's office at New London, Conn., with two five-horsepower motors and two 3½-horsepower motors has been awarded to the Thresher Electric company of Dayton, Ohio, at $700.

The American Battery Compound company has been incorporated in Chicago, with a capital stock of $2,500, for manufacturing primary and storage batteries. The incorporators are Adelor J. Petit, Daniel W. Parker and Mabel McMillan.

The lowest bid received by the Treasury Department for the installation of a wiring system in the old United States courthouse building at Baltimore, Md., was that of J. F. Buchanan & Co. of Philadelphia, in amount, $1,678, and in time, 90 days.

The Treasury Department has just awarded contracts for the installation of the lighting fixtures in the new mint building at Philadelphia, Pa. The major portion of the work will be done by the Cassidy & Son Manufacturing company of New York, at the contract price of $15,014.75, and the balance by the Horn & Brannen Manufacturing company of Philadelphia, at $2,501.15.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until December 22d, for the installation of a wiring system for the extension of the United States Postoffice building at Columbus, Ga., in accordance with the drawing and the specifications, copies of which may be obtained at the Washington office or at the office of the superintendent of construction at Columbus, Ga., at the discretion of the supervising architect.

The Akron Fillet Machine company of Akron, Ohio, calls attention to the work done by its fillet machines in a novel manner. It is sending to the trade a small cloth sack with the following admonition printed on the outside: "Don't let the cat out of the bag." The "animal" inside is a sample of leather fillet work, showing how the fillets are applied to woodwork. The machines manufactured by the company produce fillets in sizes from one-sixteenth to three-fourths inch radius.

BUSINESS.

Operators of alternating-current plants should read a little book issued and mailed free by the Electric Appliance company, Chicago. The book is entitled "Skepticism," and is written especially for alternating-current skeptics.

The American Steel Hoop company is going to put in steel bins at its Isabella furnaces, Ætna, Pa. This will require about 750 tons of steel, which will be furnished from one of the Pittsburg plants of the American Bridge company. The bins will be made in accordance with the design of Julian Kennedy, mechanical engineer.

The Eureka depolarizing solution for battery cells which Spahr & Swingle of Millersburg, Ohio, are putting on the market is said to last longer, to be cleaner and less expensive and to give better satisfaction than any other known fluid or compound. The fluid has been used by the Millersburg, Wooster and Orrville Telephone company for over six months, and during that time the company's batteries did not give the least trouble. The Eureka fluid is especially adaptable for use with the Fuller cells.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 27, 1900.

662,386. Electric Traction for Tramway or Similar Vehicles. Arthur Baisieux, Brussels, Belgium. Application filed July 31, 1900.

In the electric-railway system referred to are combined a conduit formed of non-conducting and non-magnetizable material, and embodying a series of insulated conducting sections or rails, and a live magnetizable conductor movably located in the conduit and below the sections, and in connection with a generator. A magnet is carried upon the vehicle passing over the conduit and effective to move the conductor into contact with the sections; and means independent of the weight of the conductor are shown for breaking contact between the conductor and sections.

662,410. Magnetic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Original applications filed March 10, 1900. Divided and this application filed April 14, 1900.

This method of separating diamagnetic material from paramagnetic material consists in feeding the composite material upon a receiving apron located in a magnetic field, of a strength so graduated that the magnetic sand will arrange itself in moss-like or frond-like structures and in zigzag or wavy lines, and thereupon bodily moving the structures along the zigzag or wavy lines of force established so as to occasion a corresponding zigzag or sinuous travel of the structures and their concurrent progressive re-formation.

662,411. Magnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed April 14, 1900.

An apparatus is described for separating magnetic from diamagnetic material, comprising a magnet pole piece grooved or recessed to produce a wavy, zigzag, or tortuous distribution of the effective lines of force, in combination with a traveling screen or apron, moving in front of the pole piece, and means for jostling the apron.

662,412. Magnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed April 14, 1900.

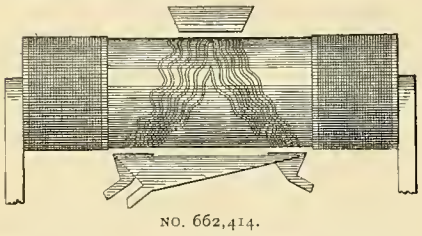
The apparatus covered by this invention for separating magnetic from diamagnetic material comprises a magnet pole piece grooved or recessed to produce a wavy, zigzag, or tortuous distribution of the effective lines of force, in combination with a rotatory screen revolving in front of the pole piece.

662,413. Magnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed April 14, 1900.

Here the apparatus for separating magnetic from diamagnetic material comprises a magnet pole piece having a wavy, zigzag, or tortuous distribution of the effective lines of force, in combination with a traveling screen or apron passing in front of the pole piece.

662,414. Magnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed July 12, 1900.

The magnetic separator mentioned comprises a magnetic cylinder having grooves or recesses in its periphery, the grooves or recesses having a zigzag or wavy arrangement, so as to provide corresponding wavy or zigzag magnetic fields of force, and a traveling apron passing over the cylinder. (See cut.)



NO. 662,414.

662,419. Electric Railway. William Grunow, Jr., Bridgeport, Conn., assignor to the McElroy-Grunow Electric Railway system, Bridgeport, Conn. Application filed April 5, 1900.

In a surface-contact system of electric railways two parallel sets of sectional rails or conductors which are substantially continuous are described, each individual rail of one set being longer than its fellow of the other set, in combination with circuit connections to the switch-controlling magnets and switches, whereby the working current is connected to the sectional rails or conductors which convey it to the motors on board the cars before the trolley or shoe makes contact therewith, no matter in which direction the car be running.

662,420. Electric Railway. William Grunow, Jr., Bridgeport, Conn., assignor to the McElroy-Grunow Electric Railway system, Bridgeport, Conn. Application filed April 5, 1900.

In this contact system of electric railways sectional rails or conductors are located in the roadbed, and a station generator and a current feeder or main extends therefrom over the route. Feeder circuit-closers and circuit connections for operatively connecting the current feeder or main with the sectional supply rails or conductors are shown, and a manually operative switch having an exposed operative part and circuit connections for transmitting the feeder current to the sectional supply rails.

662,421. Electric Railway. William Grunow, Jr., Bridgeport, Conn., assignor to the McElroy-Grunow Electric Railway system, Bridgeport, Conn. Application filed April 5, 1900.

In a contact system of electric railways having sectional rails or conductors located in the roadbed are employed a station generator and a current feeder or main extending therefrom over the route, and switching magnets and circuit connections for operatively connecting the current feeder or main with the sectional rails or conductors. In combination is a switching circuit in each switch box including an exposed contact, so arranged that circuit may be effected from an independent source of electrical energy, to and through the switching magnet in the switch box.

662,423. Current Collector. William Grunow, Jr., Bridgeport, Conn., assignor to the McElroy-Grunow Electric Railway system, Bridgeport, Conn. Original application filed April 5, 1900. Divided and this application filed May 21, 1900.

A current collector or trolley consists of two shoes pivotally secured to vertical standards, adapted to slide in sleeves secured in a supporting frame, the standards being yieldingly connected together.

662,444. Insulating Composition. Carl Jung, Vienna, Austria-Hungary, assignor of two-thirds to Adolf Kittel and Adolf Brecher, Vienna, Austria-Hungary. Application filed December 19, 1899.

As a new composition of matter, a mixture of undissolved raw caoutchouc and casein, or a vulcanized mixture of caoutchouc, caseïn and resin, or some solid hydrocarbon, is described. The process of preparing a rubber-like substance consists in adding undissolved raw caoutchouc to casein and thoroughly kneading or mixing the mass, and vulcanizing the same.

662,450. Controller for Electric Motors. John B. Linn and Maxwell W. Day, Schenectady, N. Y., assignors to the General Electric company of New York. Application filed September 17, 1898.

A hoisting apparatus is provided with a number of motors acting upon a common load; means are provided for regulating the motors to run at the same or different speeds as may be desired, and a common reversing switch for all the motors; or a number of electric motors may be provided with a regulating switch for each motor, with handles for each switch, and interlocking means for the handles, such that each switch may be separately operated, or all be moved by one handle.

662,463. Casing for Electrical Conductor Joints. George H. Paul, New York, N. Y. Application filed June 2, 1900.

As an improved article of manufacture, a joint casing is described, provided at its ends with openings through which the several conductors enter the casing, the casing being provided with grooves or marks so arranged and extended that the casing may be opened by splitting the same upon the grooves or marks, to receive the joint.

662,465. Commutator. Edward D. Priest and George L. Schermerhorn, Schenectady, N. Y., assignors to the General Electric company of New York. Application filed June 30, 1900.

A commutator for dynamo-electric machines consists of alternate strips of copper and mica, the mica being grooved out for a short distance below the level of the copper.

662,466. Lightning Arrester for Safety Cut-outs for Electric Circuits. Joseph Sachs, Hartford, Conn. Application filed September 28, 1899.

In combination with a case are a safety fuse within and extending through the case, and terminals at the ends of the case attached to the safety fuse. Base and circuit terminals are connected therewith and adapted to receive the safety-fuse case at the terminals; a ground terminal adjacent to and insulated from one of the case terminals is shown, and a device securing the same to the base and an electrical connection therefrom to ground.

662,480. Automatic Circuit Controller. George H. Whittingham, Baltimore, Md. Application filed March 19, 1900.

With a circuit controller are combined two shunt circuits around the same, a cut-out in each shunt, one of which is operated by the circuit controller; or one shunt circuit may contain one cut-out and the other contain two cut-outs.

662,484. Electric Top for Gyroscopes. Emil Ziehl, Berlin, Germany. Application filed December 26, 1899.

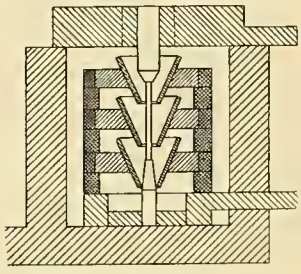
The invention relates to an improved electric top comprising the axle, the bearings therefor, the rotary body carried by the axle and arranged to turn about the same, and an inducing body mounted on the axle. The rotary body acts as induced part, the friction at the bearings of the shaft being greater than at the bearings between the shaft and rotary body.

662,491. Portable Electrical Device. John S. Mead, Buffalo, N. Y., assignor of one-half to William Comerford, Buffalo, N. Y. Application filed January 30, 1900. Renewed October 24, 1900.

An electrical hand appliance, comprises a battery case, a conical or tapering cap for closing the case at one end, adapted to receive an instrument stock and electrically connect the same with the case. An insulator disk is located within the cap, and a yielding contact arm mounted on the disk in electrical connection with the battery and adapted to contact with a contact terminal of the stock. A push button is located within the tapering side of the cap.

662,501. Safety Cut-out for Electric Circuits. Joseph Sachs, Hartford, Conn. Application filed September 28, 1899.

A safety fuse comprising two connected portions in one line for the passage of the electric current, the one portion a section of material of low conductivity to be heated and the other portion a piece of material of high conductivity connected by a joint fusible by an excess of heat of the low conductivity section, and a means for effecting a tension for the separation of the parts.



NO. 662,537.

662,527. Telegraph Signaling Apparatus. Edward B. Ellicott, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed December 8, 1899.

In a telegraph-signaling apparatus is combined, with a movable bar having a series of contact points mounted thereon, and constituting terminals for one side of an electric circuit, a contact spring forming a terminal for the other side of the circuit, the spring being adapted to engage successively with the contact points, whereby the circuit is alternately made and broken. A spring driven gear train is supplied for moving the bar, and guard pieces adapted to slide to and fro on the bar, and so to be adjusted to any desired point on the operative length of the bar. These guard pieces serve to cover certain of the contact points to prevent the engagement of the spring with such contact points, whereby signals may be transmitted.

662,537. Electric Smelting Furnace. Hugo Koller, Nuremberg, Germany. Application filed May 17, 1900.

An electric furnace has vertically disposed current-feed electrodes, a vertical series of superposed disconnected hopper-shaped electrodes, arranged between the feed electrodes, and means for insulating them one from the other and from the current-feed electrodes. (See cut.)

662,543. Telephone Switch. Levi M. Neher, North Manchester, Ind. Application filed April 4, 1900.

A telephone switch is described comprising two contact plates, a movable switch plate for contact with one of the contact plates, and having means for holding it normally out of such contact, and a rocker having fingers for contact with the second contact plate, and having means for holding it normally out of such contact. A receiver lever is shown in operative relation to the switch plate and rocker, to move them alternately into contact with their respective contact plates, the fingers and switch plate being movable into and out of contact and lying normally in electrical contact. (See cut.)

662,580. Apparatus for Electrically Lighting Railway Carriages, etc. Charles Vicarino, Nancy, France. Application filed April 24, 1900.

The automatic pole changer consists of a disk, brushes carried by the disk and adapted to rest on the collector, the disk being placed in its proper position by the movement of the armature shaft according to the direction of rotation of this latter. A fixed stop for retaining the disk in its proper position is shown, and an insulated ring carrying the brushes, and a spring contact bearing on the ring for taking off the current.

662,595. Trolley-wire Suspension. John W. Haynes, Manchester, Conn. Application filed March 10, 1900.

In combination with a trolley-wire hanger are described a cap and cone insulation, in which the cap is provided with a locking socket, and a latch loosely attached to the arm of the hanger and having its end adapted to engage the socket in the cap.

662,630. Brush Holder for Electric Machines. Sidney H. Short, Cleveland, Ohio, assignor to the Westinghouse Electric and Manufacturing company, Pittsburg, Pa. Application filed July 28, 1898.

In the brush holder referred to are a frame having one or more compartments, a brush mounted to slide in ways in each compartment, and a lever pivotally mounted at one end upon the frame, and arranged to bear at its free end upon the brush. A stud or bolt is arranged to pass freely through a perforation in the lever, while a spring is shown connected at one end to the frame and at the other end to the stud or bolt. A nut having wedge-shaped portions is mounted on the stud or bolt, the surface of the lever adjacent to the perforation therein being formed into a seat to receive the bearing edge of the wedge.

662,679. Reversible Primary Battery. Leon W. Pullen, Camden, N. J., assignor to the Pullen Battery and Electrical Manufacturing company of New Jersey. Application filed September 16, 1899.

In a negative-electrode structure for a battery are combined a central carbon conductor, a hard sealing stopper tightly surrounding the conductor at a distance from its upper end, a second hard sealing stopper covering and surrounding the lower end of the conductor, and a depolarizing mass surrounding the carbon conductor and interposed between the sealing stoppers. An inclosing wrapper of a thin asbestos sheet surrounds the depolarizing mass and peripheries of the stoppers and is tightly wrapped about them and upon itself to form a strong case, and a wrapping strand is shown tightly binding the asbestos wrapper at close intervals throughout its length to the depolarizing mass and to the stoppers, and preventing undue expansion.

662,719. Electric Fire Alarm. Charles L. Haight, Poughkeepsie, N. Y. Application filed January 25, 1900.

An electric circuit-closer comprises a casing, contact plates held in the casing and spaced apart, the plates being connected with the circuit wires of an alarm. A contact bar is mounted to slide in the casing, the outer end of the bar having a flanged offset; a spring is shown for moving the bar into engagement with the contact plates, with a binding post secured to the offset of the bar. A binding post is also secured to the casing, and a fusible connection extends between the two binding posts, normally holding the bar out of contact with the plates.

662,727. Attachment for Arc Lamps. Edwin B. Jones, Chatham, Canada. Application filed May 26, 1900.

In an arc lamp are shown a suitable frame, a globe supported in the frame, having a flaring opening at the bottom there f, a lower-carbon holder supported in the frame adjacent to the lower end of the globe, and a flexible metallic thimble seated upon the holder, and extending into engagement with the wall of the globe opening, and effecting air-tight joints at its respective terminals between the globe and holder.

662,737. Current Motor. Marcin Puszkar, New York, N. Y. Application filed September 14, 1900.

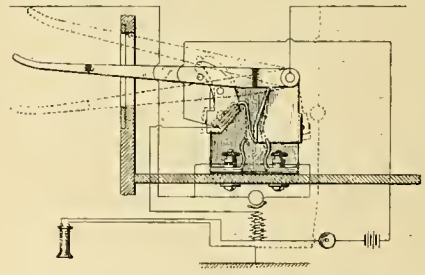
This current motor comprises a plurality of arms connected to rotate in unison; vanes, each having one end pivotally attached to the outer end of one of the arms, are adapted to swing on the arms freely. Bars connecting the arms are shown, and stops having sliding movement on the bars and arranged to project into the path of the vanes to bring them into driving connection with the arms. Bars are mounted to slide on the arms and pivotally connected with the stops, and means are provided for operating the sliding bars.

662,752. Transmission of Electrical Impulses. Frederick Bedell, Ithaca, N. Y. Application filed July 6, 1899.

The method of transmitting intelligence described consists in generating dynamically a series of unidirectional impulses of electromotive force, transmitting over a circuit code-determined current impulses, each complete from zero to zero, and receiving the transmitted impulses by means of suitable receiving apparatus.

662,772. Electric Motor. Joseph Darling, Chicora, Pa. Application filed September 1, 1900.

An electric motor is shown having, in combination with an electromagnet, an armature having a rocking axis directly at the pole of the magnet, an arm rigidly attached to the other end of the armature and extending at right angles to a point near the opposite end of the electromagnet, and a crank-shaft arranged at right angles to the electromagnet above the arm. A connecting rod is arranged on the opposite side of the crank-shaft from the armature and connecting the crank-shaft to the extended armature arm.



NO. 662,543.

662,803. Burglar Alarm. Junius L. Murphy, Denver, Colo. Application filed February 4, 1899.

An alarm mechanism located in an electric circuit is provided with a vibrating arm and a circuit-closing device adapted to be operated by the window or door. Means are shown for closing the circuit automatically independently of the circuit-closer, comprising two contacts located in the circuit, and an arm fulcrumed intermediate its extremities, one of which is forked while the other projects into the path of the vibrating arm of the alarm device. The forked extremity is located adjacent to the contacts and is normally disengaged therefrom, the arrangement being such that when the vibrating arm acts on the circuit-closing device, the latter is actuated causing the forked extremity to bridge the space between the two contacts, thus closing the circuit independently of the circuit-closer actuated by the door or window.

662,833. Railway Signaling. Samuel D. Strohm, Philadelphia, Pa., assignor to the Strohm Automatic Electric Safety Block System company, Philadelphia, Pa. Application filed August 29, 1891. Renewed June 5, 1900.

In a railway signaling system are combined, with station electromagnetic devices, two series of pairs of contact plates arranged along the line of way, and parallel therewith, the plates of each pair extending end to end. Connections are made between the plates and the station electromagnetic devices. A laterally adjustable frame carried by an engine or car has means for adjusting the frame, while a brush is elastically mounted in the frame, making contact with either of the series of plates.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, DECEMBER 15, 1900. No. 24

Electric Lighting of the Illinois Theater.

Much has been printed in the Chicago daily papers and also in other publications descriptive of the construction and erection of the new Illinois Theater, its architectural beauties, and its many advantages from a theatrical viewpoint. The main interest in the construction and equipment of the theater building to the readers of the Western Electrician is derived mainly from a consideration of the light and power equipment, which is exclusively electrical, and of the other engineering features.

The Illinois Theater is a stone and brick structure with steel framework, on Jackson boulevard, between Wabash and Michigan avenues. The front of the building, which is well illustrated in the accompanying picture, is of Buena Vista stone, with old-copper-work ornamentation, the general style of architecture being French. A large and elaborate canopy or marquee of glass and steel, 40 feet in width, extends across the sidewalk and adds much to the general attractiveness of the building. At each end and on the front of this canopy are electric signs, each wired for a capacity of 250 eight-candlepower incandescent lamps. A row of incandescents is placed along the front and underneath the canopy to light the sidewalk, while about 30 incandescent lamps are used in the ornamental globes, flambeaux, etc., on different parts of the front of the building.

One of the most artistic features of the theater is the lobby, which is 42 feet wide, 36 feet deep and 35 feet in height. An illustration gives a view of the lobby, showing the stairs leading from the dress-circle or first-balcony exit. The walls are of rubio marble, inlaid with turquoise-blue mosaic. A pleasing effect has been obtained in the design of the main chandelier and stair lights, the use of glass prisms adding considerably to the beauty of the fixtures.

An exceedingly rich scheme of decoration has been carried out in the auditorium, the body tone of the decoration being of the tint of the American Beauty rose. The main illumination comes from a central bunch of 60 incandescent lights at the ceiling. These lamps are arranged in circles and the light passes through small bead-like glass prisms hung closely together on wires beneath the lamps. For the further lighting of the house small bunches of lamps are placed on the fronts of the balcony railings, and on wall brackets on the walls, in the stairways, boxes, etc. The lamp bulbs on the balcony fronts are cleverly concealed by means of coverings, composed of glass prisms, strung on wires and held in place by adjustable clasps. Credit for the unique designs of these lamp coverings and all the decorative lighting is given to Benjamin H. Marshall, the chief architect of the theater. The fixtures were furnished by the T. W. Wilmarth company of Chicago.

Naturally, the most important and elaborate electrical wiring of the theater is on the stage. Here, at the right of the curtain, is located the main theater switchboard (herewith illustrated), from which all the lights in the house are controlled. It is built about eight feet above the floor, access being had to it by means of a ladder and gallery. This places the board out of reach of careless meddlers and where it does not interfere with the work on the stage. The switchboard consists of three white-marble horizontal panels on the left, containing the switches for all the stage and main-floor lights, and a large panel and two smaller ones on the right, which have mounted upon them the theater dimmers and the remaining house switches.

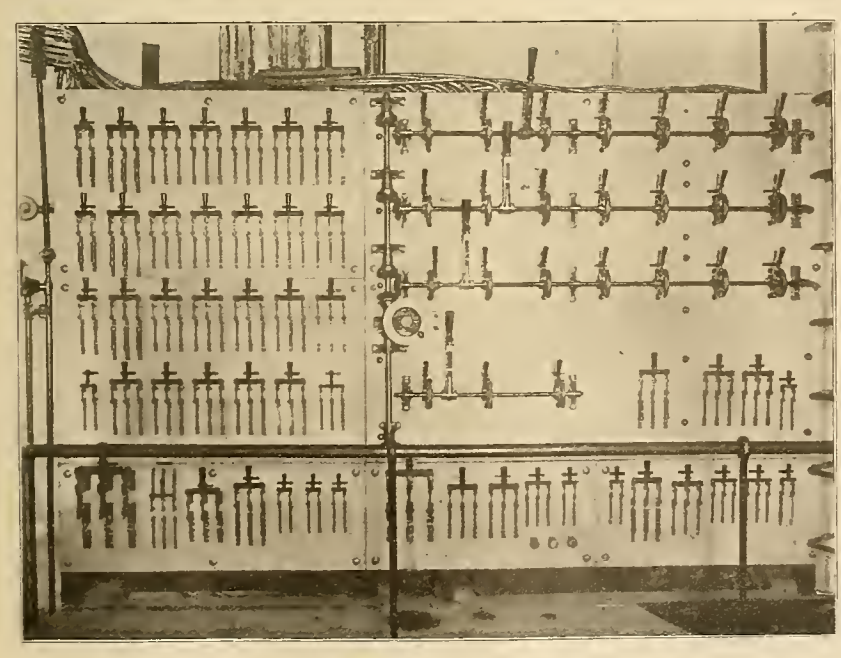
The Edison three-wire system is used throughout, the voltage of the two branches of the circuits being 110. The Edison street mains are tapped at Jackson boulevard, and 400,000-circular-mil cables lead to the switchboard. From this point 29 feeder circuits go to the different groups of stage lights and 20 circuits supply the auditorium, entrances, etc., providing outlets for over 2,000 incandescent lamps. All the wiring throughout the whole building is installed in iron-armored conduit, with the single exception of the flexible cables for the border lights on the stage. The circuits for these borders, of which there are five sets, run up to the rigging loft, or "gridiron," 80 feet above the stage floor, in iron-armored conduit, and there attach to the flexible cables leading down to the border strips. This leaves the space at the end of the borders entirely free for the operation of the scenery.

These border strips, of which there are five, are long troughs of corrugated iron, with two rows of lights. One row contains 40 clear-glass lamps; the other has sockets for 80 lamps, one-half of which are generally red and the other half blue, although any colored lamp may be substituted. At times, when a great amount of white light is required on the stage, as for a "costumic," rather than for a scenic, production, all the colored lamps are replaced by uncolored ones, thus giving 120 lamps to each border. The border strips are hung in the center (longitudinally) on swivels, so that they can be turned to any desired angle.

The proscenium strips are identical with the border lights, 40 lamps of each color being placed on each side of the proscenium arch. In the footlights there are sockets for 120 lamps, wired on three separate circuits, so as to provide for varied color work. These footlights have a long-slope trough and the hood rises but two inches above the stage level, so that the view of the audience in the parquette is in no way obstructed, and still the light is reflected to all parts of the stage.

ILLINOIS THEATER.

An important adjunct of the modern stage is the floor or wall pocket, where a flexible cable may be plugged in and the light carried to any part of the scenery. The stage of the Illinois Theater is amply equipped with these pockets, 10 being placed in the floor, two on the back wall, one on each side of the proscenium arch and four on the fly floor. In each of the pockets are two sockets, one for a light incandescent-lamp load, arranged for connection with dimmer circuits, and the other for heavy service, such as arc lamps with no dimmer connection. About 100 amperes can be carried on the light-load sockets, while the arc circuits will carry a total of 300 amperes, which is sufficient to meet the maximum requirements of any stage, viz., 12 arc-lamp projectors of 3,000 candlepower each. The stage is equipped with six bunches of incandescent lamps of eight lamps each, which can be plugged in at any of the pockets, and also 12 separate strips of from six to 10 lamps each. All the plugs are interchangeable. When it is necessary



Stage Switchboard.

View in Lobby.

ELECTRIC LIGHTING OF THE ILLINOIS THEATER.

to take more than one circuit from one pocket a plugging box providing outlets for three circuits is used.

There are 24 theater dimmers mounted on the back of the switchboard and controlled from the front by means of levers and an interlocking gear. There is a dimmer on each border, each proscenium strip and the footlights for each of the three colors, making 21 dimmers in all, and the levers are all connected so that they may be operated together or in different combinations by merely turning the gear wheel at the center of the switchboard. The three dimmers on the lower rod control two circuits leading to the floor pockets and one to the house lights. The dimmers are of the well-known type manufactured by the Wirt Electric company and are designed for 110-volt, 16-candlepower, 56-watt lamps on three-wire circuits.

Some theatrical companies carry their own cut-out boxes and switchboards for controlling the lights they use, and to provide for such an occasion three lugs have been placed at the bottom of the switchboard, so that any desired connection can be readily made. The lights in the orchestra pit are controlled by a throw-over switch, so that if necessary during dark changes on the stage these lights may be kept burning on the main circuit. The lights in the passageways and stairs of the house and in the boxes, in fact, all that throw no light directly on the stage, are on separate circuits from the main house lights, so it is not necessary to put them out when the main lights are dimmed or cut off. However, in dark changes all the lamps in the house that would throw any light on the stage can be instantly extinguished.

A heavy circuit is carried from the switchboard to the front of the first balcony for an arc-lamp projector and a similar circuit to the front of the upper balcony, where four arcs may be operated. As a rule, a double reflector and a "spot" lamp are operated from this latter circuit. Connection is made by inserting plugs into pockets in the balcony railings, similar to the stage pockets. Scattered all over the three floors of the auditorium are 34 pockets in the floor for the use of the cleaners when the house is dark. Each cleaner carries a bunch light and flexible cable, which may be plugged into any of the pockets. The same number of outlets are furnished for connecting small electric fans in warm weather. In the rear of the parquette floor is provided a pocket for connecting a biograph circuit.

All the lights in the building, except those in the basement and box offices, are controlled from the stage switchboard. The house lights can be divided into 17 separate circuits. There are four arc lamps outside, one at each corner of the building, that are also controlled from this switchboard. The stage and house wiring has been so designed that any possible change can be made with but two movements, and those practically instantaneous. Apparently all the different combinations of lights that can possibly be useful have been arranged, and credit for this design and arrangement of the circuits is due to Thomas Cleland, the electrician of the Illinois Theater, who, by reason of his past experience in theater work, was able to provide for every emergency in the wiring of the new theater. All the electric wiring and construction was installed by the Chicago Edison company, which company also furnishes the power.

The heating of the Illinois Theater is provided for in a novel manner. A large open room is provided under the parquette floor, and steam pipes run lengthwise under the whole ceiling, which is the floor of the parquette. Under each side is a grated opening and the hot air rising from the pipes passes through these openings directly into the auditorium. A similar arrangement is provided for under each of the balconies. The air is drawn in from outside through cheese-cloth screens and forced by two fans to these heating rooms, the exhaust escaping through a large opening in the roof. Each of the fans is driven by a five-horsepower electric motor. Steam is supplied from a fire-tubular heating boiler placed under the alley at the rear. A room is provided under the alley at the west side of the building for the future installation of an electrical generating unit, should it ever be desired. An intercommunicating telephone system connects the stage and boiler room with the box office and manager's office.

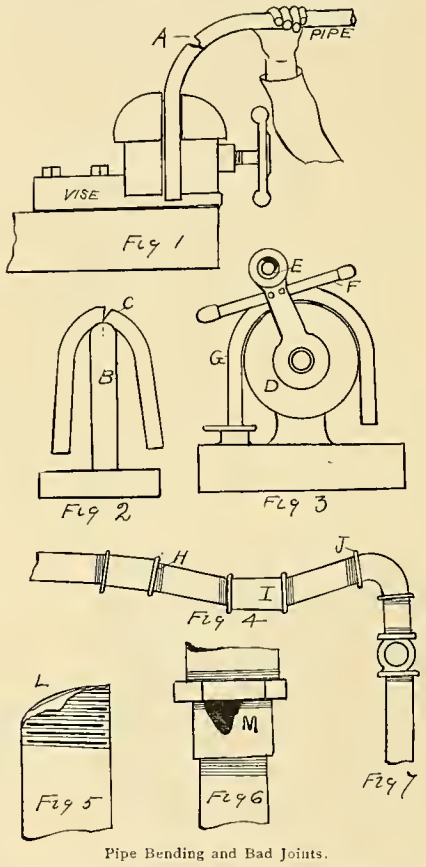
Work on the Illinois Theater was started in February of this year, and the dedicatory performance was given on October 15th. The theater has been built by the proprietor, the Hayman-Davis company, and is under the management of Will J. Davis. The general contractor on the building was the George A. Fuller company, and Wilson & Marshall of Chicago were the architects.

Pipes for Carrying Wires.

By P. I. Panamolo.

Since the use of pipes for carrying wires for electrical purposes in houses, stores, factories and public buildings has become general, electrical machinists have had considerable to do with processes of bending and adjusting piping of all kinds. There are various forms over which iron, brass, lead and other descriptions of metal piping may be bent readily. In some cases it has been noticed by the writer that the electrical machinists attempt to bend metal piping by putting the piece of pipe into a vise, something after the plan shown in Fig. 1, bending or trying to bend the pipe so as to form the proper arc, only to have it snap off at (A). This will sometimes happen even when the pipe is packed with sand, clay or rosin, or other substances inserted for the purpose of solidifying the pipe and sustaining the pipe walls. The writer has seen attempts undertaken to bend the piping in a vise by a series of hammerings on the pipe, gradually bending it over to describe the circle wanted, and sometimes finally getting the proper pattern. But, as a rule, pipes bent in this manner are weakened by the constant hammering. The shell of the pipe may be even cracked and the crack not detected until the pipe is put into service, when a fire may result through electrical contact with woodwork, the defect in the pipe permitting the electrical current to pass. The vise method of pipe bending should not be used.

Another imperfect mode of bending pipes for electrical-wire service observed by the writer in several electrical machine shops consists in the employment of a narrow wood or iron form, like (B), Fig. 2, which is used as a pattern on which to bend the pipe. The form is too narrow at the top for effective service, and usually results in the breakage of the pipe wall at about the point (C). The form should be of fuller size, describing a complete half circle, something according to the device shown in Fig. 3. In this bending device the form over which the pipe is pressed is large enough to allow the pipe to assume a full circle without liability of fracturing. For precaution, however, the pipe should be filled with clay, molten rosin or other composition, so as to steady the walls. The pipe may then be laid in the groove of the wheel (D), one end fixed to the base of the device, and the compressing wheel (E) started in at (G) to press the pipe over and to the form of the wheel (D). This is done by forcing the wheel carrier over by applying pressure with both hands to the lever (F). The pipe is readily bent on a form of this sort, as it is possible to get a good, even pressure by means of the lever.



Pipe Bending and Bad Joints.

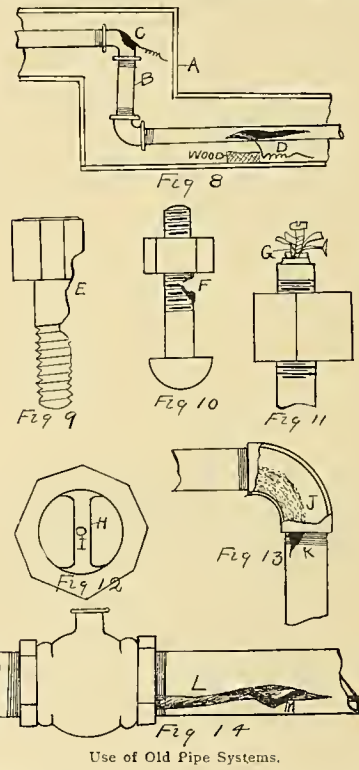
Defective Joints.

The employment of piping for carrying important electrical wires through wooden joists and beams and partitions of buildings is often abused. Your correspondent saw one pipe in which the joints were as numerous as the sample shown in Fig. 4. It was evidently supposed by the pipe fitters that as the pipe would not be used to carry water, gases or other properties that would require perfectly tight fittings, it would answer all purposes if the old pieces of piping were worked off.

I have known cases where the pipe fitters have received orders from the electrical engineers to put in certain lines of pipes for carrying wires in manufacturing establishments, laundries, stores and other places, to look about their shops and collect all the old pieces of rejected pipes and use them in putting in the pipe service for wire purposes. I have seen pieces of pipe fitted that fail to match. In other cases the threads have been poorly matched, and I recollect one case in which several of the pieces were threaded together with threads of different sizes. In Fig. 4 the first incorrect fitting is at (H), where the union permits the pipe to drop, so that the union at (I) is caused to assume a position out of alignment. To bring the pipe line up it is bent to the elbow (J). Work of this sort answers the purpose of the pipe fitters in that it permits them to utilize the odds and ends of their shops, but it does not fill the bill for electrical-wire service. Electrical wiring should be carried only in pipe lines in which the adjustments and connections are perfectly made, as if the pipe were to be used for carrying liquids or gases.

Using Old Piping Systems.

In many cases the former systems of piping employed for liquids or gases in buildings are utilized for wire service when electric lights are substituted for gas, etc. In such cases the system, as a whole, is usually effective and can be used to advantage, providing the details of defects are looked out for. In using a pipe system which has been in service for a number of years carrying gases, there are liable to be some weak places in the connections. It will be discovered that some of the ends of pipes which fit into elbows and unions are partly eaten away or worn and broken by mechanical action. In Fig. 5 is shown a sample of a common instance in this connection. The end of the interior pipe may be quite gone, as at (L), thus weakening the joint, and when the wires are inserted, this joint may become fractured and cause trouble. Examinations should be made for defects of this sort. Again, we may find that the metal is eaten out of a shoulder-piece, near a flange, as at (M), Fig. 6, in such a way that if wiring were put through, there would be danger of electrical contact with connecting woodwork, and a conflagration might occur.



Use of Old Pipe Systems.

Oftentimes piping which is carried through cases of wood, or boxed piping, after the plan shown in Fig. 8, is the source of considerable trouble to electrical engineers after the wires have been run into the pipes. The pipes may formerly have been used to carry liquids or gases and performed their service well. There may have been an interval between the discontinuance of the usage of the pipes as originally planned and for the electrical service, with the result that during this interval the pipes may have been affected in such a way as to be rendered unfit for the new work calculated for them. The writer has met with several cases of the kind. In one instance, a large factory used certain systems of piping in the plant for carrying gases. The service was discontinued for two or three years, and the pipes were neglected. Then it was decided to put in electrical wiring for lighting purposes, and the old pipes were employed in which to carry the wires from department to department. The pipes were in wood cases, as at (A), Fig. 8. After the

wires were inserted and put into use it was discovered that numerous defects in the pipe existed, due to rusting of the parts, the rust eating through the metal and breaking the protection. At one point an elbow was completely cut through, as at (C), and a part of the wire protruded. The connection (B) was perfect as yet, but down at (D) there was a long flaw opened so wide that portions of the wire were exposed, as shown. It is best to examine carefully all old systems of pipes before stringing the wires through them. In cases where only a part of the piping is defective, the pipe fitters can readily insert new pieces and make the system effective throughout.

Bolts, Nuts and Connections.

The adjustments of old systems of pipes should be looked over with a view of ascertaining the precise condition of the set-screws, bolts, nuts, washers, etc. Often the rusts of several years will unfit a set-bolt for service and make it dangerous to use the pipe depending upon it for purposes of carrying electrical wires. In Fig. 9 is a sample of the way in which many set-bolts of pipe systems become weakened through long service at points where there is enough moisture to keep the metal in a state of rust. The action of the rust is to eat into the metal and gradually affect the bolt, as shown at (E). Often the trouble occurs at a point where it cannot be seen, as at (F), Fig. 10, in which case the pipe fitters and the electrical engineers are very likely to overlook the defect.

Botch Work.

Botch work cannot be permitted with pipes for carrying wires any more than if the pipes were to be used for conveying gases or liquids. I have heard many pipe fitters remark that as the pipes were only for carrying wires they need not be particular about tight and perfect joints, the electrical men would not know the difference, etc. In one instance I saw a pipe fitter do what he would never do if the pipes were intended for any other work than that of carrying wires. A reducer was used for one piece of pipe and the plug failed to fit correctly. Therefore, instead of returning to the shop for a proper-fitting plug, he proceeded to make the ill-fitting plug tight by driving in with it a cluster of screws and pieces of wire, as at (G), Fig. 11. This made the part tight, but, of course, it would not last and was a botch job.

Brackets.

Some of the electrical engineers are now using little brackets in pipes for carrying wires, after the plan shown in Fig. 12, in which the end of a pipe is shown with a bracket (H). This bracket is fitted tightly to the interior of the pipe and is pinned. The hole through which the wire is carried is marked (I). If these brackets are liberally distributed throughout the pipes, the wire will be sustained along the center of the pipes.

Accumulations of Foreign Matter.

A serious evil in placing wires in pipes formerly used for other service is that often there are collections of dust, pieces of filings of metals, and general clogging stuffs, which gather at joints and turns and cause considerable trouble. In Fig. 13 is a sample of the common choking of an elbow, as at (J). Foreign matter of this sort will often collect in such a way as to form corroding surfaces and eat into the pipe, as at (K). Before running the wires through the pipes, precautions should be taken to clean out the pipes thoroughly. The elbows should be wiped out, even if it is necessary to unjoint some of the pieces.

Cracked Pipes and Fires.

Several instances have come to notice in which the fire-insurance engineers have traced the causes of fires in buildings to the use of pipes for carrying wires, in which the pipes were cracked, as at (L), Fig. 14, thus allowing the wire to come out, as at (M). Of course, as soon as a pipe reaches this stage of imperfection it becomes useless as a wire protection, and the wire is liable to become a dangerous element by contacting with surrounding combustible materials and igniting the same. In the event of portions of the pipe being found cracked, these portions should be removed and new pieces substituted. If this is not practicable, then the cracked parts should be tightly wound with wire, so as to close up the openings and make them tight.

John Scott Medals.

The Franklin Institute of Philadelphia, through its committee on science and the arts, has recommended the award of the John Scott legacy medal and premium to Edward G. Acheson of Niagara Falls, N. Y., for his process for the artificial production of graphite, and to Ralph D. Mershon, late of New York and now of Montreal, for his potential indicator or compensator. Both of these gentlemen are members of the American Institute of Electrical Engineers and well known in the electrical field. Mr. Acheson is president of the Carborundum company, and Mr. Mershon was for several years an alternating-current expert for the Westinghouse company, in which position his work attracted wide attention. Mr. Mershon is now connected with the Montreal Street Railway company and other electrical interests of the Canadian metropolis.

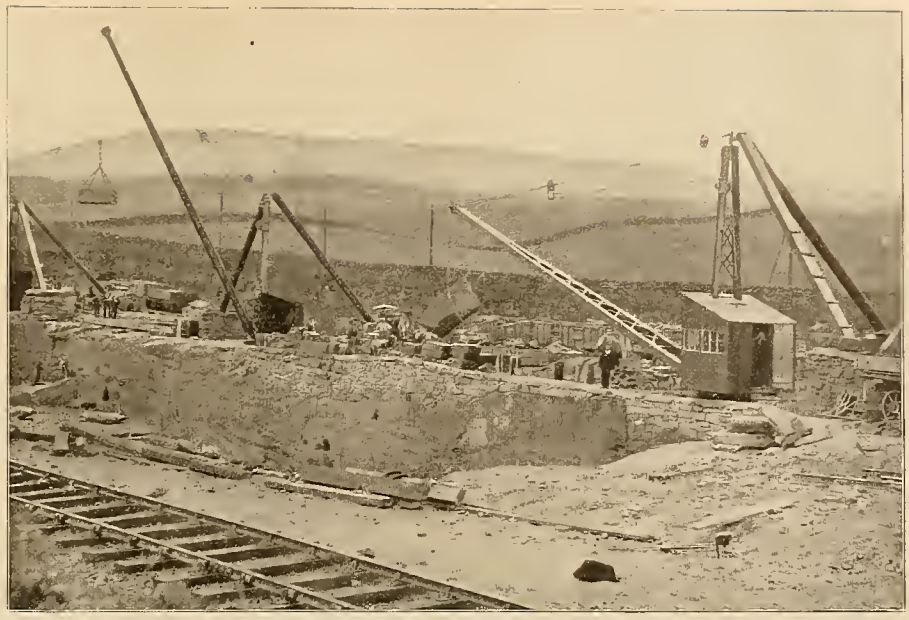


FIG. 1. ELECTRICALLY OPERATED QUARRY IN SCOTLAND.

Electrically Operated Quarry in Scotland.

The advantages and economies of electrical power are shown in a stone quarry located in a mountainous district in the Lowlands of Scotland. This quarry is about six miles from Dumfries and is two miles from the nearest coal siding. The generating station, which is at Closeburn, two miles distant from the quarry, consists of two 80-horsepower, direct-coupled units. The dynamos were manufactured by D. Bruce Peebles & Co., Edinburgh, which company also supplied the motors. The field-magnet cores and poles are of annealed cast-iron, with patent cast-iron pole tips; the function of the latter is to provide a constant magnetic fringe, independent of the main field, in order to insure sparkless commutation with fixed lead at all loads, an important point for the very varying load which is such a feature of quarry work. The engines are of the compound, single-acting type, and were built by the Mirrlees, Watson & Yaryan company of Glasgow.

The current is carried at a pressure of 500 volts by overhead transmission to the quarry, a view of which is given in Fig. 1. At the quarry there are seven 10-ton derrick cranes at work, each driven by a 15-horsepower motor of the completely enclosed type. The motor is geared direct to the crab by means of a rawhide pinion, gearing into double-reduction gear on the crane barrel. The ratio of the speed of the motor to that of the first shaft is 1:4.5.

The motions of the crane are operated by means of a patent reversing controller, as shown in Fig. 2. This controller can be worked by the most inexperienced employe, and is made as mechanically perfect and as strong as is possible. As seen in the illustration, the handle is in the middle position; a movement of the handle through an arc of 45° sends the contact arm around by means of gearing through 180° in one direction, while moving the handle 45° in the other direction sends the arm around 180° in the opposite direction, so that a very small movement of the radial arm implies a very large movement on the part of the switch. The contact blocks are removable, and have ample contact surface throughout. A view is given in Fig. 3 of the motor and controller in position on the derrick.

The crane motors are designed for compactness and ability to start under excessive torque. They are of 15 horsepower and will readily take 25 horsepower without sparking. Electric power is also utilized in the stone-planing and cutting shops, situated close by the generating station, where three 15-horsepower motors and three 10-horsepower motors drive, respectively, by means of gearing, the reciprocating stone planers and sawing machines. Several sets of combined centrifugal pumps and motors, mounted on movable platforms, are employed in the quarries for draining the workings, and are exceedingly convenient for this purpose, the power being transmitted by means of a flexible cable.

As regards the working of the plant, there are altogether seven cranes installed, each of which takes from 15 to 20 horsepower as a maximum, and the average load factor for the cranes may be set down at about 20 per cent. The same plant, however, which drives the cranes also drives the stone-cutting and planing machines, the average demand of which is 40 horsepower, with a load factor of about 50 per cent., so the whole plant could be normally run by working one 80-horsepower set at its full load, or the two running half load, so that, if absolutely necessary, either machine could act as a spare generator for the other. As, however, the maximum load is momentarily as much as 140 horsepower, it is advisable to run the two sets always. The average drop on the line is five per cent.; the line has to transmit power to the crane motors only.

The monthly coal consumption for the whole installation, consisting of seven 15-horsepower crane motors, three 15-horsepower planing motors, three 10-horsepower saw motors and a steam hammer and pulsometer, the latter taking about 15 horsepower for an average of about four hours a day, works out at about 90 tons a month at $1.80 a ton. This is working non-condensing and with cold boiler feed. With the installation of condensers, it is anticipated the consumption will not exceed 65 tons a month, which is about one-third of the coal consumption were the whole installation driven by steam.

The above facts and the illustrations are taken from the London Electrical Review.

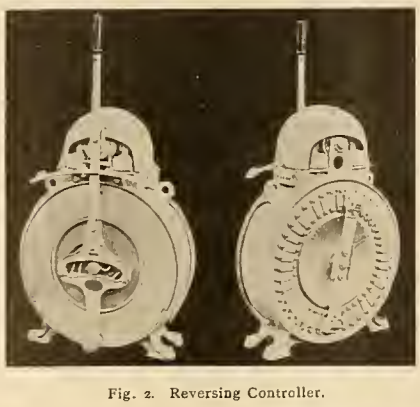


Fig. 2. Reversing Controller.

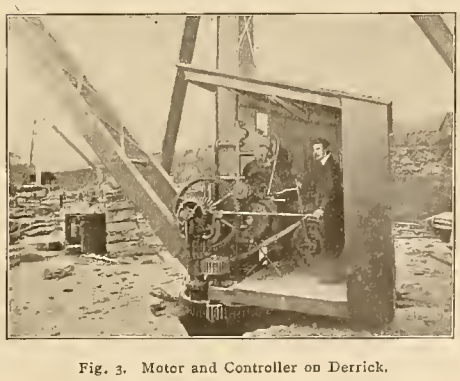


Fig. 3. Motor and Controller on Derrick.

ELECTRICALLY OPERATED QUARRY IN SCOTLAND.

Data of 153-mile Transmission from Snoqualmie Falls.

In former issues the Western Electrician has briefly noted the fact that the Snoqualmie Falls Power company had succeeded in operating a motor over 153 miles of line. This company has a line running from Snoqualmie Falls, Wash., to Seattle, and another to Tacoma, supplying light and power to both cities. The whole system was connected up in series, the line thus running from the falls to Seattle, back to the falls, to Tacoma, and finally back to the power house, where one of the generators was operated as a synchronous motor. Some interesting measurements were secured at a test made last month and are given herewith.

The single continuous three-phase circuit, 153 miles long, was composed of 58 miles of aluminum wire having an area of 69,696 circular mils, four miles No. 1 B. & S. medium hard copper, 51 miles of aluminum wire having an area of 54,756 circular mils, 36⅔ miles No. 2 B. & S. aluminum cable, 1⅔ miles No. 2 B. & S. medium, hard-drawn copper and 1⅔ miles No. 0 medium hard-drawn copper. The apparatus used consisted of a Westinghouse 1,500-kilowatt, three-phase generator, and a similar machine used as a synchronous motor at the end of the circuit. With the 153-mile circuit open at the incoming end the tests were made for charging it at different voltages, the alternations (7,200) being kept constant. It was found that as the voltage increased the charging current rapidly increased; that is, at 22,500 line voltage it required 62 kilowatts to charge the line; at 30,000 volts it required 112 kilowatts and at 35,000 volts 180 kilowatts. With the lowering transformers at the falls cut in and their secondaries open it was found that the current required to charge the line increased; that is, at 22,500 volts it required 76 kilowatts and at 30,000 volts, 123 kilowatts. The voltage at the incoming end of the circuit, with charging current only on the line, was greater than at the outgoing that is, 22,500 volts out gave 24,600 volts in, 30,000 volts out gave 32,100 in. Tests were also made to determine the different amounts of charging current required at different frequencies, the voltage being kept constant at 30,000, and it was found that at 6,000 alternations 100 kilowatts were required to charge the line, at 6,600 alternations 105 kilowatts and at 7,800 alternations, 115 kilowatts.

The line was then tested for loss of power in transmitting current for a non-inductive load consisting of a water rheostat at the falls at the end of the 153-mile circuit, and it was found that the line voltage out was 30,000, incoming 22,000, drop about 25 per cent. The current per phase at 1,000 volts out was 624 amperes, incoming 554, loss 11.2 per cent. The total generator output was 1,100 kilowatts, with 723 kilowatts delivered to the rheostat, the loss being 34.2 per cent.

A test was also made for charging current with the sub-station transformers at Seattle and Tacoma and the lowering transformers at the falls in circuit, but with secondaries all open, and it was found that with 30,000 volts out, there was 31,500 volts in, and it required 193 kilowatts to charge the line. A test was then made of operating a second generator as a synchronous motor at the end of the 153-mile circuit, and the machines were synchronized without any trouble whatever, but soon began pumping, so that it was found advisable to separate them. During this test the outgoing-line voltage had varied from 26,700 to 27,600 and incoming from 24,000 to 26,700, giving, approximately, a drop of six per cent., the current per phase at 1,000 volts out being approximately 900 amperes, incoming approximately 650, loss approximately 27.7 per cent., total output 432 kilowatts, incoming 374 kilowatts, loss approximately 13½ per cent. The figures on this last test are approximate only, as all of the instrument needles oscillated very much, many of the ammeters fluctuating over the entire range of the scale.

The experiment then was tried of operating the water rheostat and the synchronous motor in multiple at the end of the 153-mile circuit, and the performance of the motor was very much improved.

The Snoqualmie Falls power plant has been in course of construction something over two years, and, although the service began a year ago, the plant in all its details has only been recently finished. The project is very novel in several respects, principally because of the hydraulic and electric machinery at the head works being located in an excavated chamber in the solid rock nearly 300 feet below the surface, and also because of its being the pioneer in the use of aluminum wires for transmission purposes. The plant is said to be a commercial success and has cheapened industrial processes and public services in all the cities to which it is tributary.

London Metropolitan Conversion.

Reports from London state that in all eight manufacturing companies have submitted bids on the equipment of the London Metropolitan District underground railway. Three of these concerns, the Sprague Electric company of New York, the Westinghouse Electric and Manufacturing company of Pittsburg and the General Electric company of Schenectady, are American. The systems proposed include overhead trolley, conduit and third-rail for distribution, and the multiple-unit and electric-locomotive systems of train equipment. Mr. Lemuel Bannister, who is a director in both the American and British Westinghouse companies, is in London, in the interest of his company. The railway company, in inviting bids for the installation, has not hampered the bidders with any specifications whatsoever. This resulted in making the competition particularly keen, the conditions involving a comparison of the merits of the different systems, on the ground of effectiveness as well as cost. American concerns relying on the prestige gained from having built the London Central "tuppenny tube" hope to gain the lion's share of the work. It is believed that the contract will not be awarded before January 1st.

The European concerns bidding are Dick, Kerr & Co. of London, Mather & Platt of Manchester, the Electric Construction company of Wolverhampton, and Siemens & Halske and Schuckert & Co. of Germany.

Rotary Converters and Motor-generators.

By Frank C. Perkins.

Part II.

Direct-direct Motor-generators as Boosters.

Motor-generators have been more extensively used for direct-current transformation from a high potential to a low potential, and vice versa, than have rotary converters. In the St. Luke's station of the County of London Electric Lighting company (Fig. 5) bipolar motor-generators are used in connection with the storage-battery plant, one of the machines acting as a booster generator, the other as a direct-current motor. The Siemens & Halske Electric company of America has installed a number of motor-generators for transforming direct currents of one potential to continuous currents of a higher or lower potential. One of this company's direct-direct motor-generators is shown in Fig. 6.

In the series high-tension, power-transmission system of M. Thury of the Compagnie de l'Industrie Electrique of Geneva, Switzerland, the motor-generator plays a very important part. The motor part of the combination which receives the high-tension direct current is mounted on porcelain insulators on the foundation. It receives from the line a constant current of 42 amperes or 65 amperes. The generators and motors are series machines. Directly connected to the shaft of the high-tension motor is coupled a low-tension, direct-current generator for supplying the lighting circuits at 125 volts or the local small motors on a 500-volt power circuit. These direct-current, power-transmission systems are only highly successful through possibilities offered by the use of motor-generators and direct-current rotary converters.

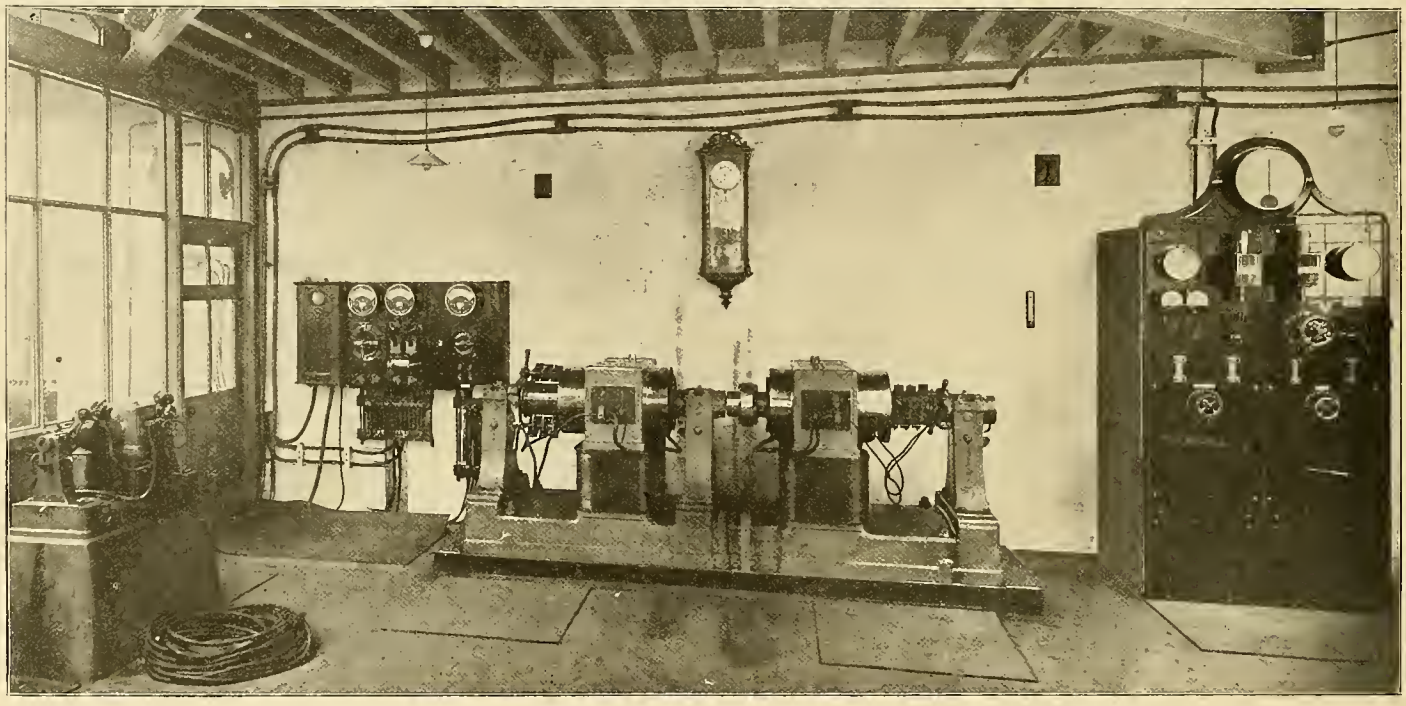


FIG. 5. ROTARY CONVERTERS AND MOTOR-GENERATORS.—MOTOR-GENERATORS IN ST. LUKE'S STATION, LONDON.

Direct direct Rotary Converters as Boosters.

The direct-current motor-generators are now being rapidly replaced by direct-direct rotary converters for storage-battery boosters. These machines are also largely used for telegraph and telephone central stations, although the motor-generator is very satisfactory for small direct currents used for raising and lowering the line potentials. The Siemens & Halske Electric company of America, as well as the Westinghouse and General Electric companies, installs many machines of this type where 500-volt power circuits must be supplied from central stations having large 125-volt and 250-volt generators, operating both on simple parallel and three-wire systems.

Alternating-alternating Motor-generators.

The alternating-current system is so flexible and satisfactory for incandescent lighting that direct current is not always necessary, but the motor-generator is often used for changing the frequency. For example, at Buffalo, the Niagara current has a frequency of 25 cycles, which is considered too low for satisfactory incandescent lighting. A motor-generator is therefore used, the alternating-current motor utilizing the 25-cycle current and the alternator, which it operates, supplying the city-

lighting circuit with an alternating current having a periodicity of 60 cycles a second. At the Pan-American Exposition next year the problem will be solved as to whether the low frequency of 25 cycles can be made to give satisfaction for incandescent illumination. All the decorative effects will be produced with incandescent lamps using a 104-volt alternating current of this low frequency. The incandescent-lighting circuits of the city are supplied from large General Electric single-phase alternators, each operated by a three-phase synchronous motor of 565 horsepower. These motor-generators receive the current from static step-down transformers at 352 volts and 25 cycles, the voltage being reduced from the potential of the Niagara power circuit, which is 11,000 volts. The motor-generators are operated at a speed of 375 revolutions a minute. The alternators, coupled to the motors, deliver a current of 92 amperes at a potential of 2,200 volts and at a frequency of 60 cycles a second. The field coils of the alternators of these motor-generators are excited by a direct current of 125 volts.

ALTERNATING-DIRECT ROTARY CONVERTERS.

Large alternators are frequently operated in central stations where it is necessary to supply a direct current of low potential for lighting purposes and the operation of small motors. It is there very desirable to have installed a transforming device which will supply a direct current of the required voltage by taking the power directly from the alternators already in operation. These alternators, when supplying a current whose frequency is not higher than 60 cycles a second, can easily be brought into service for this class of work by installing rotary converters.

Sixty-cycle, General Electric, two-phase rotary converters have been operating successfully for some time at the station of the Pennsylvania Heat, Light and Power company at Philadelphia, Pa. The capacity is 400 kilowatts and the machines are designed to transform a 60-cycle, two-phase, alternating current at from 150 to 220 volts to a direct current of 225 to 300 volts' potential. The speed of these machines is 450 revolutions a minute. The field frame has two very heavy ribs, divided horizontally, and is made movable sideways, so that the armature may be readily inspected. On account of the desirability of having the direct current variable, special 60-cycle static transformers were necessary, with 2,200 volts' primary and a variable secondary from 165 to 220 volts. A dial switch is arranged with contacts which cuts in or out more or less of the secondary turns.

From the point of economy of material and efficiency, the rotary converter stands very high, for it is obvious that with the converter one set of field magnets is made to do the work of two in a motor-generator, without increasing the dimensions. In the rotary converter there is also a gain, in that the weight of copper in the armature is very much less than the copper required in the armatures of the motor-generator. This, therefore, reduces the loss by heating and also permits an economy of copper.

ALTERNATING-DIRECT MOTOR-GENERATOR EXCITERS.

It has frequently been found desirable to use motor-generators and rotary converters for supplying the necessary direct current to excite the fields of incandescent-lighting alternators. A number of different combinations have been used for this purpose, several of which are worthy of mention. At the lighting and power station of the Buffalo General Electric company alternating-direct motor-generators are used for supplying the exciting current for the alternators. Two motor-generators are used, the motors of which have each a capacity of 30 horsepower, and are operated from a 25-cycle, polyphase circuit, the current being supplied from step-down transformers at a potential of 350 volts. The generators supply a continuous exciting current for the various machines of 160 amperes, at a potential of 165 volts.

Another method of obtaining the exciting current is by the use of alternating-direct rotary converters instead of motor-generators. These machines may also be used for supplying an ordinary low-tension, direct-current circuit for incandescent-lighting purposes, and are so used at the Buffalo station. Two General Electric converters have been installed, which supply a direct current at 125 volts, with a capacity of 800 amperes. The alternating side of the rotary converters receives the current at a potential of 80 volts from the 25-cycle, step-down, static transformers. The speed of the rotary is 750 revolutions a minute.

It is also sometimes necessary to furnish an exciting current of 125 volts when only a 500-volt, direct current is available. In this case either a direct-direct motor-generator or a direct-direct rotary converter is installed, the motor end being supplied from the 500-volt mains and the exciting current being delivered from the generator end at the required potential of 125 volts.

[*To be continued.*]

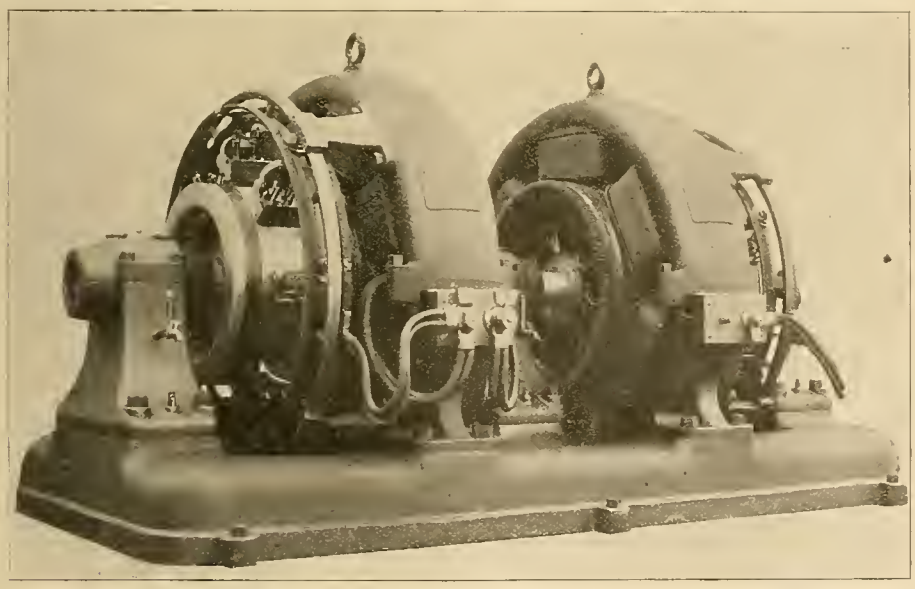


FIG. 6. ROTARY CONVERTERS AND MOTOR-GENERATORS.—SIEMENS & HALSKE DIRECT-DIRECT MOTOR-GENERATOR.

Electric Elevator for the Washington Monument.

The award of the contract for the installation of an electric elevator in the Washington monument to the Marine Engine and Machine company of New York city at its bid of $14,650 has excited much interest, as the lift is almost 500 feet. Since its completion in 1888 the monument has been constantly open to the public, with the exception of a short time for necessary repairs, and thousands of visitors from all lands have gone to its summit to "view the spreading landscape o'er," and it is a wise choice that will take every possible precaution to see that a work so important shall be done in a manner that will insure safety to the public and reflect credit on Colonel Bingham, upon whose shoulders the burden of its successful termination rests.

The work of installation will cover not only the installation of the electric elevator in the monument, but also that of a generating unit at the boiler house. The contract price of $14,650 includes the templets, anchor-plates and bolts for the complete installation of the generating unit. The necessary additions to the boiler house for the accommodation of this generating unit will be made by the government.

The main requisitions called for in this contract were a 50-kilowatt electric generator, to be operated at 240 volts, direct current, and to be direct-connected to a compound condensing engine, all to occupy a space of eight feet square; an electric-elevator mechanism and controller of at least 30 kilowatts, to be capable of intermediate speeds, but with a maximum not to exceed 100 feet a minute, and an elevator car, lighter than the present one, to weigh 4,000 pounds, and to be capable of carrying 35 persons. In addition to this, it is required that the base of the monument, which is used as a waiting room for passengers, shall be heated by electricity; that the necessary switchboards and all necessary accessories and instruments shall be provided, and that the motor and machine shall be installed on the same bed-plate. The thrust will be taken care of by interlocking spur-gearing machinery. The pinion will be of the best quality machinery steel and the gear wheel of the highest grade of cast-iron, both to be so accurately cut that they will mesh with each other with the least possible noise.

The motor will be of sufficient size to carry a maximum load for a period of 10 hours without heating more than 40° C. by the thermometer. The dielectric strength of the insulation will be tested by an alternating current of 1,000 volts; the brushes will be of carbon, with a maximum current not to exceed 30 amperes a square inch.

The elevator will be controlled by an up-and-down automatic stop switch, placed in the car, so as to give the operator full control of both speed and direction of movement, and it will be arranged to come to a stop automatically immediately upon the release of the operating lever. Provision will also be made to operate the car from the switchboard, and it is so arranged that both systems of control will not be in circuit at the same time; that is to say, when the car is run by the operator it will not be possible to control it from the switchboard, and vice versa. The controlling device will be so arranged that the car can be reversed when running at full speed in either direction, and this without injury to any part of the electric system or noticeable shock to the car. This controlling mechanism is to be provided with suitable magnetic circuit-breakers and makers, in order to close the line circuit to the motor and to short-circuit the motor through resistance when stopping the elevator.

For the safety of the car it will be equipped with a centrifugal governor and a release safety, the latter sufficient to stop the car when loaded up to 80 pounds per square foot, within six feet of release of safety with car going at full speed. In addition to this, a hand release will also be provided, to be operated from the inside of the car. Thus the operator will be enabled at any time to stop the car on down movement by springing the safety, avoiding any shock to the passengers and a strain on the car. The elevator is to be equipped with back counterweights from the drum, which will be adjusted so as to secure the most economical running. The lifting capacity, at a speed of 100 feet per minute, will be 6,000 pounds, exclusive of the weight of the car and its cables. The distance to be covered is 498 feet.

The plans include complete drawings of machine methods to be used for gearing, arrangement of framework and overhead sheaves for counterweight idler connections, supports for fastening the counterweight cables to the main hoisting drums; the proposed electrical machinery showing method of connecting electric motor to machinery, wiring of switchboard, wiring between the switchboard, car and motor.

The flexible cable to the car will have two extra wires and the weight of the cable will be carried by a center strand, which will have no electrical function. Each strand will be of sufficient size to carry a current of five amperes at 240 volts.

The car will be lighted by a cluster of six 16-candlepower lamps, the current for which will be furnished by an independent cable, and all the wiring will be done in accordance with the National Electrical Code, 1900.

The switchboard will be of the very best quality Tennessee marble, two inches thick, in one piece, and free from all metallic veins. It will be mounted on an iron frame with a border and acorn nuts of brass, polished and lacquered. It will have four double-pole feeder switches, three cabs of 100 amperes and one of 150 amperes of standard switchboard type. It will have a double-pole I-T-E circuit-breaker, and will be provided with an auxiliary shunt coil, used to open same, shutting off the current from the motor. The devices for operating will be placed one in the car and the other on the switchboard. On the front of the switchboard will be one voltmeter, range, zero to 300 volts; one ammeter, with a range from zero to 300 amperes, both of the round pattern, type F, Weston instrument; four Thomson recording wattmeters, and, in addition to these, the hand wheel of a field regulator, which will be mounted on the back of the switchboard.

The generator will be a 50-kilowatt, direct-connected machine, with a speed of 275 revolutions per minute. It will be capable of withstanding an overload of 25 per cent. for four hours.

After considerable unpleasant delay as to award of the contract, it is expected that the work will now be speedily pushed through, and the highest single electric elevator in the world will soon become a matter of history instead of theory. A. F. T.

The Chicago Union Traction company will build a clubhouse for its employes on Lincoln avenue, near Halsted street, on the site of an old car barn. The club will be maintained by the company and be open to all its employes. The building is to be 63 feet wide, 125 feet deep and will cost about $10,000. It will contain, among other things, an instruction room filled with model cars and other appliances for use in practical instruction, a small theater and a dining room. A power plant in the basement will heat the building and furnish power for the instruction room.

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The outcome of many conferences and much discussion, not always, in the beginning of the relations of insurance and electrical companies, of a harmonious nature, the National Electrical Code is now an imposing and, on the whole, satisfactory body of rules. Mr. Glover, in a paper read before the students of Armour Institute and presented in this number, gives a history of the code and says that the Underwriters' National Electric association is the most available body to make the probable changes necessary for several years to come. While all electrical men may not agree with this latter statement, the author of the paper is entitled to thanks for preparing the concise history of the code which we present.

The proposition of a well-known manufacturer of furnaces to equip the boilers of one of the electric street-lighting plants of Chicago with his furnaces without charge to the city, accepting as compensation the difference in cost of operation, in monthly payments, until the price of the new furnaces is made up, is an interesting example of a manufacturer's faith in his goods. It recalls Mr. Corliss' method of introducing steam engines with the improved valve-gear bearing his name. The city of Chicago is rather slow paying its bills, and the proposed arrangement, in which interest on the deferred payments is figured in the price of the new furnaces, seems to be ingenious and satisfactory. It is said that the furnace maker figures on getting all his money in 10 months by this method.

In the course of some interesting experiments with liquid air two German investigators, H. Ebert and B. A. Hoffman, noticed that a body suspended above the surface of the liquid acquired a strong negative charge. A series of tests revealed the fact that this charge is not due to the liquid air itself, but to the friction of minute particles of very cold ice suspended in its vapor. The authors succeeded in constructing a kind of electrifying machine by means of a tube containing a piece of wire gauze through which the vapor of liquid air was driven. Ice acquires a positive charge by friction with any metal, and imparts to the metal, and to other bodies also, a negative charge. This may account for the strong electric effects of polar snowstorms, and for other meteorological phenomena, including the aurora borealis.

Such strikes as that of the telegraph operators on the Santa Fe railroad system last week only hasten the day when the telephone will very largely supersede the telegraph in train operation. The railroad companies are making a constantly increasing use of the telephone, which has many advantages, one being that no skill is required to operate it, and telegraphers' strikes lead the companies to look forward to the time when trained operators will not be needed to transmit train orders. Conservative railroad men do not admit that the telegraph will ever be entirely done away with in train dispatching, and perhaps they are right. The invention of a practicable telephone relay ought to settle the question at once, and in the meantime the radical action of the Northern Pacific company shows the rapidity with which the innovation is making its way.

The daily papers have the news that the Fort Miller Power company of Stockton, Cal., has been capitalized for $2,000,000, to construct "the longest power line in the world." The main line will run through Stockton, "and the system when completed will be about 240 miles in length." San Francisco is to be the headquarters of the company.

This may be classed with that numerous order of news items "important if true." It may be assumed that electricity is the agent contemplated to transmit power over this 240-mile line, but up to this time electrical power transmission has not been in use, commercially, for half the distance mentioned. Very high potentials are necessary to transmit economically a working current at distances of 80 miles or over, and as the electromotive force is raised the difficulties of insulation are very greatly increased. Moreover, the amount of capital mentioned is entirely inadequate for the outlay required under any conditions conceivable as practicable.

"Earthing" has been worrying the London Lancet a great deal of late, as we learn from one of our English electrical contemporaries. The Lancet is considered an authority among physicians, but in undertaking to criticize methods of electric-lighting supply it merely causes the judicious to grieve. In its severe arraignment of "earthing" the doctors' journal says: "It is common knowledge now that an otherwise innocent current—that is, one of low voltage—may through certain defects become an exceedingly dangerous current of enormous voltage. Earthing is, of course, the main source of trouble and the generally offered excuse, but if electric lighting is to be our mode of obtaining artificial light, earthing must be overcome, and it seems to us that earthing has not been overcome; it is happening on all sides, and in several instances with most alarming results." The Lancet's trouble seems to be merely the result of misapplied energy. Let the shoemaker stick to his last and the doctor to his physic.

It has long been a commercial aphorism, particularly in England, that "trade follows the flag," but it has been left to the present day to demonstrate that it is also true that "trade follows the trolley." The Niagara border furnishes a case in point. Within a short time the Canadian city of St. Catharines, Ont., and the New York city of Niagara Falls have been connected by a new trolley line, the cars crossing the Niagara River over the upper steel arch bridge. With the advent of the trolley in Niagara Falls, N. Y., there began to appear the advertisements of leading dry-goods houses of St. Catharines, and, despite all the barriers of the duty, there is every reason to believe that the St. Catharines merchants are profiting by the new trolley connection. Thus it will be seen that the flag of the old saying has nothing to do with this trade, but that the more modern influence of the trolley is the spur that diverts trade from the one country to the other. It has been evident for some time that where small towns are connected with large cities by trolley, the trade of the smaller places is largely diverted to the more pretentious stores in the cities. But the international diversion of trade by trolley is later and more interesting.

Although it is conceded that the United States has, in general outline, the best patent system in existence, there is room for improvement in some details; and to secure this improvement the workings of foreign practice may well be studied in conjunction with the requirements of American inventors and manufacturers. Two and a half years ago the president, acting by the direction of Congress, appointed a commission consisting of Judge Grosscup of Chicago, Mr. Forbes of New York and Mr. Greeley of Washington "to revise and amend the laws of the United States concerning patents, trade and other marks and trade or commercial names, so far as the same relate to matters contained in or affected by the Convention for the Protection of Industrial Property, concluded at Paris, March 20, 1883, the agreements under said convention concluded at Madrid, April 14, 1891, and the protocols adopted by the conference held under such convention at Brussels, 1897, and the treaties of the United States and the laws of other nations relating to patents, trade and other marks and trade or commercial names." The law creating the commission provided that a report of the work performed be submitted to Congress. The commissioners were directed to indicate such changes in existing laws as they deemed necessary and to accompany these recommendations by notes. How well this task has been performed may be judged by the long abstract of the commission's report given on another page.

The commissioners recommend that the existing law be amended to provide that an application for a patent filed in any one of the countries which are parties to the convention of 1883 shall, if the inventor file an application in the United States within seven months from the date of the foreign application, be given the same force as regards priority that it would have if originally filed here. They also recommend (and in this their views will meet the approval of nearly all patent lawyers) that the law permitting the filing of caveats be repealed. But if caveats are still to be permitted, foreigners as well as citizens of this country should be permitted to file them. Several other changes of minor importance are suggested, and the recommendations are embodied in three short bills, none of which, however, affects the really essential features of the existing patent laws of the United States.

The report is an able and exhaustive review of our patent and trademark system, with especial relation to foreign patent laws, and in these days of great and growing export trade it is of much importance. The eminent commissioners gave their services without remuneration and they are entitled to the grateful thanks of all Americans interested in the protection of industrial property.

The National Electrical Code.[1]

By B. H. Glover.

Before entering upon a discussion of the rules and requirements of the National Electrical Code, or Underwriters' Rules, as they are often styled, it has been thought advisable, as well as interesting, to consider the various stages through which these rules have passed, and the manner in which uniformity of action and harmony has been secured from the numerous interests they affect.

The adoption of a uniform set of rules for the safe installation of electric-light and power apparatus, by the electrical, insurance and allied interests marks a distinct epoch in the history of rule-making in this country. From the crude beginnings of 20 years ago up to the present time, corrections, changes and additions have been made, so that the rules are as nearly perfect as combined experience and development have been able to make them.

It seems that to the New York Board of Fire Underwriters belongs the credit of the first printed requirements in relation to electric lighting. On October 19, 1881, a circular was issued by that board containing the following resolution:

Resolved, That the committee on police and origin of fires is hereby directed to notify the owners and occupants of all buildings in which uncovered electric-light wires, or in which arc lights with open bottoms or without globes, are found that the wires must be covered and the lamps altered to conform to the rules of this board within 10 days from date of notice, and request that the lights shall not be used until the alterations are made; and in case the alterations are not made within said time, the committee is hereby directed to notify the members of the board of said failure, and the companies insuring said property are hereby recommended to give notice to the owners and occupants of such buildings that, unless the request is complied with and the alterations made within a reasonable time, the insurance on said property will be canceled.

The Boston Manufacturers' Mutual Fire Insurance company comes in one day later, with a circular dated October 20, 1881, calling attention to the same hazards from arc lighting. Under date of January 12, 1882, the New York board issued a very brief circular, containing a few rules for the installation of electric lights; and in January, February and March of the same year the Boston Manufacturers' Mutual Fire Insurance company issued circulars on this subject, in which the elements of later developments are shown by the classification of the requirements under the headings of dynamo machines, wires, arc lamps and incandescent lamps.

On May 19, 1882, the National Board of Fire Underwriters adopted the standard requirements of the New York board for the installation of electric lights, and in the same month, the Boston Board of Fire Underwriters issued a circular containing similar rules.

On August 1, 1885, the New England Insurance Exchange issued rules covering both arc and incandescent systems. Previous to that time they had used the rules of the Boston board, issued in 1882. The rules of the New England Insurance Exchange were perhaps the most complete that had yet been put in print; and, in a report of the electric-light committee of that body, it is stated that in the arrangement of these rules they were "largely aided by some of the leading electric-light people."

At a meeting of the National Electric Light association in Baltimore, in 1885, representatives of the Boston board and the Boston Manufacturers' Mutual Fire Insurance company were present; and while there was considerable talk and discussion on the matter of rules, nothing was carried to an issue. In the following summer a joint conference of certain insurance representatives and members of the National Electric Light association insurance committee formulated rules, which were later presented to the National Electric Light association, but which were not adopted. The rules resulting from this conference were promulgated simultaneously by the Boston Fire Underwriters' union and the New England Insurance Exchange, under date of May 15, 1889, and these rules, it may be said, were the first which fairly deserve to be called comprehensive, as the rules of other insurance boards, as late as January, 1890, were still very brief and incomplete.

During the year 1890, numerous and more or less complete rules were issued by the various boards, associations and insurance companies. In August, 1890, a joint conference was held between the members of the National Electric Light association and insurance representatives, resulting in the agreement on a larger number of points and the foundation of a conference committee under the name of the National Electro-insurance Bureau.

In September, 1891, a code of rules was issued by this bureau, but as there was no special effort on the part of the National Electric Light association or the Electro-insurance Bureau to secure the general adoption of the rules, they were adopted only by three or four insurance boards, covering a small portion of the United States; and some of these made changes to suit themselves, while most of the insurance boards continued to use the rules of their own, as they had no pressure brought to bear upon them in the interest of uniformity.

In August, 1892, representatives of the Underwriters' boards, covering the New England, Middle, South Atlantic and Gulf states, met in New York, and, taking as a basis the rules which had been adopted by the National Electric Light association, they considered them section by section. The interest of the insurance companies in this effort for uniformity resulted in another meeting, at which the whole United States and Canada were represented, and which effected a permanent organization.

The rules were put in print, proof copies were widely distributed, with the request that they be examined and suggestions submitted for changes or improvements. These rules were far in advance of any hitherto published, either in this country or abroad, and were issued under date of March 20, 1893, being almost immediately adopted by the following-named fire underwriters' organizations:

National Board of Fire Underwriters.
New England Insurance Exchange.
New Hampshire Board of Fire Underwriters.
Boston Board of Fire Underwriters.
Suburban Underwriters' association.
Underwriters' Association of New York State.
Philadelphia Fire Underwriters' association.
Underwriters' Association of Middle Department.
Pacific Insurance Union.
Western Union.
Association of Fire Underwriters for Arkansas.
Chicago Fire Underwriters' association.
Cleveland Board of Underwriters.
Underwriters' Association of Cincinnati.
Detroit Board of Underwriters.

So, very general uniformity of insurance rules was secured in less than one year after the meeting of the insurance inspectors.

Other meetings were held in Chicago and Boston, at which further revisions and amendments were made, so that in June, 1894, a bulletin was issued, stating that the New York Board of Fire Underwriters, covering New York city, Buffalo Association of Fire Underwriters, Michigan Inspection Bureau, Southeastern Tariff association, Milwaukee Board of Fire Underwriters and Memphis Board of Underwriters had adopted the rules of the association, and in August, 1894, the Associated Factory Mutual Fire Insurance companies also adopted the rules, with a few modifications, so that, in less than two years, so far as the insurance rules were concerned, uniformity had been secured.

It might not be out of place to state at this point that in the meantime a bureau for the testing of devices and materials and for the dissemination of information had been established here in Chicago, in charge of William H. Merrill, Jr., who was a member of the electrical committee, with whom it has been my pleasure to be associated, and quarterly reports were issued containing brief accounts of fires in all parts of the country due to electricity, as well as bulletins containing reports of tests of wires, devices and materials.

There was still a feeling, however, that the electrical interests did not have as full an opportunity to express themselves on these rules as they were entitled to, and a communication was sent to various associations, suggesting a joint conference composed of delegates from the American Institute of Electrical Engineers, the American Street Railway association, the National Board of Fire Underwriters, the American Institute of Architects, the International Fire Chiefs' association, the American Bell Telephone company, the Western Union Telegraph company, the Postal Telegraph-cable company, the General Electric company, the Westinghouse Electric and Manufacturing company and the National Electric Light association, who should "undertake the codification, promulgation and enforcement of one standard set of rules, which shall meet as fully as possible the conditions that now exist, and be acceptable to all electrical, insurance and allied interests."

Later the Underwriters' National Electric association, the American Society of Mechanical Engineers and the Factory Mutual Insurance companies were invited to send delegates, and certain others were invited as complimentary delegates.

From this meeting the National Conference on Standard Electrical Rules was organized and a committee on code appointed, to which was assigned the task of amending and codifying the standard electrical rules. A pamphlet had been prepared, embracing the various codes, printed in parallel columns. These were carefully discussed, and it was decided that the rules promulgated by the Underwriters' National Electric association were the most feasible ones to take as a basis. The rules were arranged and classified without materially changing their wording. The rules were then issued, with the following note:

The National Electrical Code, as it is here presented, is the result of the united efforts of the various electrical, insurance, architectural and allied interests, which have, through the National Conference on Standard Electrical Rules, composed of delegates from the following associations, unanimously voted to recommend them to their respective associations for approval or adoption:

American Institute of Architects.
American Institute of Electrical Engineers.
American Society of Mechanical Engineers.
American Street Railway association.
Factory Mutual Fire Insurance companies.
National Association of Fire Engineers.
National Board of Fire Underwriters.
National Electric Light association.
Underwriters' National Electric association.

As soon as meetings of these associations are held and action taken, the fact will be noted.

Now we have in 1897, for the first time, a "National Code" stamped with the approval, not only of the insurance interests, but also of the national societies of electrical, architectural and allied interests.

From the foregoing sketch it is evident that the underwriters have, from the beginning, availed themselves of the advice and suggestions of the electric interests. The 1885 edition of the New England Insurance Exchange rules was prepared with the "aid of some of the leading electric-light people." Insurance representatives were present at the Baltimore meeting of the National Electric Light association in 1885, and, while that association took no action on the rules which came from this and later meetings, they were recognized and adopted by the Boston board and New England Insurance Exchange in 1889.

When the Underwriters' National Electric association was organized in 1892, it took as a basis of its rules those which had been formulated in 1891 for the National Electric Light association by the Electro-insurance Bureau. The rules prepared by the Underwriters' National Electric association were submitted to, and received the hearty approval of, representative experts. The insurance interests, however, have always felt that it was their province to settle what should be the electrical equipment of risks which they insured. This course has always been pursued in England, where the Phœnix Fire Office rules are practically the only ones recognized.

It is true that the underwriters should not be arbitrary and overbearing, and should make their rules as favorable to the electrical interests as the overcoming of the fire hazard will permit, and the facts show that this course has been generally maintained. The principal reason why harmonious relations between the electrical and insurance interests in the matter of uniform rules were not reached sooner was because of no organization through which the electrical, architectural and allied interests could be reached until the National Conference on Standard Electrical Rules was formed. For the same reason, uniformity of rules in the various insurance boards was not accomplished until the formation of the Underwriters' National Electric association, an organization through which the various boards could be reached, and in which they had a voice. Just as soon as this association was formed, uniformity of rules, so far as the insurance interests were concerned, became an accomplished fact, and just as soon as an organization of the other interests was formed, complete uniformity of rules was secured.

The efforts of the members of the code committee of the National Conference to secure harmony and uniformity have been appreciated, not only by the electrical, but by the insurance, interests as well. As the matter now stands, the conference accomplished its work, and has adjourned. The organization remains, and the work it has done stands as a precedent, so that, should occasion ever again demand, the machinery could be easily put into motion.

It is recognized that, from time to time, changes in the rules will have to be made to meet the natural growth in electrical lines; but considering the very satisfactory results now secured, and the slight changes needed in all probability for several years to come, the Underwriters' National Electric association is the most available body to charge with this work of revision for the present.

It is the practice of the Underwriters' association to give the fullest hearing on all criticisms or additions to the rules, so that the recommendations made for changes are based upon the judgment and opinions of recognized and best authorities. It can be affirmed, without fear of contradiction, that, while some mistakes have been made and imperfections may exist, the National Electrical Code, as it stands to-day, is the most complete, thorough and reliable set of electrical rules in existence.

1. Read before the students in the electrical engineering department of Armour Institute, Chicago, December 6, 1900. Mr. Glover is connected with the Underwriters' Electrical Bureau in Chicago.

The Metric System.

The bill of Representative Shafroth of Colorado for the adoption of the metric system by the United States has been favorably reported by unanimous vote of the House committee on coinage, weights and measures. The bill was changed so as to make the system go into effect January 1, 1903. Mr. Shafroth stated that all the civilized nations except Great Britain and the United States had adopted the metric system, Russia being the last to do so a few weeks ago. The bill, as reported, provides that on and after January 1, 1903, all the departments of the government of the United States in the transaction of all business requiring the use of weight and measurement, except in completing the survey of public lands, shall employ and use only the weights and measures of the metric system, and on and after January 1, 1903, the weights and measures of the metric system shall be the legal standard weights and measures of and in the United States.

Power from Blast-furnace Gases.

The United States vice-consul-general of Frankfort reports that in October 25 representatives of the largest iron works in France and Belgium visited the Hörde Mining and Rolling Mills association at Hörde, near Dortmund, Prussia, to inspect the electrical central station for utilizing the gas coming from the mouths of blast furnaces. The plant, when fully completed, will have a capacity of 6,400 horsepower. At present three twin engines of the Oechelhaüser system are run by this furnace gas to produce electric current for supplying power and light for the Hermann rolling mills. A fourth engine of 600 horsepower, and four others of 1,000 horsepower each, are now in process of construction to serve like purposes.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone and Telegraph War Taxes May Be Repealed.

The ways and means committee of the House of Representatives has agreed upon a war-revenue reduction bill that will be submitted in a few days. Based on the current year's revenues the total estimated reduction is $40,000,348.

Some of the existing taxes are reduced in amount, others entirely repealed, and some left as at present. Of the taxes repealed, principal in importance are those on theaters, expositions, brokers, bank checks and drafts, telephone messages, conveyances, telegraph dispatches, insurance policies, leases, mortgages, passage tickets and warehouse receipts. The present tax on telephone messages and telegraph dispatches is one cent on each message. Should the committee's bill become a law, it is estimated that the reduction in revenue due to the repeal of the telephone tax would amount to $315,000, while in the case of telegraph dispatches the reduction would be $800,000.

John M. Clark, president of the Chicago Telephone company, when asked his opinion of the proposed bill, said: "If the reduction of the tax on telephone messages means a cancellation of the tax, it will meet with general gratification. The trouble has been not with the amount of the tax so much as with the time and labor involved in keeping account of the tax items. The relief, while the taxation has been charged to the patronizing public, will be mutual with the company and its patrons."

E. J. Nally, assistant general superintendent of the Postal Telegraph-cable company, said: "The news that the revenue tax on telegrams is to be canceled will meet with general satisfaction. This will be true not only with the operating companies but with the people. The patrons have paid the tax, but the companies have been put to an infinite amount of detail work in bookkeeping and work of that kind. Generally, we feel that it is high time for relief, and we are pleased that it is in sight."

Rumored Telephone Combination.

From rumors of consolidation of several Independent telephone companies that have been prevalent in the East during the last few weeks, it is evident that the National Telephone and Telegraph company, which was incorporated last July, with $50,000,000 capital stock, to succeed the Telephone, Telegraph and Cable company of America, as was supposed, has not yet accomplished that purpose. In relation to these companies the New York Sun states that the "T. T. C." company, with its dependency, the Erie Telegraph and Telephone company, is understood to be considering a plan of merging with the National Telephone and Telegraph company. In relation to the statement sent out from Baltimore that the Erie company was to consolidate with Independent telephone companies of Maryland and Pennsylvania, President Charles J. Glidden of the Erie company is credited with saying that there was no truth in the report. The rumor, he said, evidently was founded on the fact that most of the offices of the Erie Telegraph and Telephone company have been moved from Lowell, Mass., to New York city, occupying a large portion of the offices heretofore occupied by the Telephone, Telegraph and Cable company of America at 100 Broadway.

Telephone System for the Northern Pacific.

Additional information in regard to the adoption of the telephone by the Northern Pacific Railway company is furnished by the Minneapolis correspondent of the Western Electrician. The company's plans involve the gradual superseding of its telegraph system by a telephone system which shall cover its entire transcontinental line. The officials of the road have been considering the matter for a year and a half, and have come to the conclusion that the saving in time and the increased accuracy will be worth the expense. Each message received must be transcribed at once with a carbon copy, and be subject to the usual rules which now govern corrections and erasures. It will then be repeated, word for word, to leave no room for error. It will probably take a year and a half to supersede entirely the telegraph.

Farr Drop, Jack and Plug.

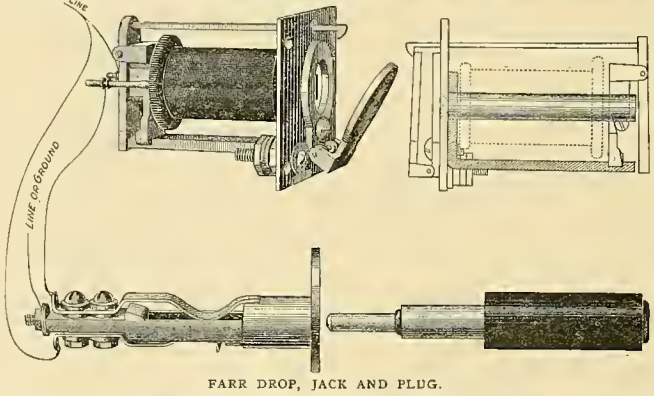
The Farr Telephone and Construction Supply company of Chicago is putting out some new designs in telephone-switchboard drops, jacks and plugs, as shown in the accompanying illustration. The drops are constructed with such close adjustment that the shutter can be thrown very easily through heavy resistance, giving excellent results on series or bridging lines. The jacks can be used for grounded or metallic-circuit lines. The drops are mounted on strips for the convenience of telephone companies that manufacture their own boards.

Ohio Telephone Notes.

The Columbus Citizens' Telephone company, Columbus, has a new directory almost completed which will be a beautiful piece of work. The body is printed on heavy calendered paper and the list of names is not marred by the insertion of advertisements here and there between them. Space for this has been arranged in a different way. The cover will be of heavy chocolate-colored paper and will contain only the name and the shield of the company. This will appear both on the back and the front of the book. The company's calls are running close to 5,000 a day now and a new section of switchboard which will accommodate 1,040 drops is being installed. About 100,000 feet of new cable is being put in also to carry the additional lines that will be necessary. Manager Frank L. Beam is well pleased with the progress that is being made.

The Chagrin Falls Telephone company, Chagrin Falls, Cuyahoga County, has been incorporated, with a capital stock of $15,000, to build and operate an exchange in that town and 12 townships in the immediate vicinity. The incorporators are C. H. Hubbell, T. P. Shumaker, W. D. Brewster, J. W. Hutchinson and L. S. Hubbell.

The Akron People's Telephone company, Akron, Ohio, was recently incorporated, with a capital stock of $1,000, for the purpose of building and operating an exchange in Akron, with the main line extending from the northern line of Summit County near Cuyahoga Falls to a point in the southerly line of the county at or near Turkey Foot Lake, including complete systems for the towns of Barberton and Cuyahoga Falls, with branch lines and connecting lines in the county and other portions of the state. The company has also filed notice with the secretary of state of an increase of capital stock to $500,000. The incorporators are Alonzo M. Snyder, Frederick A. Henry, L. M. Hildreth, Harrison B. McGraw and Henry Ford. With the papers filed was the consent of the original Akron People's Telephone company to the use of the same name. It was signed by President Will Christy and Secretary A. B. Conklin. The names given as the incorporators of the new company are the Cleveland attorneys for the old company, and this course was taken in order to reorganize completely the old company, which has been in operation for some time. It is stated that the plant at Akron will be greatly enlarged and that complete new boards will be put in at Barberton and Cuyahoga Falls. This will form a very complete and important system.



FARR DROP, JACK AND PLUG.

Within the last year several large mercantile establishments in this state have put in complete telephone systems and have found them of great value. The last one to decide upon this is H. H. Sturtevant & Co., Zanesville, Ohio. This firm conducts a large department store, and in order to bring all departments into closer touch with the management and with the office a complete system will be installed with an instrument in each department. A private switchboard will be placed in the office, and through this any telephone in the house may be connected with the Central Union system, giving communication from any department to any part of the city.

The Kent Home Telephone company had a little experience with a farmer a few days ago. James Moore owns about one mile of frontage in the country along which the company is building. When the construction gang reached his place he appeared with a gun and dared the men to begin work. One of the workmen walked up within a few feet of the muzzle of the gun and began to dig a hole, but the farmer lost his nerve, and before he could get an injunction the men had the poles up the entire distance along his land.

The Freeport Telephone company, Freeport, Harrison County, was incorporated recently. The capital stock is placed at $5,000. The company will build a plant at Freeport and also has the right to manufacture telephone supplies. The incorporators are J. F. McMath, John A. Barricklow, John Courtright, N. M. Gray and R. M. Black.

The City Council of Dayton, Ohio, has passed an ordinance requiring all wires within a certain district to be placed underground. This includes telephone, telegraph and electric-light wires. The Central Union underground system there is about completed. The underground district is said to be quite large.

J. H. Zeke, superintendent of the Home Telephone company, Greenfield, Ohio, thinks he will have the line completed between that place and Hillsboro and an exchange put in by early spring. It is probable that an exchange will be put in at Leesburg also.

Robert Wolf, for some time superintendent of the Independent telephone company at Lancaster, has resigned his position and accepted a place with the Ohio Natural Gas and Fuel company.

J. M. Hoge, superintendent of construction for the United States Telephone company, is now building a line from Columbus to Marysville, Union County. Mr. Hoge is also superintendent of the Columbus Citizens' Telephone company. O. M. C.

Telephone News from the Northwest.

The local telephone company at Fergus Falls, Minn., is putting in a conduit system.

It is understood that negotiations are pending for the sale of the Northern Minnesota Telephone company to Wadena (Minn.) parties. Other parties are ready to purchase the system, also.

The Winfield Telephone company has been incorporated at Winfield, Iowa, with $3,000 capital stock.

The Cedar Valley Telephone company is installing an exchange for Ackley, Iowa.

The Tyndall Telephone company of Tyndall, S. D., has been incorporated, with $2,500 capital stock.

The Hotel Spokane, at Spokane, Wash., is to be equipped throughout with a complete telephone system, connecting every room in the building. There will be 200 connections and a central office in the building. Connection can also be made from any room in the house with any city on the Pacific States Telephone company's system.

The District Court in Minneapolis is considering the case of the Northwestern Telephone Exchange company against the county of Hennepin. The point involved is the right of the county to assess a tax on the building of the company, the latter contending that its gross-earnings tax covers all its property.

A local exchange, with 100 connections, has been opened at Red Lake Falls, Minn.

Poles are being set on the Medina-Kankanna branch of the Fox River Valley Telephone company's toll system in Wisconsin. Work on the exchanges at Neenah, Appleton and Kaukauna will not be started till spring, but the toll line is to be completed by January 1st.

The Wisconsin Telephone company has made a toll rate of 25 cents between Platteville, Wis., and Dubuque, Iowa. The toll from Cuba City to Dubuque is but 10 cents.

The Hutchinson (Minn.) Telephone company has completed its line to Acoma and Greenleaf.

A. W. Bryant, secretary and manager of the Wood County Telephone Toll Line company, has resigned, and Charles Doherty, manager of the exchange at Grand Rapids, Wis., is now in charge.

The Rocky Mountain Bell Telephone company plans to build a line from Billings, Mont., to Cheyenne, Wyo., next season. It may also build lines into Fort Benton, Kalispell and several other points.

The central office of the Rocky Mountain Bell Telephone company at Great Falls, Mont., has been removed to new quarters. A new switchboard has been put in service.

W. A. Smith is building a private telephone line between Missouri Valley, Iowa, and California Junction, Iowa.

The Creston (Iowa) Mutual Telephone company has increased its capital stock from $10,000 to $15,000.

The Brighton and Nicollet Telephone company is projected at Nicollet, Minn., to build a line to Brighton.

T. H. Bunn of Pine Island, Minn., thinks of putting in a telephone line to Berne and Roscoe.

The Northeastern Telephone company will build a line from Princeton, Minn., to Milaca.

The Red Lodge and Wyoming Telephone company has completed an extension from Red Lodge to Carbonado, Mont.

Orrial H. Harrell has brought suit against the Northwestern Telephone Exchange company in St. Paul for $50,000 damages. He was in a hole nine feet deep, in obedience to orders, when the side caved in, almost completely burying him. He alleges that he received injuries which will permanently disable him.

The Fergus Telephone company of Fergus Falls, Minn., is putting in an underground system and a new switchboard.

The Dwelle Telephone company of Lake City,

Minn., announces that henceforth free telephone service is to be refused to non-subscribers, and a five-cent charge made.

The council of Bridgewater, S. D., is considering a franchise for a local telephone exchange to W. S. Burroughs.

The Mazomanie Telephone company of Mazomanie, Wis., has been incorporated, with $6,000 capital stock, to operate in Dane and Iowa counties. E. L. Case, D. L. Bestor and T. H. Ward are the incorporators. R.

Indiana Telephone Items.

The Home Telephone company of Elkhart County, with headquarters at Goshen, has decided to construct a full metallic line from Goshen to Milford, there to connect with the Warsaw Independent Telephone company's line, recently purchased by Strauss & Co. of Ligonier, which firm announces that it will construct a direct Independent line to Indianapolis.

The Pennville Telephone company was organized on December 3d, and will construct an exchange at Pennville at once. The officers are: President, F. E. Moyer; treasurer, W. M. Hall; secretary, Bee McCarty, and manager, Jap. Lineback.

The Indiana Electric company, with a capital stock of $23,500, has filed articles of incorporation with the secretary of state. The company will operate telephone lines in western Indiana and eastern Illinois. The directors are Edgar Vansickle, C. E. Fair, J. G. Shame, C. S. Wolfe, G. W. Fair and Anna Vansickle, all residents of Vermillion County, Ind. The headquarters will be at Dana, Ind.

The telephone situation in Logansport is becoming interesting. S. P. Sheerin, who is at the head of the Independent Telephone exchange at Indianapolis, and also interested in many of the Independent exchanges throughout the state, has made a proposition to the City Council looking to the establishment of a bona fide Independent exchange in that city. A mass-meeting was held last week to discuss franchises and rates, the sentiment being in favor of an annual rate of $12 for residences and $18 for business houses. The Bell company is seeking an extension of its grant, with no rate restrictions. An acrimonious debate was indulged in by representatives of the Bell company and the Indianapolis company. Another meeting has been called and the interest is becoming intense. F.

EXTENSIONS AND IMPROVEMENTS.

The Independent companies in Pennsylvania and New Jersey are said to be contemplating a line joining Atlantic City, Camden and Philadelphia.

Among the structures for which plans have been drawn in Boston recently is a new telephone building to be erected on Chardon street, for the New England Telephone and Telegraph company, four stories in height, to cost about $40,000.

The Oakland Telephone company announces that it now has 325 telephones working in Pontiac, Mich., and has 85 more that will soon be connected with the central. Toll lines are nearly completed to Holly, Davisburg, Clarkston, Waterford, Drayton Plains, Oxford and Orion. These will be in operation soon, and the five-cent rate, one of the provisions of the company's franchise, will go into effect. Messages between any two places in the county will be but five cents for five minutes.

The Central Union Telephone company is making extensive improvements at Rockford, Ill., including the installation of a new multiple switchboard. The exchange is in the heart of the business district, at 319 West State street. The company has here a fine suite of rooms, making the plant among the best of the company's exchanges in northern Illinois, if not in the state. R. H. Gibboney is manager of the Rockford exchange. The estimated cost of the new construction is $5,000.

The Maryland Telephone company of Baltimore, Md., is putting in new instruments in the offices and residences of the 1,300 subscribers who have the instruments of the old Home Telephone company. The use of the old instruments will not be interfered with until all the new telephones are in position, when, on the night of December 20th, all the new instruments will be connected with the new plant. In addition to these 1,300 subscribers are 2,000 others who will be supplied with the new telephones as rapidly as the working force can install them. The new service that is being installed is of the central-battery express type.

TELEPHONE MEN.

Paul W. Bossart of the Kellogg Switchboard and Supply company of Chicago was a recent visitor in Denver.

M. V. Keyes, who has been chief inspector for the Central Union company at Rockford, Ill., has left Rockford for Moline, Ill., where he has taken charge of the Central Union exchange at that place.

The Corsicana Telephone company of Corsicana and San Antonio, Texas, has been chartered, by Frank B. McElroy, H. M. Aubrey and others, with a capital stock of $50,000.

Further Trials of Wireless Telephony at Minneapolis.

James Kelsey of the Northwestern Telephone Exchange company, Minneapolis, recently attempted another wireless-telephone experiment, this time at Lake Harriet, within the city limits of Minneapolis. Two trials were made. The first one failed for lack of a definite understanding. The lake is about three-quarters of a mile across. The second time all arrangements were completed, but it was again a failure. A voltmeter was finally attached to the wires and revealed an astonishing leakage from the wires of the street-railway line which skirts the shore on one side of the lake. At times 0.7 of a volt was shown, and it threatened to break the needle in the meter. Further trials at wireless telephony will be made at another lake which is free from street-car interference.

GENERAL TELEPHONE NEWS.

D. R. Creecy and others will organize a $200,000 company to put in a telephone system at Norfolk, Va.

An ordinance has been introduced in the New York City Council instituting a crusade against bacilli in telephone transmitters and receivers.

Thomas S. Wilcox and associates of Chattanooga, Tenn., have secured a franchise and will organize a company to put in a telephone system there.

It is reported from Norfolk, Va., that there will be no immediate consolidation of the Independent Virginia and North Carolina telephone interests for the purpose of fighting the Bell company. One reason given is that the consolidation must wait for the connection of the lines of the Virginia Long Distance Telephone and Telegraph company and the Interstate Telephone and Telegraph company of North Carolina.

The local telephone exchange at Austin, Texas, was badly damaged on December 9th. Someone reached the roof of the exchange building and, boring a hole into each of the 15 cables entering the main exchange, poured liberal quantities of prussic acid on the wires, which incapacitated them and effectually stopped all business of the exchange. Almost the entire system of the city was affected. A large force of workmen spent the day in repairing the damage. The local telephone officials attribute the work to friends of telephone strikers in other parts of the state, as there was no trouble in Austin.

An assessment of 10 per cent., or $5 a share, has been levied upon the capital stock of the Telephone, Telegraph and Cable company of America. A circular from William J. Latta, the company's president, that has been sent to the stockholders, says: "Certain negotiations looking toward a change in the character of your interests have reached that point where it is reasonably sure that they may be submitted to you for consideration within 30 days. The notice for an assessment was deemed necessary by your board to protect the interests of your property should further delay intervene in the final adjustment of plans referred to."

The Board of Aldermen of Worcester, Mass., has granted to the Citizens' Telephone and Telegraph company (Independent) a location in about 50 public streets. The order is full of conditions regarding the construction of conduits, the location of poles and the opening of streets. It also provides that the maximum rates shall not exceed about one-half the rates charged by the New England company. Another section of the franchise calls for a forfeit of $15,000 in case an exchange is not in operation within two years. It is also provided that the city may at any time take over all the property of the company at an appraisal based solely on property value.

MANUFACTURERS AND DEALERS.

The telephone system that was recently installed in cars of the St. Louis, St. Charles and Western Electric Railroad company at Welliston, Mo., was erected by the D. A. Kusel Telephone and Electric Manufacturing company of St. Louis, the instruments being of this company's manufacture also. The system has operated very successfully.

The Kansas City Telephone Manufacturing company of Kansas City, Mo., by reason of its western location, is in a good position to supply the telephone trade in Missouri, Kansas, Oklahoma, Indian Territory and the West. It turns out high-grade apparatus which it sells in competition with eastern manufacturers both as to quality and price, giving its patrons the opportunity to buy at home and save delays in shipment. The company uses the Holtzer-Cabot and Williams-Abbott magnetos in making up its telephones, and it is also agent in its territory for the Eureka metallic, self-restoring express switchboard, Moon terminal head. Warner generator, etc. A 52-page illustrated catalogue and price-list has just been issued by the Kansas City company, describing its telephone instruments and the large stock of telephone appliances and supplies which it handles. The company will be pleased to mail a copy of this catalogue on application.

DOINGS OF SOCIETIES.

Engine Builders' Association.

Sherry's, New York, on December 4th, was the scene of the first annual meeting of the Engine Builders' Association of the United States. This meeting was a great success and was well attended, as is indicated by the following list of prominent engine builders of the United States, who were in attendance. The various engine companies were represented as follows: Ames Iron Works, Oswego, N. Y., Mr. Ames and Arthur L. Meriam; Ball Engine company, Erie, Pa., D. N. McBrier and E. J. Armstrong; Ball & Wood company, Elizabethport, N. J., Thomas C. Wood, Charles R. Vincent, C. A. Gates and Mr. Bird; Buckeye Engine company, Salem, Ohio, C. S. Bonsall; Chandler & Taylor company, Indianapolis, Ind., William M. Taylor; Harrisburg Foundry and Machine Works, Harrisburg, Pa., W. R. Fleming; A. L. Ide & Sons, Springfield, Ill., H. L. Ide; New York Safety Steam Power company, New York, A. G. Nichols, Hope Valley, R. I.; Payne company, Elmira, N. Y., Nathan B. Payne; Phœnix Iron Works company, Meadville, Pa., Colonel John Dick; Russell Engine company, Massillon, Ohio, C. A. Gates; Straight Line Engine company, Syracuse, N. Y., Professor John E. Sweet; Westinghouse Machine company, Pittsburg, Pa., Mr. Sniffin; Watertown Engine company, Watertown, N. Y., S. F. Bagg.

After the opening council session the meeting was called to order by President John E. Sweet, Syracuse, N. Y., the following papers being read and discussed: "Some of the Requisites of Modern Lighting Generator Sets," by H. G. Reist of the General Electric company; "Inter Relations Between Engine and Generator Builders in Connection with Engine-type Units for Power Purposes," by H. C. Ebert of the Westinghouse Electric and Manufacturing company; "Economy Guarantees of High-speed Simple Engines," by E. J. Armstrong of the Ball Engine company.

Particular attention was paid to standardizing engines and parts, as well as to the intimate relations which now exist between steam-engine and electrical-generator builders relative to direct-communicated power units.

On Tuesday evening the members sat down at Sherry's to a sumptuous dinner that had been planned under the auspices of N. B. Payne and Thomas C. Wood of the committee of entertainment. Mr. Wood presided as toastmaster. In addition to those in attendance already mentioned, the following-named gentlemen were on hand during the meeting, and many of them were also at the dinner: Mr. Greenwood, General Electric company; Mr. Ingles and Mr. Ales, Detroit Blower Works; Mr. Palmeter, Watertown Engine company; H. G. Reist, General Electric company; H. C. Ebert, Westinghouse Electric and Manufacturing company; Mr. Robb, Robb Engineering company, Amherst, Nova Scotia; Mr. Bird, Ball & Wood company; Mr. Smith, Ball & Wood company; Mr. Allan Ames, Ames Iron Works; Mr. Ball, American Engine company; W. A. Kreidler, represented by F. L. Perry, Western Electrician; J. M. Wakeman, Electrical World and Engineer; Mr. Dunlap, Engineering Magazine; Mr. Moore, London; Mr. Hubbard, B. F. Sturtevant company; F. R. Low, Power.

For 1901 all the old officers of the association were elected as follows: President, John E. Sweet; vice-president, W. M. Taylor; treasurer, H. L. Ide; secretary, S. F. Bagg; members of the council, W. R. Fleming, C. A. Gates, Thomas C. Wood, S. B. Richards, John Dick and Leonard Ames.

It was voted at the close of the meeting that the association hold its next gathering in Indianapolis, Ind. This was in acceptance of a very cordial invitation extended to the association by William M. Taylor of the Chandler & Taylor company of Indianapolis, Ind.

American Society of Mechanical Engineers.

The forty-second annual meeting of the American Society of Mechanical Engineers was held at the clubhouse of the society in New York city on December 4th to 7th. The attendance was very large, 354 persons having registered on the first day of the meeting. Charles H. Morgan, the retiring president, opened the first session on Tuesday evening with an address, treating mainly of the development of the rolling mill. He gave the history of the rolling mill in England and this country, and showed how it would have been impossible to build railroads across the continent if methods had not been discovered to make the manufacture of steel rails a less expensive process than it was 50 years ago.

At the business session held on Wednesday morning there were elected 47 members, nine junior members and 41 associates. The financial report showed the society to be in a most flourishing condition. The following-named officers were elected for the ensuing year: President, Samuel T. Wellman, Cleveland; vice-presidents, David Townsend, Philadelphia; Jesse M. Smith, New York; James M. Dodge, Philadelphia; Stevenson Taylor, Hoboken, N. J.; Arthur M. Waitt, New York city; Ambrose Swasey, Cleveland; managers, Edgar C. Felton, Harrisburg, Pa.; R. H. Soule, New York; John A. Brashear, Allegheny, Pa.; A. M. Goodale, Waltham, Mass.; Francis H. Boyer, Somerville, Mass.; Alfred H. Raynal, Washington; W. F. M. Goss, Lafayette, Ind.; Decourcey May, Scranton, Pa.; D. S. Jacobs,

Hoboken, N. J.; treasurer, William H. Wiley, New York city; secretary, F. R. Hutton, New York.

On Thursday the society was the guest of President Low of Columbia University. The afternoon was spent in inspecting the mechanical laboratories of the university and in the evening a reception and supper was held at Sherry's.

During the different sessions the following papers were presented: "Comparison of Rules for Calculating the Strength of Steam Boilers," by H. De B. Parsons; "A Record of the Early Period of High-speed Engineering," by Charles T. Porter; "Steam Engine of Maximum Simplicity and Highest Thermal Efficiency," by Robert H. Thurston; "Notes on Centrifugal Fans for Cupolas and Forges," by William Sangster; "Power Plant of the Massachusetts General Hospital," by F. W. Dean; "The Construction of Contracts," by Reginald P. Bolton; "An American Central Valve Engine," by E. T. Adams; "Mechanical Integrator Used in Connection with a Spring Dynamometer," by Max H. Wickhorst; "Apparatus for Dynamically Testing Steam Engine Indicators," by Carleton A. Read; "Tests of the Boilers of the Purdue Locomotive," by W. F. M. Goss; "A New Recording Air Pyrometer," by W. H. Bristol; "Comparative Value of Different Arrangements of Suction Air Chambers on Pumps," by F. Meriam Wheeler; "Tests of Centrifugal Pumps," by W. B. Gregory; "Hardness or the Workability of Metals," by William J. Keep; "New Principle of Gas-engine Design," by Charles E. Sargent; "Heat Efficiency of the Gas Engine as Modified by Point of Ignition," by C. V. Kerr; "Power and Light for the Machine Shop and Foundry," by Forrest R. Jones.

Chicago Electrical Association.

The regular meeting of the Chicago Electrical association was held at its rooms in the Monadnock block, on the evening of Friday, December 7th. In the absence of the president and vice-president F. S. Hickok presided. The paper of the evening was prepared by Charles Wirt of the Wirt Electric company, Philadelphia, and was on the subject, "Development of the Theater Dimmer." Mr. Wirt was unavoidably detained in the East, so the paper was read by Edward W. Lloyd. Thomas G. Grier assisted Mr. Lloyd in presenting a number of stereopticon views which were used to illustrate the paper, and afterward supplemented Mr. Wirt's paper with a description of the Wirt and other types of dimmers found in the theaters in Chicago. The paper itself traced the development of the theater dimmer from the old squirrel-cage and chicken-coop types to the present compact standard apparatus that is being largely adopted all over the country. The pictures showed a great variety of dimmers and several modern stage switchboards equipped with Wirt universal dimmers. A brief discussion of the paper was indulged in by members of the society. The next meeting of the association will be held on December 21st, when a paper by J. M. Hollister of the Western Electric company, on "Electrical Features of the Paris Exposition," will be presented. Officers for the ensuing year will also be elected at this meeting.

Illinois State Electric Association.

At the business meeting of the Illinois State Electric association held at Champaign, Ill., recently, the committee on coal freights and transportation was named as follows: L. A. Ferguson of Chicago, chairman; R. S. Wallace, Peoria; W. A. Martin, Quincy; W. E. Steinwedell, Belleville; John W. Glidden, De Kalb. The committee on heating consists of C. E. Hay of Springfield, chairman; H. J. Frith, Watseka; C. H. Langford, Paxton; W. E. Steinwedell, Belleville; J. N. C. Shumway, Taylorville. Mr. C. E. Hay of Springfield was added to the committee on mutual insurance, of which J. J. Frey is chairman.

President Draper of the University of Illinois and the other members of the faculty were made honorary members of the association. Votes of thanks were tendered to President Draper and the University of Illinois for the hospitality and cordial reception afforded the association; to H. J. Pepper, superintendent of the Urbana and Champaign Railway, Gas and Electric company, for his efforts toward making the first annual meeting a success, and to the officers, especially the secretary, Mr. Chubbuck, for official services.

G. I. Alternating Series Enclosed-arc System.

An enclosed-arc system that is being offered by the General Incandescent Arc Light company of New York, for either street or commercial lighting, consists of G. I. type L7 lamps and a G. I. regulator for use in series on constant-current, alternating-current circuits. The only limitation to the number of lamps that can be connected in a series is that each lamp must have not less than 80 volts at the lamp terminals. The lamp operates on the shunt principle and is provided with an automatic cut-out and a substantial hand switch, the working parts of which are placed under the top casting, which protects them from the weather and other injury. Fig. 2 shows a view of the lamp mechanism.

A feed lever is provided, which carries on one end a lead weight; on the other, the U-shaped laminated core is attached. Two shunt coils, connected across the arc, surround the legs of the core. The clutch operates directly on the carbon. There are no windings in series with the arc. The arc voltage is the same as at the hangers and the only loss in the lamp is from the power consumed by the shunt-regulating coils, which is about 10 to 12 apparent or five to six actual watts.

The efficiency of the lamp is about 97.4 per cent., while its power factor is 85 to 90 per cent. The lamp is 25½ inches over all in length and weighs 25 pounds complete. A one-half by 9½-inch carbon is used in the top and a one-half by 5¾-inch carbon in the bottom, one being cored and one solid. The lamp is generally adjusted for 72 volts at the arc. On account of the absence of series coils, the lamp in operation keeps remarkably cool and there is little, if any, liability to burn out. All parts of the lamp are so designed that any one may be inspected or repaired without disturbing other parts, a feature of much interest to central-station men. The efficiency of a system comprising 25 of these lamps and a 25-light regulator will be about 96.4 per cent. Fig. 3 illustrates a lamp with metal reflector.

The G. I. regulator (Fig. 1) is designed to keep the current constant on an alternating-current circuit of arc lamps or arc and incandescent lamps connected in series. The source of supply may be either primary or secondary, and the regulator is connected at any point in the lamp circuit in series with the lamps. The actual loss in the regulator is constant at all loads from short circuit to full load, being simply the copper and iron loss, together making about 140 watts actual loss in a 25 to 27-light regulator adjusted for 6.8 amperes on a 2,200-volt, 60-cycle circuit. These figures show a 25-light regulator to have 98 to 99 per cent. efficiency. The regulator keeps the current constant within one-tenth of an ampere, and when the load changes on the lamp circuit the regulator changes instantaneously, and does not slug or work slowly.

In construction, the regulator consists of two reactance coils, connected in series with the lamps. A laminated U-shaped core is suspended under these coils in such a way that it can play up and down in the field of the coils. When the system is not operating only a small portion of the legs of this U core is surrounded by the windings of the reactance coils. If the outside line is short-circuited and current turned on, the U core is immediately drawn into the coils, which then react against the line potential and keep the current constant at the value for which the regulator is adjusted to operate. When the short-circuit is removed the current on the circuit will fall, allowing the U core to drop down; this will decrease the reactance of the regulator and sufficient of the line potential is allowed on the lamp circuit to start and operate the lamps. If one or more of the lamps should be switched off, or cut out, the resistance of the lamp circuit will decrease, and its current will increase. This causes the regulator coils to attract the U core, which, when entering the coils, further increases the reactance of the regulator, and the current will again be brought to its given value. A dash-pot is provided, attached to the core, to prevent sudden fluctuations and to aid the starting of the lamps. The total height of a 25-light regulator is 34 inches, the floor space it occupies being 14 by 19 inches. The apparatus weighs about 100 pounds.

The G. I. L7 lamp may also be operated from two to six in series on constant-potential circuits ranging from 200 to 660 volts, and for each series will be furnished a suitable reactance coil. Fig. 4 shows such a reactance coil with the case removed.

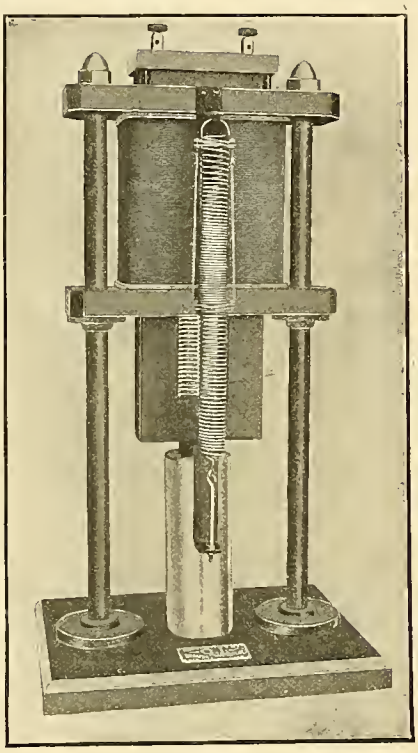


Fig. 1. Regulator.

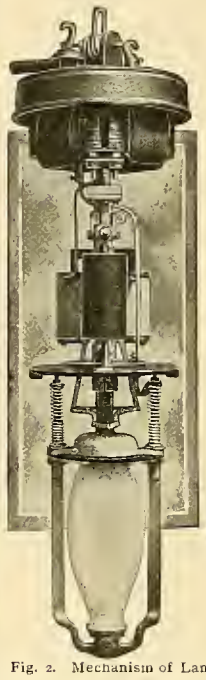


Fig. 2. Mechanism of Lamp.

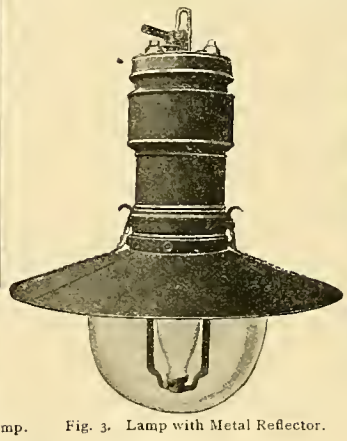


Fig. 3. Lamp with Metal Reflector.

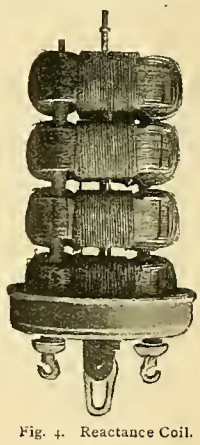


Fig. 4. Reactance Coil.

G. I. ALTERNATING SERIES ENCLOSED-ARC SYSTEM.

Reports of Massachusetts Railway Companies.

Boston, December 8.—According to requirements in this state the various electric-railway companies have submitted their annual reports to the railroad commissioners, and the results indicate a growth in number of passengers carried and in material prosperity, with great improvements in efficiency attained through the numerous consolidations that have taken place during the last two years. Twelve new roads have come into existence and there remain but two horse-car lines now in the commonwealth, one at the Onset Bay campground and the other in Marlboro street, Boston. The latter will soon be a thing of the past also.

The Boston Elevated Railway company, which operates the principal service for Boston and its suburbs, has transported 201,124,170 revenue-paying passengers during the last year. This is a gain of about 10,000,000 over the previous year's record. The number of car miles run was 38,171,984. Gross earnings for the year were $10,041,209, a gain of 4.8 per cent., while net earnings show a gain of 16.5 per cent., an open winter season having lessened the cost of running the road materially. The number of employes is 6,546.

The various companies operated under control of the Massachusetts Electric Companies show very good growth also. The Lynn and Boston line carried 38,751,814 revenue passengers, and has a profit and loss surplus of $187,270. The Quincy and Boston's gross earnings were $139,146, net $33,352, charges $23,030, balance $10,321. The dividends amounted to $37,921. The Lowell and Suburban earned $472,930 gross and $212,697 net. Dividends were $77,000, charges $120,396, surplus $15,301. The Lowell, Lawrence and Haverhill earned gross $555,342, net $241,953. The dividends amounted to $105,000.

The Springfield company earned $686,049 gross and paid out $116,672 in dividends. The Brockton company's gross earnings were $614,374, net $271,000, dividends $42,125. The Globe company of Fall River earned $400,338 gross and paid $54,520 in dividends.

The Worcester Consolidated earned $710,022 gross, and an eight per cent. dividend disbursed $56,000 of the nearly $80,000 balance above operating expenses and charges.

The smaller roads showed good earnings as a rule and the year was an unusually good one for a large percentage of the companies. B.

The government commission appointed to investigate the question of establishing mail service by pneumatic tubes in Chicago has reported unanimously in favor of the system. The commission has also mapped out routes over which the tubes may be laid.

Report of the Patent and Trademark Commission.

The commissioners appointed by the president, under the act of Congress of June 4, 1898, to revise the patent and trademark laws, submitted their report to Congress on December 4th. The report is a valuable and interesting one, both as regards the recommendations made by the commissioners and the carefully collated information which it presents as to the patent and trademark systems of this and other countries.

In creating this commission, the members of which are Hon. Peter S. Grosscup, judge of the United States Circuit Court of Appeals of Chicago, Francis Forbes of New York, who is well known as a trademark lawyer, and Hon. Arthur P. Greeley, lately assistant commissioner of patents, and at present in patent and trademark practice in Washington, Congress directed especial attention to certain international agreements respecting patents and trademarks, to which the United States is a party, which are not at present given the force and effect to which they are entitled, and, it seems, are not effective without legislation. The commissioners were also directed to take into consideration the patent and trademark laws of other countries.

The first part of the report relates to patents. The commissioners find that the principal treaty agreement to be considered is that known as the International Convention for the Protection of Industrial Property, concluded at Paris, March 20, 1883. To this nearly all the important countries of Europe are parties, the most important exceptions being Germany and Russia. Brazil and Japan, as well as a number of less-important countries outside of Europe, are also parties to it. The full list of countries is as follows: Belgium, Brazil, Denmark, Dominican Republic, France, Great Britain, Italy, Japan, Netherlands, Norway, Portugal, Servia, Spain, Sweden, Switzerland, Tunis and the United States. Germany and Russia have under consideration the question of adhering to this convention, and the union formed under the convention is likely at an early date to include practically all the countries of the world which are of industrial and commercial importance.

The history of this convention and the causes which led to its conclusion at Paris in 1883 are fully reviewed in the report. The first step toward an international agreement of this kind was taken at Vienna, in 1873, a congress of nations interested in patent and trademark protection being called together in connection with the International Exposition held there. In opening this congress, Count Andrassy, the Austrian premier, said: "I look to England and I look to America and I find that they are the foremost countries of the world in manufactures. I find, also, upon examining their laws, that they have the best patent systems in the world. Putting these two facts together, I conclude that the one is dependent upon the other, and, therefore, I am in favor of a thorough reorganization of the patent laws of Austria."

In this early movement toward securing greater harmony between the patent systems of the world the United States took an active part, the system presented in the resolutions adopted by this congress being, in its main features, the United States patent system. No definite results were secured until 1883, and owing to the fact that the United States did not take an active part in the later conferences, the convention as agreed to was drawn with reference the European systems rather than our own. The United States adhered to the convention in 1887.

The convention, while not all that could be desired from the American standpoint, is, as pointed out in the report, in many respects of material advantage to our inventors, as well as to our commercial interests. It secures to American inventors the enjoyment in the foreign countries of equal rights as to securing protection of their inventions with foreigners. It secures a so-called "delay of priority" of seven months after the filing of an application for patent here within which to apply for patents in the foreign countries without losing the right to patents. It permits patented articles made here to be introduced into foreign countries by the inventor without invalidating the patents granted there. These are material advantages, which in many of these countries are not given by the laws and can be secured only through the convention.

Aside from the advantages directly given by the convention, the result of its adoption and the agitation of the subject both before and after the agreement was entered into has led to important changes in foreign patent laws, many of the important European countries having since 1883 practically rewritten their laws in the direction of far greater liberality toward inventors than was thought possible before that date. Many of these changes are pointed out in the report.

Considering what legislation is necessary to give full effect to the provisions of the convention, the commissioners review the convention in detail and conclude that the law should be amended to provide that an application for a patent filed in any one of the countries which are parties to the convention shall, if the inventor files an application within seven months from that date, be given the same force as regards priority that it would have if originally filed here. They conclude also that if caveats are still permitted to be filed, foreigners, as well as United States citizens, should be permitted to file them, but they recommend, in view of the fact that caveats are generally regarded as of no practical value, that the law which provides for them be repealed.

They also recommend, as called for by the spirit of the convention, a change in the law by which it shall be made clear that the executors or administrators of a deceased inventor, whether appointed abroad or in this country, be permitted to apply for a patent for the invention. As the law is now construed, letters of administration are required to be taken out in this country. An amendment by which it will be made more convenient for foreign inventors to make oath to their applications than under the present law is also recommended.

The commissioners find that no less than 71 countries have patent laws, and the general features of these laws with particular reference to the differences existing between them and the United States law are clearly presented in the report. For instance, in many foreign countries, patents are granted without investigating the question of novelty and without regard to even the probable validity of the patents; many countries require inventions to be unknown to the public up to the day on which application for patent is filed; many inventions, such as foods and medicines, which are patentable here are excluded from protection in foreign countries; patents in many foreign countries date from the date of application, instead of from the date of issue, as here; in nearly all foreign countries annual taxes are required to keep patents in force throughout the terms for which they are granted; patented inventions are required in foreign countries to be manufactured on a commercial scale within a short time after the grants of the patents, on pain of forfeiture, and owners of patent rights may be compelled to license others to make and use the patented inventions.

None of these features should, in the opinion of the commissioners, be incorporated into the United States patent system. There is no doubt, as regards its essential features, that the United States patent system is the best which has been devised up to the present time. But in some matters not affecting the essential principles of the system, the commissioners find certain features of the foreign laws desirable. These are, first, that foreigners who take out patents here should have in this country a representative on whom papers may be served in any suit affecting their interests; second, to give to a foreign patent, as a bar to the grant of an application for patent here, the same weight as any other disclosure—that is, if printed, the patent should be given the effect of a printed publication, and if not printed (and in many foreign countries patents are not printed and may even be kept secret) it should have no other effect than that of knowledge or use of the invention in the country in which it was granted; third, to provide that a mere application for a foreign patent shall not be a bar to the grant of a patent here, and, fourth, to provide that after a patent has been once granted for an invention the patent granted thereafter for the same invention to another, which is permitted only after it is shown that the later applicant is the real inventor, shall be granted only for the unexpired term of the first patent.

The recommended changes are embodied in three brief bills, none of which affects the essential features of our patent law.

The portion of the report which relates to trademarks may be read with even greater interest than that relating to patents, both for the reason that trademarks affect commercial interests more widely than do patents, and for the reason that information on the general subject of the protection of trademarks in domestic and foreign trade has not been heretofore readily accessible. In fact, trademark laws, both here and abroad, are of comparatively recent origin and are a development of modern commercial conditions.

The commissioners find that, in reference to trademarks, the United States is not only a party to the international convention referred to under the part of the report relating to patents, but has entered into special trademark agreements with a large number of countries. All of these treaty agreements, as well as the international convention, are carefully reviewed in the report, and it is made clear from this review that a material revision of the present trademark law—practically its rewriting—is necessary.

The commissioners also present the results of their consideration of the foreign trademark laws. Nearly every country of commercial importance has such laws, and the work involved in this part of the report will be understood from the fact that comparatively few of these laws are accessible in the English language.

Trademark laws are found to fall into two general classes—those which provide for registration as declaratory of the right acquired by actual use of the mark in trade, and those which make the ownership in a mark depend upon registration, the first who presents the mark for registration becoming by that act the owner of the mark, whether he was the first to use it or not. The latter laws are termed attributive laws. Many foreign laws, like that of Germany, are of this character. Differences between foreign laws and that of the United States are pointed out in the report.

In foreign countries generally registration is recognized as of great importance to the public, as notice of what marks are claimed as the subject of exclusive rights. Every effort is made to induce owners of trademarks to put them upon the register.

The registration fees are made very much smaller than in this country, being in a number of countries less than $5, while $25 is required here. The procedure in registering is generally much simpler than here. Provision is generally made for the legal transfer of trademarks, and under all foreign laws wilful infringement of a registered trademark is made an offense punishable by fine or imprisonment.

The commissioners find it necessary to present their views as to the constitutional power of Congress to provide for the registration and protection of trademarks used in interstate commerce, in view of the fact that some doubt on this question has been heretofore expressed. Their conclusion is that Congress has this power under the commerce clause of the constitution. They cite in their report a report made on this very question by Thomas Jefferson to the Second Congress (1791), in which he takes the ground "That it will, therefore, be reasonable for the general government to provide in this behalf by law for those cases of manufacture generally, and those only which relate to commerce with foreign nations, and among the several states, and with the Indian tribes." They also point out clearly the intimate connection which is now recognized between trademarks and commerce, and the importance and necessity for a law which shall provide for marks used in interstate, as well as foreign, trade.

On behalf of Judge Grosscup and Mr. Forbes there is submitted a proposed bill to regulate and protect marks, trademarks, etc., and to enforce the treaties regarding the same, which provides for acquiring the right to a trademark used in interstate or foreign trade by registering it; provides for giving effect to treaty provisions; makes the wilful infringement of a registered trademark punishable by a fine of not more than $500. The bill also provides for seizure of goods bearing a false mark, and provides very fully for the regulation of commerce, both interstate and foreign. The fee for registration is reduced to $10, and the procedure necessary to secure registration is made as simple as possible. Practically all marks which could be considered good trademarks at common law are made registrable.

The commissioners submitting the proposed bill do not express their conclusions as to its expediency, but submit it only as an adequate measure in case the attributive system is to be adopted.

Mr. Greeley, the other member of the commission, while concurring fully as to everything in the report except the proposed bill, dissents as to this, and submits a bill which, while it includes the features of the majority bill so far as permitting the registration of marks used in interstate commerce, reducing the registration fee, simplifying the procedure necessary in registration and providing additional remedies for registrant beyond those now secured under the common law, does not make ownership dependent upon registration.

Mr. Greeley expresses his opinion that nothing should be included in a trademark law which will abrogate common-law rights as now enjoyed by owners of trademarks, and for the purpose of indicating the origin, development and extent of trademark interests, and particularly the common-law rights thereto, presents a review of trademark history, as shown by the decisions and laws of this and some other countries.

The report is accompanied by an appendix, containing many documents not heretofore accessible, bearing upon the question of patent and trademark protection in this and other countries, including digests of foreign laws on certain important points, the debates in Congress on the trademark laws and other matter of essential importance to anyone who would attempt to understand fully these subjects.

The preparation of this report has taken most patient investigation, covering a period of more than two years, and will be regarded as a document of unusual interest and importance. An unusual feature of the work is the fact that the commissioners serve without compensation, the total appropriation for the expenses of the commission being but $250. The work done in preparation of the report has led to the publication by Mr. Greeley of a comparative study of foreign patent and trademark laws, which has been found of great value to American manufacturers, as well as patent and trademark lawyers, and has had a large circulation.

Respecting this report, Judge Grosscup, who has recently returned from Washington, where the final meeting of the commission was held, had this to say: "The report, so far as it covers trademarks, introduces into legislative matters in this country a very important new subject. A proper trademark law is looked upon by its friends as essential, not simply to protect the manufacturer against unfair competition, but the public, also, against imposition. As things now exist, the manufacturer who has made a useful commodity, and has succeeded in bringing about a widespread public interest in its advantages, is set upon by hordes of competitors who seek to divide with him the profits of the good will he has thus built up. The new doctrine of injunction against unfair competition, which has grown up more effectively, perhaps, than anywhere else through the Circuit Court of Appeals for the Seventh Circuit, ameliorates these hardships, but a statutory trademark system, such as is submitted by the commission, would, perhaps, in a much larger measure, be successfully protective. In some

such protection the public is as much interested as the manufacturer, for the public is entitled to know that the familiar marks upon which it purchases its goods shall designate the genuine article, and not, by some jugglery, lead to the purchase of a counterfeit article.

"The report of the commission is a very able paper. It exhausts the literature of the subject, both foreign and domestic, and presents, in compact form, the thought of the world as it exists to-day upon these important protective measures. It should be read by every manufacturer, and by everyone interested in trademarks and the public judgment and sentiment thus created should be brought to bear upon Congress.

"I can say these favorable things about the report without any violation of good taste, for the report is almost entirely the work of my associates. I assisted in its arrangement, in the elimination of immaterial matter and in the statement of its legal conclusions; but the extensive research, the translations and the compilation were the work of Mr. Forbes and Mr. Greeley."

Changes in Chicago and London Traction Management.

The recent resignation of D. H. Louderback from his position as representative of the interests of Charles T. Yerkes in the Charing Cross underground railroad of London has been the cause of some changes in the management of the Yerkes properties in Chicago. Howard Abel of Chicago and H. C. Davis of New York will go to London together and take up the duties which Mr. Louderback has been forced to abandon. Mr. Davis is connected with the banking firm of A. A. Houseman of New York and has been actively identified with the London underground-railroad plans for some time.

Mr. Abel withdraws from all official connection with the Yerkes companies in Chicago. He has been acting as president of the Lake Street Elevated Railroad company since Mr. Louderback's withdrawal from that position last July, and he is now succeeded by Charles E. Yerkes, son of C. T. Yerkes. Mr. Abel also resigned his position as secretary and treasurer of the Northwestern Elevated Railroad company, and William V. Griffin was elected to succeed him. Mr. Griffin is also secretary and treasurer of the Lake Street company.

Howard Abel, who will leave for London soon to take up his new work in collaboration with Mr. Davis, is an Englishman by birth. Soon after coming to this country he was identified with the Fox Solid Pressed Steel Car company at Joliet, Ill. Later he was connected with the Chicago Telephone company. He went into the street-railway business in 1893, when he was elected secretary and treasurer of the Chicago North Shore Electric Railway company, under D. H. Louderback. Since that time he has held various positions, first in the Yerkes surface lines, and latterly in the elevated companies.

Charles E. Yerkes, the new president of the Lake Street company, started his business life in his father's office in Philadelphia in 1882, where he remained for some years. Later he became identified with the Siemens & Halske Electric company of Chicago as president. Mr. Yerkes is a member of the brokerage firm of Dewar & Yerkes, and he will continue in that business while he is at the head of the Lake street property.

Consolidation of Railways in New Jersey.

The electric street-railway lines in Elizabeth, Rahway and Plainfield, N. J., with the exception of the North Jersey Street Railway company's system in Elizabeth, have been consolidated, and will be known as the Elizabeth, Plainfield and Central Jersey railway. The new company has a capital stock of $3,000,000, and is authorized to issue bonds to the amount of $2,500,000. The lines consolidated include about 60 miles of track. Extensions of the system are contemplated. David Young, vice-president and general manager of the North Jersey Street Railway company, is president of the new corporation, and the other officers are Thomas A. Nevins of Orange, vice-president; State Senator Thomas N. McCarter of Newark, treasurer, and Colonel Edwin W. Hine of Orange, secretary. The companies consolidated are the Westfield and Elizabeth Street Railway company, the Elizabeth City Horse Railroad company, the Elizabeth Street Railway company, the Plainfield Street Railway company and the Rahway Street Railroad company. The lines extend, with branches, to Dunellen, Westfield, Rahway, Boynton Beach, Plainfield, Roselle, Scotch Plains and North Plainfield. Among the extensions projected are lines to connect Cranford, Springfield and Millburn. It is said through cars will soon be run between Newark and Plainfield.

C. C. Harris of Mont Clare, Ill., a village north of Oak Park, is at the head of a company styled the Chicago and Grand Avenue Street Railway company, which proposes to build a trolley line from Harlem and Chicago avenues north to Grand avenue, and thence west to Elmwood and Franklin Park. He says that ample capital is ready to build the road at once if the necessary franchises can be secured from the boards of Cicero, Harlem, River Forest and the highway commissioners of the town of Proviso.

CORRESPONDENCE.

London Letter.

London, November 27.—The underground-railway boom now on in London is growing day by day and new projects for tube transportation are announced at frequent intervals. Parliament will be asked to pass acts giving the necessary powers for the construction of 10 new lines and extensions. A number of these proposed lines are projected in the same territory. In the city, particularly in the neighborhood of Cannon street, the tubes, if all planned are driven, would honeycomb the ground and be laid in tiers, one on another. It is highly improbable that Parliament will grant enabling powers to all these companies, and unless there is a general harmonizing of interests a number of ambitious promoters will be disappointed. It has been suggested by transportation experts that the consummation desired by Mr. Yerkes is the one that Londoners should wish for most devoutly—that is, a general welding of the underground lines into one system, with a five-cent fare and free transfers. Mr. Yerkes' plans for the extension of the Charing Cross, Euston and Hampstead railway are interesting. He will ask Parliament for authority to drive a tube from the main line in Charing Cross road and running via Whitehall to a station on the western side of Parliament Square near the Canning statue, the line to be continued thence to the Victoria station of the London, Brighton and South Coast railway. In the north Mr. Yerkes wishes to extend his tube from Hampstead to Golders Green, just north of the junction of the North End road with the Finchley road, midway of the line. Extensions are proposed from Kentish Town to Islington and Hornsey. Both are to be of the electric tubular pattern, consisting of two tunnels running parallel. Electric elevators will convey the passengers to electric trains illumined with electric lights, and the electric power will be conveyed by a third rail between the track rails. The new railways will, in fact, be precisely similar to the Central London, except in the arrangements for passengers. There will be two classes—first and second. The first-class passenger will descend by a first-class elevator to a first-class platform, from which he will step into a first-class carriage. He will not even see his brother of the second class. It is proposed to go down 80 feet. If necessary, the promoters are prepared to descend 120 feet, but the engineers think a depth of from 70 feet to 80 feet will be sufficient. Light freight or express trains will be run at times which will not interfere with the passenger traffic. It is said that the railways will take about 2½ years to construct.

The preparations of the Metropolitan District Railway company for adopting electricity in place of steam are creating a great stir in transportation circles. The first section of the line to be equipped will be the inner circle, which is about one-fifth of the system. A canvass of electrical engineers now in London, representing firms which have entered tenders for the work, showed that the general belief was that the entire work would cost at least $15,000,000. The old tunnels will be tiled and a new system of ventilation put in. W. H. B.

New York Notes.

New York, December 8.—Many of the Brooklyn trolley lines were tied up on Tuesday by the burning of the Ridgewood power house of the Brooklyn Rapid Transit company. Fire broke out in the power house late in the afternoon, and, aided by several barrels of oil which had just been delivered, gained such headway inside of 10 minutes that the attendants at the station had barely time to get out. The lines were finally supplied with power from the Kent avenue station and from the Coney Island and Brooklyn Railroad company. The fire is supposed to have been caused by deteriorated insulation in the wiring on the main floor.

President Rossiter of the Brooklyn Rapid Transit company has received the resignations of George W. Edwards, general superintendent of the elevated-railway division, Mr. Edwards' secretary, John J. Owens, and Station Inspector James W. Norris.

The Rapid Transit Commission is about to make an effort to obtain an amendment to the rapid-transit act providing for the construction of pipe galleries along the entire route of the new subway. If this can be done, the mains that are now laid underground will be placed where they will be readily accessible, and tearing up of the streets will be done away with. This would result in an actual financial benefit to the city and to all the patrons of the galleries, as well as avoiding the inconvenience and interruption of traffic incident to the tearing up of the pavements. It is estimated that the cost of the proposed galleries, built so as to allow for the city's growth, will be about $1,500,000.

The shareholders of the Metropolitan Street Railway company of New York held their annual meeting recently, and the former directors were re-elected. The gross revenue of the fiscal year ending June 30th was $14,721,550, an increase of over $1,500,000 over that of the previous year on the same mileage. Net receipts were $7,068,028, while taxes, interest and rentals were $4,608,768, leaving a balance for dividends of $3,460,160. Dividend payments for the year were $3,145,891.

A general mortgage for $10,000,000, covering all the property of the Westchester Lighting company in Mamaroneck, Yonkers, Mount Vernon, Pelham, New Rochelle and Mount Kisco, and other real estate, has been made in favor of the Colonial Trust company, and secures an issue of 50-year five per cent. gold bonds. The money will be used for the improvement and extension of the property, and to provide for contingencies due to the consolidation of several lighting companies, of which mention has been made previously.

General Wilson, the chief of engineers of the army, proposes to establish an elaborate system of searchlights as a part of the defenses of New York harbor. He intends to spend $150,000 for the purchase and installation of the system, and will ask an appropriation in the regular fortifications act for the purpose. The searchlights will be so placed as to command with their rays the entire field of approach.

Edward Stone, a barkeeper on Eighth avenue, has been sentenced to a fine of $150 or imprisonment for 60 days for stealing current from the Edison mains. The nine Chinamen who were arrested some time ago for "plugging" their meters were discharged on the ground that they were too much afraid of electricity to tamper with the meters.

M. L. G.

From the Buckeye State.

Columbus, December 8.—The Youngstown and Sharon Street Railway and Light company has been incorporated in New Jersey, by Messrs. Penhale and Fisher of New York, who purchased the light plants at Youngstown and are now constructing an electric line between there and Sharon. The names of the directors of the new company are as follows: G. M. McKelvey, H. W. Whipple, William T. Wallis, Alex. McDowell, James S. Fruit, Simon Perkins, Grant Hamilton, Fred Hamilton, M. A. Devitt, M. A. Norris, George F. Penhale, Colonel C. B. Wick, J. H. Morris, H. W. Heedy, W. J. Hitchcock, George D. Wick, Randall Montgomery, A. M. Hyatt and P. F. Thompson. Randall Montgomery of Youngstown has been made president of the company, and it is understood that he will have charge of the business. It is said that the capital of the new company is in the neighborhood of $3,000,000. The properties controlled are the Youngstown Electric Light and Gas company, the Youngstown and Sharon Electric Railway company, the Valley Electric Railway company of Sharon, the Shenango Gas company of Sharon, the Struthers Electric Light company and the Sharpsville Electric Railway company.

The Northern Ohio Traction company is putting in new Manhattan lamps all over the city of Akron, and it is said that there is a great improvement in the light over that made by the old lamps. The new machinery has all been installed in the light plant and the old one will be closed down within a short time.

The Cincinnati Street Railway company has applied to the Board of Public Service for permission to relay 21 miles of track next spring. The cost will be about $126,600. Much of this track will go on the principal streets of the city, and President Kilgour has asked for an answer as soon as possible, that he may purchase rails before the prices change too much.

The Union Electric Railway company has been incorporated in New Jersey, to build an electric road from Delaware to Magnetic Springs, Richwood and Marysville, in Ohio. It is stated that the Marysville branch will be extended on to Columbus. T. N. Kerr of Columbus has charge of the local interests, but the stock has all been subscribed by eastern capitalists. The capital stock of the company is placed at $400,000. Franchises have been arranged for in Delaware and Union counties, but nothing has been done as yet in Franklin County.

The Columbus, New Albany and Johnstown Traction company has filed in the Franklin county auditor's office a mortgage of $200,000 to the Cleveland Trust company to secure that amount of bonds which it proposes to issue. The bonds are to run 20 years and bear five per cent. interest.

The Toledo, Adrian and Jackson Railway company will within a short time commence the construction of an electric line from Sylvania, west of Toledo, to Jackson, Mich. It is stated that the company has a capital stock of $70,000 and all of it has been paid in. Much of the stock is held in Cleveland. From Sylvania to Toledo the cars of the new company will run over the line that is now being constructed between these two points. F. E. Seagrave is interested in the road.

The city of Urbana has granted an extension of time to the Dayton, Springfield and Urbana road to finish the line in that town. This road has made some innovations on the portion which is already in operation by placing a fire-department car in service and running a market car for the accommodation of market gardeners and dairymen.

The Belmont county commissioners have granted a franchise to a company which proposes to build an electric line from Bridgeport to Cambridge, and it is thought the Muskingum county commissioners and Guernsey county commissioners will also agree to the franchise. The line will probably be extended to Zanesville and connect with Columbus.

It is said that William A. Lynch of Canton is arranging to form a company to build an electric line from the terminus of the Canton-Massillon line to the Northern Ohio Traction company's line at Barberton and thus connect the towns of Canton and Akron.

The Cincinnati Street Railway company has declared a quarterly dividend of 1¼ per cent., payable January 2d.

The commissioners of Medina County have granted a franchise to the Cleveland, Elyria and Western Railway company, and the company has given a mortgage on its rights and franchises to the Western Reserve Trust company to the amount of $500,000, to secure bonds to be issued for the purpose of building the road. It is probable that the line will be constructed in the spring. It will connect with the main line at the nearest point to that county.

It is said that eastern capitalists are negotiating with the owners of the Steubenville gas and electric plant and the Steubenville traction line with a view to purchasing them, and that the deal will likely be consummated. It is the intention to extend the railway to Toronto and Empire, up the river several miles, if the deal goes through.

Plans are being discussed by the officials of the Dayton, Springfield and Urbana road of extending the line to St. Paris, Champaign County.

There is a plan on foot among the street-railway officials at Cleveland to build a loop by which they will be able to reach the Union station with their cars. At the present time they are compelled to stop at the top of the hill and let their passengers walk down to the station. The plan is to build what is known as a high-level approach to the station.

The stockholders of the Scioto Valley Traction company have chosen the following-named directors: W. J. Weaver, Circleville; W. F. Burdell, E. R. Sharp and H. Bennett, Columbus; T. J. Wilson, Chillicothe. The officers chosen by the directors are as follows: President, W. F. Burdell; vice-president, T. J. Wilson; secretary, E. R. Sharp.

John P. Martin of Xenia has been engaged for the last few days in arranging the finances of the Little Miami Traction company, and this work is now said to be completed. It is reported that the work on the line will be commenced at once. It will extend from Xenia to Cincinnati, a distance of 123 miles.

The Fort Wayne, Dayton and Cincinnati Traction company of Dayton was incorporated this week with a capital stock of $20,000. The line the company has planned to build is indicated by the name. The incorporators are Samuel F. George, Charles W. Gerhart, C. E. Swayne, Charles A. Lucine, D. S. Waymin, C. J. Montstiphen, A. J. Miller, D. W. Sinks and W. H. Coblit. O. M. C.

Canadian Intelligence.

Ottawa, Ont., December 8.—The town of Aylmer, Que., has decided to issue debentures to the amount of $58,000 for the purchase of the electric-light plant of the town and the installation of a water service.

Mr. W. L. Stockon, representing the Western Electric company of Chicago, which is putting in an electrical apparatus for the Ottawa Electric company, is in Ottawa in connection with the work.

It is reported that the absorption of the Metropolitan railway by the Toronto Street Railway company will take place on January 1st next. It is also said that the residents of North Toronto will secure a single fare over the combined lines to the city of Toronto, by voting the sum of $65,000 to the railway company.

The civic lighting committee of the city of Kingston, Ont., will recommend the corporation to establish a municipal electric-light plant, at a cost of $50,000, rather than arbitrate for, and probably not purchase, the present plant owned by the Kingston Electric Light company.

It is stated that President McKinley's proposition for an accurate determination of the meridians of the Yukon is made feasible, owing to the construction of telegraph lines in that region by the Canadian government. A line from Ashcroft to Atlin, B. C., was started last summer, and will be finished next spring. It connects with a line from Bennett to Dawson, which was strung last year. From Dawson the line has been extended to Forty Mile Creek. These telegraph facilities permit the accurate determination of longitude. The matter is one of the exchange of time. Between Ottawa and Vancouver the time was fixed some time ago. Vancouver will form a basis for exchanging the time with some northern point in the Yukon, and when that is done, the time between such northern point and the capital of the Dominion can easily be exchanged. The astronomers will then get the difference of time between Greenwich and the Yukon, or, in other words, the longitude.

A special cable from London, England, states that last spring the all-British Pacific cable scheme was in danger of collapse, owing to certain Australian colonies having entertained the proposition of the Eastern Extension Cable company. The scheme was saved by the attitude of Canada, which insisted upon adherence to the original terms of partnership between the several governments. This view has now been accepted and a clear understanding arrived at that all shall abide by the original terms of agreement. This assures the successful completion of the scheme. Curiously enough, the construction company, which has been awarded the contract to lay the cable, consists largely of gentlemen interested in the Eastern Extension Cable company, the rival concern of the Pacific cable. The cable, which is to be completed by the end of 1902, will be the longest in the world, as it will cover a distance of nearly 9,000 miles in all.

Of the many large industries of which the Ottawa Valley can boast, none is of greater importance than that which was inaugurated on the 3d inst., by the formal opening of the new electric power house of the Capital Power company of Ottawa. This new electric power plant is situated at Deschenes Rapids, about seven miles distant from Ottawa, and was built by the Conroy Bros., lumbermen of that city, for the purpose of furnishing power to mills that are miles away from Deschenes. The electrical plant consists of 11 turbines and two generators. Each of the latter is of 800 kilowatts' capacity, at 10,000 volts. The amount of electrical power developed by this plant, at the present, will be 2,200 horsepower. Practically the whole of this has been leased by Mr. E. B. Eddy for his sulphite and paper mills at Hull, five miles distant. In addition, there are two turbines, driving a plant which has been leased to the Hull Electric company, totaling 332 horsepower, and two turbines, driving a plant for the Deschenes Milling company, giving 175 horsepower, making a total of 3,015 horsepower. There are facilities for doubling the present development. W.

Information from Indiana.

Indianapolis, December 7.—Work was begun on Monday on the Muncie-Hartford City Interurban electric line. F. G. Bonnell of Muncie is the chief promoter. The line will pass through that part of the gas belt that is devoid of railroads, and will eventually be extended to Fort Wayne.

The first official act, assuring beyond all question the construction of the electric line between Wabash and Peru, was performed on December 4th, when the promoters of the enterprise bought and paid for 12 acres of land on the north bank of the Wabash River, near Rich Valley. F. C. Boyd, who obtained $20,000 subsidy and has the enterprise in charge, will at once let the contracts for ties, grading and bridges. The company will spend $15,000 in beautifying the park at Rich Valley, which is expected to attract great summer crowds.

The Union Traction company has completed the planting of poles and the stringing of wires between Indianapolis and Anderson, and the laying of rails has reached to within a few miles of Indianapolis. Cars will be put in operation the first of the year. The power house in course of completion is said to be the largest in the West and will cost nearly a million dollars.

A new interurban electric line is being projected between Indianapolis and Franklin, following the old national road.

Electric lights will soon illuminate Thorntown, and the people are now talking of electric street and interurban cars.

The suit of the city of Muncie against the Muncie Electric Light and Power company to test the right to advance rates will be tried in Randolph County. The company continues to charge the advanced rate.

Zionsville has decided to construct an electric-light plant, to cost $16,000.

The new municipal electric-light plant for Richmond will cost about $150,000. Bids will be advertised for at once, and the contract will probably be let January 3, 1901. J. B. Nelson of Indianapolis is the consulting engineer.

The trustees of the Indiana State Normal School at Terre Haute have decided to ask the Legislature for a specific appropriation with which to install an independent electric-light plant for the buildings. The cost will be about $13,000.

The local union of the International Electrical Workers gave a ball at Indianapolis last week. The hall was artistically decorated with varied colored electric lights, and the calls for the dancers were all announced by an electrical device. Along the line of the balcony were telephone receivers, which were used at will and through which could be heard a concert given in Central Music Hall, Chicago.

The county commissioners of Marion County and of Boone County have granted a 50-year franchise for the construction of an electric railroad on the Lafayette pike, to connect Indianapolis and Lebanon. The line parallels the Big Four Railway company's line. The incorporators are J. M. Manker, A. A. McKain, Ernest Dawson, J. S. Holliday and A. M. Gloss Brenner. The company will be known as the Indianapolis and Lebanon Traction company. It is to pay $25 a mile for each mile to the county. The promoters say they ultimately expect to extend the line to Lafayette.

There is a general protest coming up from the people in Indiana against the ready and liberal method of giving away franchises for trolley lines over the public highways for insignificant compensation. Taxpayers are demanding a halt. It has been demonstrated that these interurban trolley lines are unexpectedly profitable investments, and that the public is entitled to much better terms for the franchises, and it is insisted that these terms can be obtained without danger of retarding the development of the lines by exacting an equitable and just compensation or tax.

The Indianapolis Electric Street Railway company has paid $150,000 for copper wire within the last six months. A new power station will be erected in the northeastern part of the city next season.

George Townsend, William Reed and C. C. Miller, capitalists backing the proposed electric line from Fort Wayne to Huntington, have purchased the bed of the old Wabash and Erie Canal for a stretch of 15 miles. This puts to flight all doubts of the success of the enterprise. F.

Gleanings from Colorado.

Denver, December 7.—In accordance with an agreement signed at Colorado Springs a few days ago, only one of the two large power stations projected in that city will be constructed. The Colorado Springs Electric company has signed a contract to furnish power to the Citizens' Light, Heat and Power company from the new plant which it is erecting at the coalfields at Austin Bluffs, four miles north of the city. This action will stop the probability of litigation between the two corporations. The Colorado Springs Electric company is the consolidation of several companies in the city, and now is the only corporation furnishing current. The Citizens' company was organized last spring and obtained a franchise from the City Council. It erected a pole line and made contracts to furnish current for light and power in Colorado Springs and Colorado City. At about the same time the Colorado Springs Rapid Transit company passed into the control of W. S. Stratton, J. R. McKinwin and others who were interested in the Citizens' company. The old directors of the street-railway company had made a contract to take current for running the system from the Colorado Springs Electric company, but the new owners preferred to patronize the company in which they were interested. Expensive and long-continued litigation was threatened, but it will be averted by the action just taken. It is understood that no consolidation of the two companies will take place.

It is stated that the Colorado Springs Rapid Transit company, in making improvements on its plant, will expend $200,000. New cars will be operated and a large part of the line will be double-tracked. A contract has been signed for taking power from the new station of the Colorado Springs Electric company.

The Lacombe Electric company of Denver for the first time furnished current during the fair for the benefit of the cathedral, held in the old cable power station. The electricity was not generated at the company's new power station, but from a temporary installation. Work on the new structure is rapidly progressing.

The Leadville Herald-Democrat refers as follows to a new enterprise for utilizing waterpower in Colorado: "A company is now quietly installing a big waterpower plant at the head of Homestake Creek, near Holy Cross, in a country little known or explored. The representatives of the company, who have made occasional visits to Leadville, are not inclined to give out any of the details of the enterprise, except to say that it is progressing satisfactorily, and that in due time the public will be informed as to the details. It is known, however, that the new company has secured a very large acreage in the section referred to and has also acquired important water rights and also has done considerable preliminary work. The most important point in connection with an enterprise of this description is the storing of the water during the period of minimum flow, that is, in the winter. One of the greatest natural reservoirs in the West is said to be situated in this Holy Cross section. It is capable of holding a quantity of water that is measured by the billions of gallons, so that it is stated the water is available all the year around."

Work is progressing rapidly on the installation of the electrical machinery in the new power station of the Colorado Springs Electric company. It is stated that the generators will be in operation soon after January 1st.

The General Electric company has installed a 500-volt power generator in the smelter plant of the American Smelting and Refining company at Pueblo. The plant furnishes current for an electric locomotive used for carrying the slag pots. The trolley line is about half a mile in length. The use of the locomotive dispenses with the services of 20 horses. Eventually, electricity is to be used for power on a large scale in the smelter.

The Denver Consolidated Tramway company has appealed from the decision in the taxation case in which the District Court held that the plaintiff, not being a railroad but a street railway, should be taxed according to the figures of the county assessor, and not those of the State Board of Equalization. Judge Palmer granted an injunction restraining the county authorities from selling the property of the company for taxes while the appeal is pending. The attorneys for the county and the company agreed to petition the Appellate Court for a speedy hearing of the case. The Tramway company gave an appeal bond of $100,000.

M. L. Stern of the Lacombe Electric company left for New York a few days ago on a business trip. J. W. D.

PERSONAL.

Charles McCaul, one of the leading building contractors of the country and well known to many electrical men, died at his home in Philadelphia on December 8th.

Henry H. Humphrey, a prominent consulting engineer in St. Louis, announces the removal of his offices from 543 Century building to suite 1305 Chemical building.

Mr. John B. Falkner, Jr., died in Washington on November 29th. Mr. Falkner had not been in good health for some time and went to Washington to recuperate. While there typhoid fever developed and he was ill but a few days. Mr. Falkner

was purchasing agent of the Electric Storage Battery company of Philadelphia for a number of years and made many close friends in the trade.

Morris W. Mead, city electrician at Pittsburg, Pa., sustained painful injuries recently from a fall. The accident occurred while he was making an inspection of a new installation.

C. R. Collins, general manager of the Seattle Gas and Electric company, has resigned, to be able to devote more time to his personal affairs. His successor has not yet been named.

H. C. Judson has resigned as superintendent of the State Electric company at Clinton, Iowa, and has gone to Buffalo, N. Y., to take a position with the Niagara Falls Power and Traction company.

James Parmelee has been elected president of the National Carbon company of Cleveland, Ohio, to succeed the late Washington H. Lawrence. Mr. Parmelee has been vice-president of the company since its organization. Colonel Myron T. Herrick succeeds him as vice-president. Mr. Parmelee is treasurer of the Wheeling and Lake Erie Railroad company and a resident of New York city.

Samuel Little, president of the West End Street Railway company of Boston since 1893, and prior to that time for 20 years identified with the street-railway service of Boston, most of the time as treasurer and director of the Highland Street Railway company, declined a re-election at the annual meeting held last week. His successor is Joseph B. Russell. C. M. Baker succeeds Mr. Little as a director and E. F. Atkins takes the place of R. M. Saltonstall

ELECTRIC LIGHTING.

A. Field is to install a lighting plant at Asheville, N. C.

Zionsville, Ind., will early in the new year construct an electric-light plant that will cost $6,000.

The city of Nashville, Tenn., has voted to issue $150,000 bonds for erection of an electric-light plant.

A franchise has been granted to Charles Gates for the establishment of an electric-light plant in Port Arthur, Texas.

The Jackson Springs company of Biscoe, N. C., is in the market for a 200-light generator and hydraulic driving machinery.

The village of Mayville, Mich., wants electric lights, and has offered to give a bonus to any reliable person who will put in a plant.

The Barrington Electric Light and Power company, Barrington, Ill., was incorporated recently, with capital of $25,000; the company will furnish electricity for light, heat and power. The incorporators are Frank Roberts, Avery R. Hayes and William R. Clasen.

ELECTRIC RAILWAYS.

The work of reconstructing the Valley street railway between Sharon, Pa., and Sharpsville has been commenced. About $100,000 will be expended in improvements.

The annual meeting of the stockholders of the Union Elevated Railroad company of this city was held on December 3d. The old directors were re-elected, but no financial statement was given out.

The City Council of Allegan, Mich., has granted a franchise to the Grand Rapids, Allegan and Kalamazoo Traction company through the village for 30 years. W. A. Tateum of Grand Rapids and W. H. Patterson of Sand City are interested.

Plans have been completed for the electric railroad from Kalamazoo to Benton Harbor, touching at Hawthorne Lake, Hartford, Watervliet and Kanowa. Application for a franchise has been made. Chicago capitalists are represented by S. A. Bailey.

The Michigan Traction company is considering the extension of the road from Battle Creek to Lansing, via Olivet. R. L. Rand, general superintendent, states that the Railways Company General is back of a project to connect Detroit with Chicago, via St. Joseph and the lake line. The right-of-way for roads between Detroit and Kalamazoo has all been obtained, and work is in progress on sections not yet finished. Mr. Rand is about to push building on the line between Kalamazoo and St. Joseph.

AUTOMOBILES.

The third international automobile exposition will be held from January 21 to February 10, 1901, under the auspices of the Automobile Club of France. The exposition will be held at Paris, in the Grand Palace, Champs Elysées, tendered for the purpose by the minister of public instruction and fine arts.

The Electric Vehicle company has bought the entire $4,000,000 capital stock of the Riker Motor Vehicle company, and will probably increase its own preferred and common stock each by $1,000,000. George H. Day has been elected president of the Electric Vehicle company, succeeding Robert McA. Lloyd, who remains a director. F. C. Stevens, president of the Metropolitan Street Railway company of the city of Washington, who has been the president of the Riker company, will be a director of the Electric Vehicle company. John Jacob Astor resigned as a director of the Electric Vehicle company, his place on the board being filled by George Chapman, his business representative. President Day is also the president of the Electric Storage Battery company, which has a monopoly of the business of supplying storage batteries for the vehicles of the Vehicle company.

PUBLICATIONS.

"Are your hands tied to uncongenial work?" is the question strikingly illustrated on the cover of a pamphlet fresh from the press of the International Correspondence Schools, Scranton, Pa. The schools' answer to the question within the pamphlet comprises descriptions of the institution's courses, advantages, etc.

The American Blower company of Detroit, Mich., manufacturer of A B C high-speed engines, blowers, fans, heating apparatus, etc., has recently brought out a neat catalogue on vertical and horizontal high-speed engines with automatic and throttling governors. These engines are especially adapted to dynamo driving. They are manufactured in large lots by special tools, all parts being perfectly interchangeable.

"The Steamloop and Holly Gravity Return System," a system for returning automatically the hot water of condensation from steam pipes to boilers, is treated in a catalogue issued by Westinghouse, Church, Kerr & Co. of Pittsburg. The descriptive matter discusses the need, philosophy, application and saving of the Holly system, while a number of very clear pictures illustrate a few of the representative plants where this system is quietly and effectively doing its work. The pamphlet has been prepared with care and should be of assistance to electrical, as well as steam, engineers.

ELECTRICAL SECURITIES.

Directors of the General Electric company have declared the regular quarterly dividend of two per cent. and an extra dividend of one per cent., payable January 15th, to stock of record December 29th. This makes eight per cent. for the year.

TELEGRAPH.

The Pacific Cable company, on behalf of the governments of Great Britain, New South Wales, Queensland and New Zealand, has let the contract for the construction and laying of the cable from Vancouver to Queensland, via Fanning, Fiji and Norfolk islands, for £1,795,000, the work to be finished by the end of 1902.

Owing to a disagreement between the management of the Santa Fe railroad system and the Order of Railway Telegraphers relating to wages and other regulations, a strike was ordered last week which affected the entire Santa Fe system. The officials of the road have apparently had no difficulty in filling the vacant places, and the road was not tied up.

SOCIETIES AND SCHOOLS.

The National Association of Automobile Manufacturers was organized on December 3d in New York city. Following are the names of officers elected: President, S. T. Davis, Jr.; first vice-president, John H. Flagler; second vice-president, J. Wesley Allison; treasurer, D. S. Walker; secretary, E. P. Wells; board of directors, comprising 15 members, to serve for one, two and three years, respectively: Three years, John Brisben Walker, C. J. Field, E. P. Wells and Alexander Winton; two years, J. M. Hill, A. L. Riker, W. C. Baker, R. A. Ballantine and John H. Flagler; one year, S. T. Davis, Jr., F. T. Bradbury, W. T. Duryea and a representative of the Daimler Manufacturing company.

SPACE TELEGRAPHY.

The French War Department has decided to devote $80,000 to secret experiments with wireless telegraphy, with a view to perfecting its campaign applications.

The wireless-telegraph apparatus being installed for use between Ilfracombe and the Mumbles, on the coast of Wales, is now complete. It is expected that messages will soon be sent across the Bristol Channel, a distance of 25 miles. The great height of the poles has excited much interest and wonder.

The War Department of the United States Government maintains two stations for wireless telegraphy at San Francisco, one at Alcatraz Island and the other at Fort Mason. Staffs 75 feet high have been erected at each station, and the messages are automatically recorded on printing tapes. The Marconi system is used.

It is stated that the Chilian government has authorized Luis Zegers, representative of the Wireless Telegraph and Signal company of London, to establish a service of telegraphic communication, upon the Marconi system, between Punta Arenas and Ancud, or Puerto Montt. The government reserves the right to terminate Mr. Zegers' concession upon six months' notice.

Some remarkably successful trials of wireless telegraphy weer witnessed last month by the Belgian government officials on the east coast of England. A message from M. Gerard was sent from the steamer Clementine to the wireless station at Dovercourt, Essex, a distance of some 80 miles, including many miles of cliffs. Long messages were also sent from Dover pier to Marconi's office in London, via Dovercourt and Chelmsford.

The Russian government is adopting wireless telegraphy for use in the navy. The Popoff system is used. All the lighthouses in the Black Sea are to be provided with the Popoff apparatus, and will be able to communicate with the coast and warships in the immediate vicinity. Two hundred complete pieces of apparatus were shipped recently from Vladivostok to Port Arthur, in order to fit out Russian warships in the Pacific, and also to connect the two towns by means of stations along the Corean coast.

Mr. Tommasi has presented to the Academie des Sciences a device intended to send space-telegraphic messages which shall not be legible to parties within a certain zone of influence. Two transmitters are used at the sending station. One of these transmits the real dispatch by the usual code, while the other sends only a series of meaningless dots and dashes produced by a mechanical process. The range of this last transmitter is kept always rather less than the other, so that at the receiving station only the code signals will be received. If, however, an attempt be made to intereept the signals by means of a receiver interposed between the sending and receiving stations, both the real message and the meaningless clicks will appear together, with the result that the messages will be unintelligible.

MISCELLANEOUS.

The Manchester Manufacturing company of Manchester, Tenn., is in the market for electrical factory equipment.

The Civil Service Commission of Chicago gives notice of the following examinations: Secretary of the street-railway commission, December 18th; interior wiremen, January 4th; battery men (fire-alarm service), January 3d.

TRADE NEWS.

The Siegfried Power company of Easton, Pa., has been incorporated, with $300,000 capital stock.

The American Steel and Wire company states that it brought suit in New York, on December 1st, against the Morris Electric company for infringement of its Crown rail bonds.

The pure flake graphite manufactured by the Joseph Dixon Crucible company, Jersey City, N. J., can be used in an ordinary squirt can. This is a very convenient and efficient way for applying this lubricant. When the coarser flake is used the opening in the nozzle of the can may require enlarging, and the can should be dry.

Owing to a constantly increasing demand for its products, the Sprague Electric company has been obliged to increase considerably the floor space in the New York office, which is now located on three floors of the factory. The New York factory is devoted exclusively to the manufacture of the various lines of interior conduit and appliances which have brought the art of electric wiring to an absolute simplicity. The company operates a still larger plant in Bloomfield, N. J., where are manufactured all the light and power apparatus, such as generators, motors, fans, elevators, hoists, etc.

After being out of the actual manufacture of automobiles for over five months, Clinton E. Woods of Chicago has entered the manufacturing field again and is bringing out a line of electric vehicles under his own name. The construction of the new automobiles is said to have some very radical departures of a mechanical nature, as well as in the design. Mr. Woods has issued an announcement and neat folder, which state his plans and describe the salient features of the new vehicles, as well as giving prices and other interesting information. Exceptionally handsome illustrations, showing different types of the Clinton E. Woods automobiles, accompany the printed matter.

The municipal electric street-lighting plant of the city of Detroit is to be altered considerably, and eventually four new units will be installed. The contract for one of these generating sets has just been let to the Northern Electrical Manufacturing company of Madison, Wis., for $35,865. The apparatus called for is to be of Northern and Stanley makes. The competition in bidding for the contract was remarkably close, the Westinghouse company's bid being but $166 higher and that of the General Electric company but $9.05 higher than the bid of the Northern company. The difference was so slight that it was considered entirely negligible by the lighting commissioners, who expressed the feeling that the contract should be awarded on merit instead of price. The fact that the work was entrusted to the Northern company, a comparatively young concern, speaks volumes for its reputation and the evidently high position which it holds in the es-

timation of engineers and the public. When finished the Detroit lighting plant will be one of the most complete and modern municipal installations in the country.

The Chicago House Wrecking company of Chicago reports a most prosperous business. An idea of the growth of this company's business may be obtained when it is stated that it now has over 500 employes, where two years ago it had but 75. The company makes a specialty of buying second-hand machinery and supplies of all kinds, and has in its possession at the present time a fine line of dynamos and motors and other electrical supplies. The company also offers exceptional bargains in steam, gas and gasoline engines, as well as in boilers, pumps, etc. Every machine is overhauled and placed in perfect running order, and a binding guarantee is given with each sale. The company has issued a new catalogue, No. 156, which should prove interesting to prospective purchasers. It may be obtained on request.

BUSINESS.

The Arthur Frantzen company, electrical contractor, 225 Dearborn street, Chicago, is sending out to its friends a neat aluminum letter opener, which is also a rule.

John H. Fowler, Fisher building, Chicago, makes a specialty of handling cedar poles in lengths of 50 to 80 feet, and states that he is obtaining his share of the pole business.

The Dearborn Drug and Chemical Works, Chicago, report an increased business in their boiler compounds. They state that over 10,000 boiler-feed waters are being treated by Dearborn methods.

The Shelby Electric company, Shelby, Ohio, states that the demand for the Shelby lamps has been greater this fall than the company anticipated. The Shelby lamp is used in every state in the Union and is said to be giving most satisfactory results.

O. W. Firkins & Co., Lumber Exchange, Minneapolis, producers of Idaho red-cedar poles, have recently received several large orders for their product. The firm makes a specialty of long poles and is known for its ability to furnish poles which are "as straight as a string."

Persons interested in alternating-current electric-light plants who have not received the little book "Skepticism" should address the Electric Appliance company, Chicago. The book is not only very neatly gotten up, but tells, so the publisher enthusiastically states, about the best thing yet in reference to wattmeters.

E. J. Noblett, Chicago, manufacturer of cross-arms, pins and brackets, reports a most prosperous business. Mr. Noblett controls seven factories, and therefore has excellent facilities for filling orders promptly. In 1899 Mr. Noblett manufactured and sold over 6,000,000 pins and 2,000,000 cross-arms.

The Cream Flux company, 100 Washington street, Chicago, is more than pleased with the reception accorded its insulating soldering flux by electrical contractors and others. It states that its flux is indorsed by the National Board of Fire Underwriters, and all users, and is highly recommended by some of the largest concerns in the electrical business.

The Allegheny Steel and Iron company will erect a steel plant at Brackenridge, Pa. The contract for the buildings has been let to the American Bridge company. This includes two producer sheds, a boiler house, a main building, an open-hearth building and a crane runway. The main building will be 72 feet by 252 feet, with four lean-tos. The open-hearth building will be 72 feet by 161 feet, with three lean-tos. About 500 tons of steel will be required. The American Bridge company is fabricating at its Gillette-Herzog branch at Minneapolis the structural steel for the Webster County courthouse at Fort Dodge, Iowa.

The large addition to the machine shop and the new building provided for the brass foundry, boxing and brass-polishing departments of the Bullock Electric Manufacturing company of Cincinnati are nearing completion. When occupied they will so increase the floor space and improve the facilities to such an extent that the capacity of the works will be nearly doubled. Many large contracts have been recently received from both home and abroad, and the company states that the present outlook for business during 1901 is even better than during the last four years. The company has recently issued bulletin No. 37, which gives a list of purchasers of the Bullock apparatus, shows numerous views in the works and the various types of machines manufactured.

The Economy Electric company of Warren, Ohio, which recently started in the business of refilling incandescent lamps, expects to be able to convince the customer that its proposition is a good one. The company proposes to put a lamp upon the market which will be equal electrically to any and perfect in appearance. It says: "It is a reasonable proposition to us that if the consumer has something which he has already paid for which can be repaired at a very distinct saving to him, he will embrace the opportunity as soon as he becomes convinced that we are financially responsible and capable of carrying out our end of the agreement, which is to save him money and to furnish him a lamp equal in burning qualities to the one he had originally."

If anyone doubts the popularity of Crystal chemical coloring, a solution used for coloring incandescent lamps, manufactured by the Webster Chemical company of St. Paul, it is but necessary to visit the offices of the company. Almost every mail brings an assortment of testimonial letters, orders from those who have never tried the coloring, and, most welcome of all, "repeat" orders from those who have given the coloring the most severe tests The process is simple and practically instantaneous, consisting merely of an immersion of the lamp in a bath of the solution. The lamp is withdrawn immediately and dries upon exposure to the air, thus producing a brilliant and durable transparency. When it is considered that this is done at an expense of one cent a lamp, the success of this coloring is explained.

W. C. Sterling & Son of Monroe, Mich., have had the best fall trade they have ever experienced in their 21 years of cedar-pole, tie, shingle, post and lumber business. During the last few months they have closed some good-sized contracts with electric-railway companies, including ties and poles for the Dover Construction company at Canal Dover, Ohio, which is building an electric road between Findlay and Fostoria. This order calls for 2,000 poles, 5,000 fence posts, 40,000 cedar ties. Other large orders the firm has placed are for the following-named electric railways: Greenville and Dayton, Ohio; Jackson and Suburban Traction company, between Jackson and Ann Arbor, Mich.; extension of Detroit, Ypsilanti and Ann Arbor Electric railway; extension of Toledo and Monroe electric railway; American Railways company between Joliet and Chicago; railway between Erie and Northeast, Pa. Since October 1st this firm has sold poles, ties and posts to 36 telephone companies, 18 electric-light companies, 27 electric-railway companies, two telegraph companies and six gas-pipe-line companies, which is considered a good record for two months; over 500 carloads were shipped in this time, and more would have gone forward had the railroad company furnished the cars. There isn't much question, this firm says, but what prices will be much higher in the spring, as the cost of getting out cedar is increasing.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 4, 1900.

662,911. Electric Heater. John E. Brown, Philadelphia, Pa., assignor of one-third to John J. Shanfelter, Philadelphia, Pa. Application filed January 24, 1900.

In this heater a chamber formed of fireproof insulating material is composed of top, bottom and rear walls with slotted ears projecting into and formed integral with the chamber. It contains a resistance composed of coiled sections. Reduced necks join the sections and fit in the slot of the ears.

662,913. Elevator. John Bush, London, England, assignor of one-half to Arthur David Jenkins, Borough, England. Application filed April 11, 1900.

A mechanism controlling the movement of the cage is arranged to be thrown into and out of action by electromagnets operated by two circuits under control of a double-throw switch thrown by the opening and closing of the door.

662,921. Apparatus for Electric Traction. Henri Dolter, Paris, France. Application filed July 6, 1899.

A conduit contains a source of electric energy, a box of insulating substance, two magnetic contact pieces supporting the box, and a non-magnetic piece separating the magnetic pieces from each other. A conductor is located in the insulating box and normally connects with the source of energy. A pendulum is adapted to be elevated when the magnetic pieces are magnetized to complete thereby the circuit from the conductor through the magnetic pieces.

662,928. Space Block for Armatures. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 18, 1900.

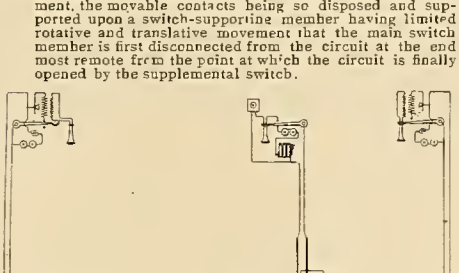
This space block comprises a core plate punched with radial slots and space pieces adapted to be inserted into the slots the space pieces being slotted to permit movement relatively to the core plate, and locked thereto by the walls of the slot.

662,931. Electric Arc Lamp. Frederick A. Gilbert, Brookline, and Emil O. Lundin, Beachmont, Mass., assignors to the General Electric company of New York. Application filed July 22, 1898.

The lamp contains a tube to receive and permit vertical movement therein of the upper carbon, and a clutch mounted wholly upon the tube. The clutch comprises clamping jaws for the carbon, levers upon which the jaws are pivoted, and a support for the levers, mounted to slide upon the tube. Links connect the tube and the outer ends of the levers, and a fixed stop normally engages the jaws and moves the support on the tube, to release the carbon. Auxiliary means are provided to engage and move the levers when the jaws are in engagement with and more widely separated by the carrier attached to the upper end of the carbon.

662,979. Automatic Magnetic Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing company of New Jersey. Application filed April 27, 1900.

A main switch is combined with a supplemental switch, the contacts of which are substantially in vertical alinement, the movable contacts being so disposed and supported upon a switch-supporting member having limited rotative and translative movement that the main switch member is first disconnected from the circuit at the end most remote from the point at which the circuit is finally opened by the supplemental switch.



NO. 662,984.

662,984. Telephone Exchange System. Alfred Stromberg, Chicago, Ill. Application filed October 18, 1899.

In a telephone-exchange system, a number of metallic circuit telephone lines each extending by both of its limbs from a subscriber's station to an exchange, limbs of the metallic telephone lines being directly connected together at the exchange independently of the cord-connecting apparatus, are combined with a single cord strand provided with suitable connecting means adapted to connect the remaining limbs of the metallic-circuit telephone lines. The telephonic circuit between the subscribers comprises the limbs of the metallic lines that are directly connected at the exchange and the single cord strand with the remaining limbs united thereby. Battery transmitters are provided at the substations. A common battery for supplying the transmitters is connected in bridge at the exchange between the cord strand and the directly united limbs of the telephone lines, the latter being free of direct connection except at the exchange where they are directly connected with one terminal of the battery. (See cut.)

662,985. Telephone Transmitter. Alfred Stromberg, Chicago, Ill. Application filed February 24, 1900.

In a battery telephone transmitter, a diaphragm to be actuated by sound waves is combined with a substantially rectilineal reciprocating electrode actuated thereby, a second electrode engaging the reciprocating electrode. Means are provided whereby the resistance of the circuit including the electrodes may be varied without subjecting the second electrode to varying pressure.

662,986. Telephone-exchange System and Apparatus. Alfred Stromberg, Chicago, Ill. Application filed June 6, 1900.

In a telephone-exchange system, the limbs of a metallic-circuit telephone line are combined with a plurality of line switches provided on a switchboard, one limb of each line being provided with a loop at and connected with each of the line switches, the other limb of the line being also provided with a loop at each line switch, but free of direct connection therewith, the loops being twisted.

662,987. Circuit Protector. Alfred Stromberg, Chicago, Ill. Application filed June 28, 1900.

Combined with a fuse for inclusion in the circuit to be protected thereby is a grounded lightning-arrester terminal composed of carbon opposed to the fuse which constitutes a second lightning-arrester terminal, the grounded terminal having its surface that is opposed to the fuse partially faced with insulating material, and means for maintaining the fuse under tension.

662,988. Telephone-exchange System. Alfred Stromberg and William M. Davis, Chicago, Ill., assignors to the Stromberg-Carlson Telephone Manufacturing company, Chicago, Ill. Application filed June 28, 1900.

In a telephone-exchange system, a subscriber's telephone line extending from a substation to an exchange is combined with an indicator at the exchange, a battery, means controlled by the magnet of the indicator for including the helix of the magnet in the circuit with the battery to maintain the indicator in its actuated condition, and an operator's listening key adapted to exclude the battery from circuit with the helix of the magnet to restore the indicator.

662,992. Electric-current Indicator. Harry M. Warren, Schenectady, N. Y. Application filed December 9, 1899.

The electric-current indicator described comprises a cylinder with closed bottom having a central projection with conical top, a ring partially closing the top of the cylinder, a tube inserted in the ring and over the central bottom projection, a helix between the cylinder and tube, a core in the tube having the conical hollow in its bottom and suspended in mercury, a pointer-operating rod secured to the core and a counterbalancing lever connected to the rod by a joint permitting true vertical movement of the core and rod.

662,995. Electric Arc Lamp. Ozro N. Wiswell, Lynn, Mass., assignor to the General Electric company of New York. Application filed May 4, 1899.

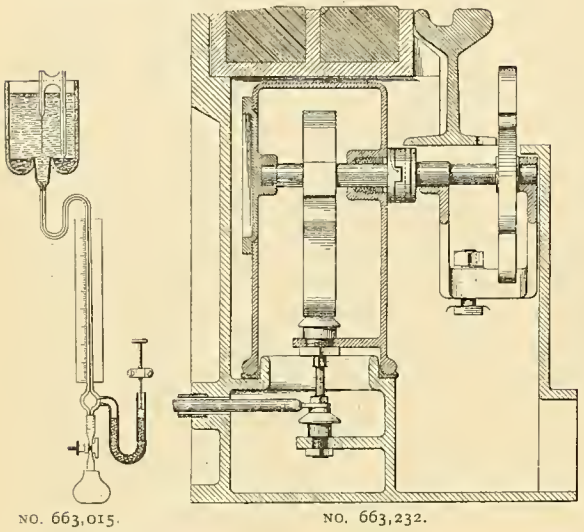
A feed-regulating magnet is provided with a core and armature, one of which is permanently fixed and the other movable, the two having co-operating faces shaped to produce a sudden decrease of the magnetic reluctance of the circuit and thereby afford a sharp increase of pull at or near the feeding point of the lamp. The feed regulating magnet has a paraboloidal pole tip, and the armature surrounds the pole tip, the pole tip being provided with an enlargement of magnetic material at or near the feeding point for exerting a sharp increase of pull.

662,996. Electric Arc Lamp. James J. Wood, Fort Wayne, Ind. Application filed December 4, 1899.

This arc lamp has distinct separating and feeding magnets A lever is connected at its normal fulcrum axis to the separating magnet and operated by the feeding magnet. A resistance shunt is connected around the arc, and a cut-out is adapted to be operated solely by the excitation of the separating magnet to break the resistance shunt independently of the movements of the feeding magnet.

663,015. Electric Meter. Thomas A. Edison, Llewellyn Park, N. J. Application filed March 17, 1899.

In the electric meter described an electrolytic cell having a metallic mercury electrode immersed in a solution of a soluble mercury salt contains an electrode on which metallic mercury will be deposited by the electrolytic action of the current to be measured, and a capillary tube connected to the cell for measuring the mercury deposited on the electrode. A pump forces the mercury from and draws it into the tube. (See cut.)



NO. 663,015.

NO. 663,232.

663,039. Flush-switch Support. Charles G. Perkins, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing company, Hartford, Conn. Application filed June 28, 1900.

A metallic frame has wings projecting outwardly and lugs extending inwardly, with the outer faces of the lugs in a plane below the outer edge of the frame, an insulating receptacle having recesses that open from the back edge of the receptacle and that are adapted to receive the lugs, and screws passing through perforations in the receptacle walls into the lugs.

663,043. Return Signal Device for Call Boxes. Joseph S. Robinson and Henry M. Robinson, Chicago, Ill. Application filed February 12, 1900.

The call mechanism is combined with an electromagnet, an armature therefor, an electrically connected stop-post, a spring for normally holding the armature in contact with the stop-post, a wire connected to the armature having a return bend thereto, and carrying signaling devices on its free end, and means actuated by the call mechanism for moving the wire to actuate the signaling devices and move the armature out of contact with the stop-post and into the field of the electromagnet.

663,059. Automatic Electrical Apparatus for Indicating Leaks in Ships. Wladimir W. Zvorikin and Serge de Blumenthal, Moscow, Russia. Application filed March 24, 1899.

This is an automatic indicating device, comprising two sources of electric energy, a closed circuit for each, and a relay in each of the circuits, a circuit-breaker included in one of the closed circuits, a shunt circuit from the other closed circuit including the relay of the first-named closed circuit, a motor in the shunt circuit, and secondary circuits branching, respectively from one of the closed circuits and including the relay of the other closed circuit. Each secondary circuit contains signal devices.

663,082. Fire-alarm Telegraph Apparatus. William H. Kirnan, Bayonne, N. J., assignor to the Gamewell Fire Alarm Telegraph company, New York, N. Y. Application filed October 4, 1899.

In this system a street circuit controls a repeater magnet, which in turn operates a joker-transmitter magnet. A joker-transmitting apparatus is under the control of the joker magnet, and a joker circuit is controlled by the transmitting apparatus.

663,095. Incandescent Body for Electric Glow Lamps. Alexander Just, Vienna, Austria-Hungary. Application filed September 20, 1900.

This patent covers incandescible bodies composed of intimate mixtures of (1) a conductor of electricity and a refractory nitride of a metalloid, (2) of nitride of boron, silicon and a carbonaceous material, (3) of nitride of boron and carbon, (4) of boron, carbon and nitride of boron, and (5) of boron, silicon, carbon and a refractory nitride of a metalloid.

663,130. Electrical Apparatus for Controlling Signal or Other Circuits. Homer A. Parrish, Jackson, Mich., assignor to the Parrish Signal company, Jackson, Mich. Application filed August 11, 1899.

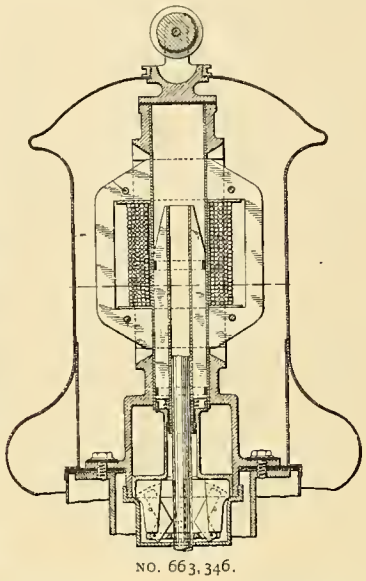
In a signaling apparatus are combined an electrically operated signal, a circuit-closing device for establishing a circuit which actuates the signal, and means normally retaining the circuit-closing device out of operative position. An electromagnetic mechanism controls the operation of the retaining mechanism, and the passage of a train furnishes means for supplying a current to the controlling mechanism. Means are provided for automatically varying the strength of the current supplied to the controlling mechanism. The circuit-closing device is set electromagnetically, and the passage of the train operates means for actuating this setting mechanism.

663,196. Telephone Receiver. Charles H. North, Cleveland, Ohio, assignor to the North Electric company, Cleveland, Ohio. Application filed November 15, 1899.

This receiver has a casing consisting of a shell and a cap secured directly thereto, combined with a magnet within the casing and supported by having a projection clamped between the cap and shell, and a diaphragm supported in proximity to the magnet pole.

663,198. Clip or Support for Trolley Wires. William H. Russell, Watertown, Mass. Application filed March 20, 1900.

This is a clip for sustaining trolley wires consisting of two members hinged together and provided with an irregular groove in which the wire may be placed and upon which the members are adapted to be clamped.



NO. 663,346.

663,207. Means for Starting or Stopping Electric Motors. James J. Wood, Fort Wayne, Ind. Application filed July 11, 1899.

This starting box comprises a rheostat and its arm, an electromagnetic detent for holding the arm in the normal running position, a switch, and an actuator distinct from the switch adapted upon being struck by the arm to open the switch. (See cut.)

663,209. Knife Switch. John A. Wright, Irwin, Pa., assignor of one-half to William F. O'Neill, Wilkinsburg, Pa. Application filed May 16, 1900.

This switch has a contact having one of its sides formed with a lateral projection adapted to be bent across the path of the switch blade to form a stop.

663,216. Railway Telephone System. Elmer E. Carpenter, Worcester, Mass. Application filed May 25, 1900.

This is a telephone system for electric railways, consisting of the combination of a telephone instrument mounted in a car, telephone line wires extending along the track upon which the car runs, and a circuit-making device comprising a jointed pole having two contact strips mounted therein with springs or hooks carried in position to co-operate with the contact strips, and flexible wires connected to the contact strips, whereby connection from the telephone instrument on the car may be established without leaving the car.

663,217. Ceiling Cut-out. Walter A. Church, Pittsburg, Pa. Application filed February 16, 1900.

The cut-out comprises an insulated base block and a pair of contacts secured to the outer face of the block. The contacts are provided on one end with a clamping lug and on the other end with an outwardly extending contact flange. A pair of fastening catches are secured on the outer face of the block and located on a diameter at right angles to the contacts. A cap engages the outer face of the block, and fastening hooks are carried by the cap and adapted to engage with the fastening catches carried by the base block, contact plates being carried by the cap, and yokes formed integral with the plates for engagement with the contact flanges of the contacts.

663,232. Switch Box for Electric Railways. William Kingsland, London, England. Application filed July 5, 1900.

An outer box with a removable cover contains mechanism to operate a switch mechanically. A removable case is placed inside the box through the cover aperture thereof, and a switch is contained within the case, and an operating spindle therefor projects through a water-tight bearing in the side of the removable case. The case is rendered water-tight. Means are provided for permitting of the placing and removal of the case to or from the box together with the contained switch without dismounting the mechanism located in the outer box, and for detachably connecting the projecting end of the switch shaft to the mechanism contained in the outer box for mechanically operating it. (See cut.)

663,233. Connection of Strikers to Motor Vehicles for Mechanically Operating Electric Switches. William Kingsland, London, England. Application filed July 10, 1900.

A striker is carried by an axle provided with a wheel to run upon the track rail. A frame connected to the motor vehicle carries the axle, and means are provided for permitting the frame to have vertical motion relatively to the axle, whereby the position of the striker is maintained constant relatively to the track rail and to the switch-operating mechanism. The acting end of the striker is maintained in a working position in the direction of its action.

663,289. Dry Battery. Ernest Meyer, Paris, France. Application filed November 10, 1899.

A centrally-located negative electrode is surrounded by a depolarizing mass, the positive electrode surrounding the depolarizing mass at a distance. The depolarizing mass is covered by a cloth and a layer of peat fiber or moss interposed between the cloth cover and the positive electrode and impregnated with an exciting liquid. A filling of plaster containing some of the exciting liquid is used, and extends at the top of the battery between the two electrodes.

663,304. Magnetic Separator. Frederick Theilengerdes, Memphis, Tenn., assignor of one-half to Walter Goodman, Memphis, Tenn. Application filed June 8, 1900.

An inclined hinged feed-board is fitted with a flat electromagnet core beneath and extending nearly from end to end, and having its broad ends turned upward into slits in the board. Approximately parallel bars of magnetizable material are sunk in the upper surface of the board and rest upon the ends. Non-conducting plates rest against the upturned ends and oppositely extending lugs, and a coil is wound about the core between the plates.

663,346. Electric Arc Lamp. Walter C. Johnson and Adolph Wunderlich, London, England. Application filed September 10, 1900.

This lamp has a solenoid and core consisting of a laminated iron yoke inclosing the coil, and a tubular core having ribs of laminated iron, whereby the lamp is rendered capable of operating with alternating currents. (See cut.)

663,360. Electrical Rail Bond. William Pervenko, Kiew, Russia. Application filed December 30, 1899.

The rail bond described consists of ribbon or ribbons of flat sheet metal extending continuously between the track rails and their supports from end to end of the track, the ribbons being in contact with the base of the track rails.

663,367. Switchboard for Telephonic or Telegraphic Purposes. Charles Shore, Bolton, and Charles Heap, Caldershaw Rochdale, England. Application filed October 7, 1896.

In a multiple switchboard for telephone exchanges a plurality of jacks, each bearing an upper and lower series of insulated metal strips, are combined with plugs without cords having non-conducting portions insertible in the jacks. Contact terminals project from these portions to engage the metal strips, spring contacts engage the projecting ends of the plugs, and electrical connections are made between the corresponding metal strips of the separate jacks.

663,376. Electrical Railway-signaling System. Louis C. Werner, Louisville, Ky. Application filed November 8, 1899.

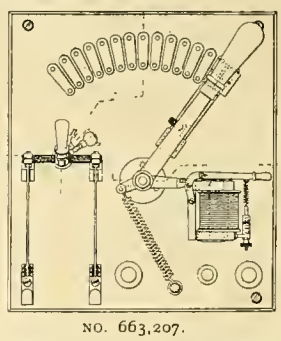
This is a train apparatus comprising a normally closed safety circuit, a local signal circuit, a bell included in the signal circuit, and a danger circuit. The danger circuit is arranged to close the local signal circuit and to open the safety circuit. The danger circuit is closed automatically.

663,388. Electric Igniter for Explosive Engines. Montague S. Napier, London, England, assignor of one-half to Selwyn Francis Edge, London, England. Application filed January 8, 1900.

In this igniter for use with motor-vehicle engines a clutch pedal and the handle for adjusting the position of the contact device are so combined as to furnish means whereby the contact device is shifted by the pedal without disturbing the position of the adjusting handle for the purpose specified. The handle may be locked in any desired position.

663,398. Electric Railway. Ernst Sussmann-Hellborn and Wilhelm Hornauer, Munich, Germany. Application filed October 11, 1900.

This patent covers means for feeding electricity to motor cars by induction, comprising a divided transformer having the primary elements embedded in the ground and the secondary elements or windings on the car, the iron cores of the primary and also of the secondary elements being each continuously magnetically connected up among themselves, parallel to the direction of the rails, by means of a plurality of parallelly located compound iron binders between the rails and on the car.



NO. 663,207.

663,400. Method of Controlling Mechanism by Means of Electric or Electromagnetic Waves of High Frequency. Ernest Wilson and Charles J. Evans, London, England. Application filed July 28, 1898.

This invention comprises a device for controlling mechanisms by electric waves, the combination of receivers being arranged at right angles to each other, and the transmitters being also arranged at right angles to each other and in a plane parallel to the plane of the receivers, so that the line joining their centers will be approximately perpendicular to the parallel planes. Relays are connected with the receivers arranged at right angles to each other and contact-making devices are in circuit with the receivers. Electromagnetic mechanisms are connected with the relays, the construction being such that the transmitters thus arranged opposite to the receivers may impart an electric impulse to either of the receivers.

Designs.

33,640. Telephone-transmitter-arm Base. William J. Barr, Cleveland, Ohio. Application filed October 20, 1900. Term of patent, seven years.

33,641. Motor Base Frame. John A. Secor, New York, N. Y., assignor to the General Power company of New Jersey. Application filed September 8, 1900. Term of patent, 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, DECEMBER 22, 1900. No. 25

New Municipal Arc-lighting Plant in Chicago.

Of the municipal arc-lighting plants operated in Chicago the Robert A. Waller lighting station at Sixty-fourth street and Wentworth avenue, in the Englewood district of the South Side of the city, is the newest and most modern. The plant was named in memory of the late Comptroller Waller, who gave valuable assistance to the extension of the Chicago municipal lighting system. It was largely due to his persistent efforts that the Department of Electricity was given an opportunity to install the lighting station which now bears his name. Work on the plant was first commenced in the spring of 1899, but later abandoned for some time pending a change of plans for lighting the city.

It was the first intention in building this plant to construct a model lighting station, regardless of the first cost. With this end in view, proposals were received for nearly everything that could be installed in a plant and that would in any way increase its efficiency. On a basis of 1,000 lights, the total cost of the station, as first planned, would have been $89,000, but the plans were changed and the present station was erected at an expense of about $60,000.

In dimensions, the building is 43 feet wide, 160 feet long and 20 feet clear under a steel truss roof. A transverse wall divides the building into the engine room, 100 feet in length, in the front of the building and the boiler room in the rear. The structure is fireproof throughout, excepting the wood used in the doors and window frames. The walls are of brick, the front being constructed of Milwaukee pressed brick and neatly trimmed with white sandstone. Pressed brick is also used for the lining of the engine room, thus imparting a neat finish, easily kept clean and of a substantial character. The floor is of concrete. Tiling, laid with cemented joints, forms the roof of the building. The brick stack, located at the rear of the building, is octagonal in shape, 96 inches in diameter and 175 feet high.

In the boiler room are located three Oil City water-tube boilers, each with a capacity of evaporating 12,000 pounds of water an hour. Two of these boilers are equipped with automatic traveling grates manufactured by the McKenzie Furnace company. These grates are said to be the first of their type that have been put in operation. They are mounted on self-contained frames, which are easily and quickly rolled out from under the boilers to enable repairs being made either to the grates or the furnace walls. This operation is made possible by reason of the boilers being supported without any attachment to the grates. In construction, the grates consist of slotted iron sections, mounted on sprocket chains and operated in the usual manner. The coal is fed on the grates at the front of the boilers, the ashes and cinders being carried over the end of the grates at the rear of the furnaces. A differential ratchet is used to vary the speed of the grates, while the coal feed is varied by a gate extending the full width of the grates. It is said that these grates are operating satisfactorily and that the saving in coal over hand firing in ordinary operation is about 20 per cent. This type of furnace and grate is also said to be an excellent smoke preventer, scarcely any smoke ever being discernible from the stack.

In the engine room, a general view of which is shown in Fig. 1, the engine equipment consists of two upright engines, each connected to an end of a long driving shaft that runs the full length of the engine room. The engine seen in the illustration at the east end of the shaft is an 800-horsepower, cross-compound, marine type of engine, built by the Charles F. Elmes Engineering Works of Chicago. At the opposite end of the shaft (the end near the spectator in the picture) is an 800-horsepower, cross-compound, Westinghouse, special engine. Both engines have a speed of 200 revolutions a minute and are run condensing. A friction clutch is used with the Elmes engine and a magnetic clutch with the Westinghouse engine, thus enabling either or both engines to be used. The magnetic clutch, a portion of which is shown at the right in Fig. 1, is of the type manufactured by the Arnold Electric Power Station company, under designs of B. J. Arnold. It is 70 inches in diameter, has a capacity of 1,000 horsepower and is to be operated by a three-ampere current at 50 volts, generated by a small dynamo driven by the engine. The armature of the clutch is bolted to slide upon studs, which are fixed to the flywheel arms. It is arranged so that it will be pulled away from the field of the clutch, which is fixed fast on the shaft, when not in operation. A clearance of three-sixteenths of an inch is provided and a centering device keeps the two parts centered.

At the east end of the engine room four Brush 160-light arc machines are belted to the line shaft. Each of these generators is an 8,000-volt, 9.6-ampere machine, driven at 500 revolutions a minute. These dynamos are equipped with Thomson arc ammeters. The latest addition to the station equipment consists of five more arc machines, manufactured by the General Electric company. They are installed in a manner original with Mr. Edward B. Ellicott, city electrician of Chicago, who designed the plant. The five machines, shown at the left in Fig. 1 and well illustrated by Fig. 2, are coupled together in a line by means of a special insulated coupling and are driven by means of a rope drive, the driving pulley being connected with the machine at the east end. The rope drive, which is operated from a large pulley on the main line shaft, consists of 20 turns of 1⅛-inch manila rope. This arrangement was decided upon so that space might be saved, allowing for the future addition of a similar row of machines in the center of the engine room, and also with a view of the possible application of electric motors operated by power derived from the Drainage Canal for municipal purposes. All of the municipal station equipment for the last two years has been made with the idea that at no very distant time this power may be obtained by the city, and its adaptation to existing apparatus will therefore be comparatively simple.

Each of the five new arc machines is of the double-circuit type and has a capacity of 11,000 volts at 6.6 amperes, the speed being 500 revolutions a minute. The insulated couplings between the generators consist of spider arrangements, the projections on the driving part of the device being insulated

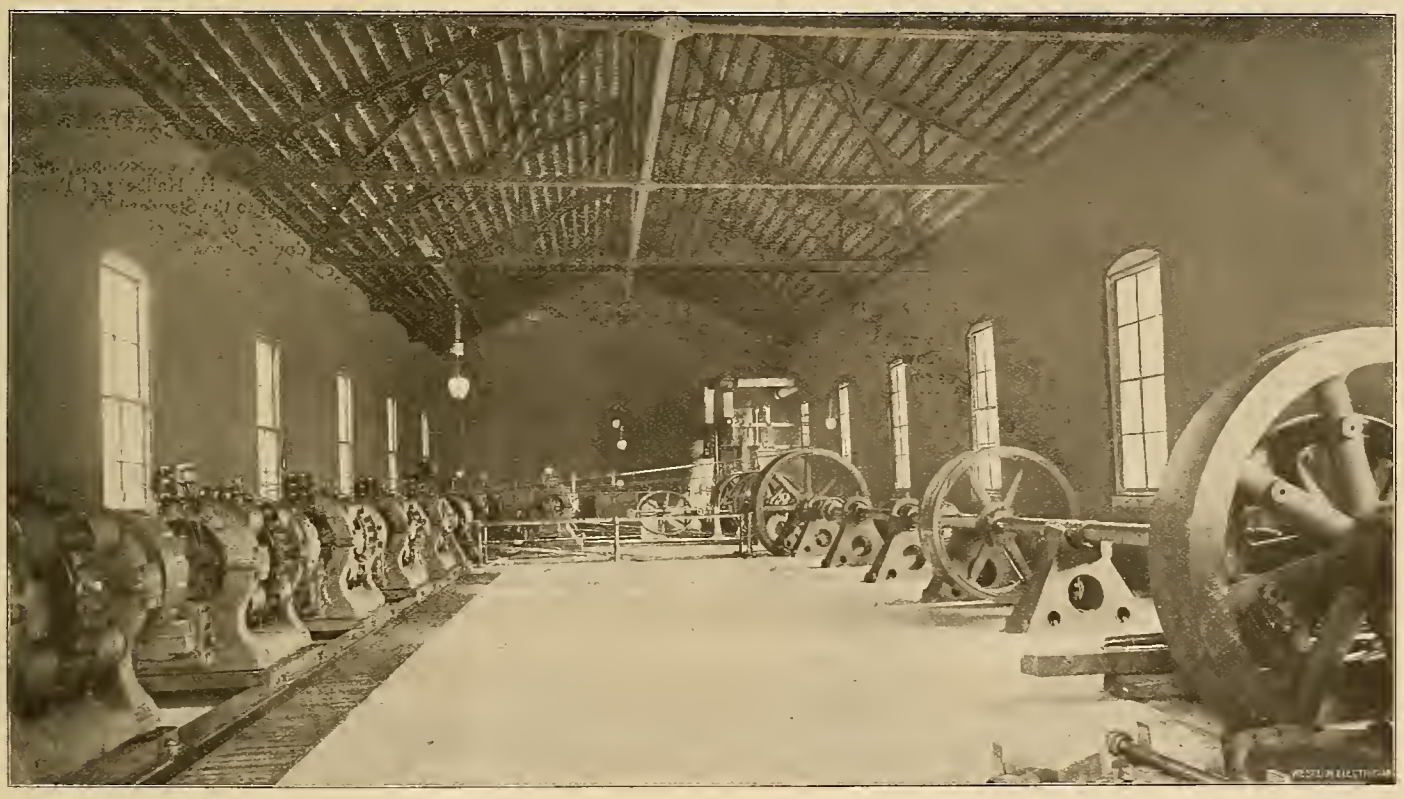


FIG. 1. NEW MUNICIPAL ARC LIGHTING PLANT IN CHICAGO—GENERAL VIEW IN ENGINE ROOM.

from the recessed portions of the driven part, into which the projections fit, by means of pieces of rubber cylindrically shaped.

A two-panel switchboard of white marble is located at the left end of the new arc machines, as shown in Fig. 2. It is equipped with 12 Western Electric ammeters. The station is designed for a capacity of 2,000 lights and the present equipment provides for 1,200 lights, 831 lamps being now used. Seven series circuits are supplied from the station, two of these circuits belonging originally to the municipal plant located at Fourteenth street and Indiana avenue. The territory covered by the arc-lamp circuits is principally in Englewood and extends west to Ashland avenue, south to Sixty-ninth street, east to Cottage Grove avenue, with a few lights east on Sixty-third street to Stoney Island avenue, and north to Thirty-ninth street, while one circuit extends north to Fourteenth street. There is no boulevard or arc lighting except for a few blocks on Michigan boulevard. The Fort Wayne make of lamps is used, most of them being of the

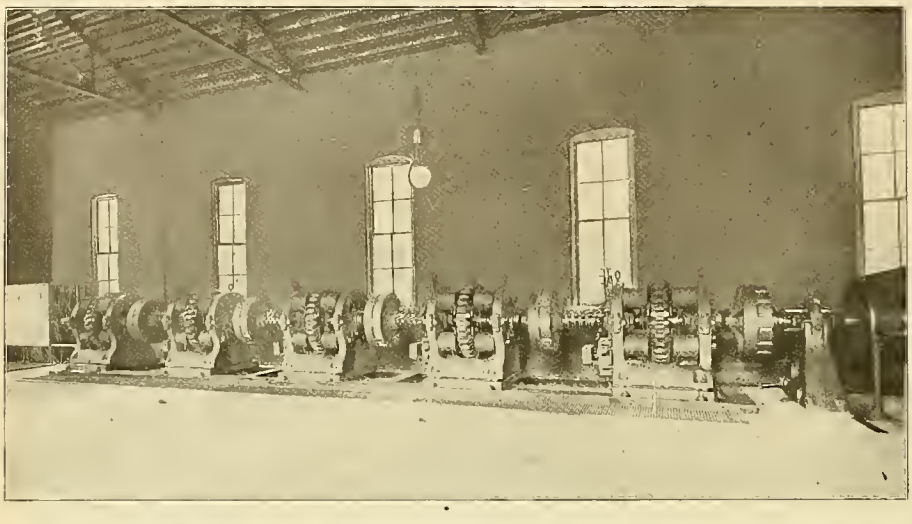


FIG. 2. NEW MUNICIPAL ARC-LIGHTING PLANT IN CHICAGO.—LINE OF GENERATORS COUPLED TOGETHER.

open type Enclosed-arc lamps are used on Indiana avenue. Many of the lamps are of the 100-hour type.

No money has been spared to make this station one that can be depended upon to furnish good service and within reasonable economy. The actual station equipment has been carefully selected, and when entirely completed it is expected that the plant will furnish to the southern section of the city a reliable and economical source of light.

Automobile Show in Washington, D. C.

With its many miles of broad asphalt streets and avenues, Washington presents unusual advantages for automobiles, and the public, during the week ended December 15th, took full advantage of the fine displays shown by manufacturers of these vehicles at the automobile show. The exhibition was held in Convention Hall, a large building extending on Fifth street N. W., between K and L streets. It was a success in every way, and doubtless will become an annual affair in Washington. The success of the show was due to Edward Reynolds, manager, W. J. Foss (the local manager of the American Bicycle company), treasurer, and Rudolph Jose, secretary.

Around the elliptical arena in the central portion of the hall which contained the exhibits, was built a wooden track, one-eighth of a mile long. The hall and the bridge over the track were beautifully decorated with streamers, flags and colored incandescent lamps.

The following is a list of the names of the exhibitors of electric vehicles: American Bicycle company, Automobile and Manufacturing company, Electric Vehicle company, Woods Motor Vehicle company and Riker Motor Vehicle company.

Among the non-electric exhibitors were the De Dion-Bouton Motorette company, Overman Automobile company, Pennsylvania Horseless Carriage comoany, Knox Automobile company, Mobile company of America and the Locomobile company of America. The New York Belting and Packing company, the Rose Manufacturing company and others exhibited automobile accessories. Several local dealers in sporting and other goods had stands along the side of the track.

Each night there was a large number of entries from the different classes of vehicles in the obstacle and brake contests, which took place on the portion of the track bordered by the private boxes and reserved seats. Society turned out "en masse" on Thursday to witness the floral parade. Each vehicle was covered with a mass of flowers, carnations, roses and chrysanthemums being used lavishly in beautifying vehicles that already represented the best skill in the command of the carriage maker. Lieutenant-general Nelson Miles was first in line. The first prize, a silver cup, was awarded to Mr. and Mrs. Kastle. The second prize, a silver loving cup, to Mr. F. Beck and Miss Rupp. Mr. A. M. Welch's carriage was third in point of beauty and received honorable mention. Throughout the week the attendance was large and the exhibitors at the close of the show will take away but a small portion of their exhibits, as the greater portion was sold to Washingtonians. The exhibitors, spectators and management were all more than pleased with the splendid success of this, the first automobile show in Washington. B. C. W.

Electrical Measurements of Precision.

At the meeting of the New York Electrical society, held on December 12th, Dr. Samuel Sheldon, professor of electrical engineering at the Brooklyn Polytechnic Institute, lectured on "Electrical Measurements of Precision." In opening his lecture Dr. Sheldon said that nearly all the measurements carried out in the practice of the electrical engineering profession are made with an accuracy which entitles them to the name of measurements of precision. However, they permit of classification into two groups, viz., commercial measurements and measurements of precision. Commercial measurements are made with only such a degree of accuracy as is required by commercial conditions, while every possible refinement is employed in the making of measurements of precision. Commercial determinations, e. g., of hysteretic constants, of *B-H* curves, of dielectric strength, and of insulation resistance permit of errors of 10 per cent., of two per cent., of 20 per cent. and of 25 per cent., respectively. Comparisons of standard resistances, of standard cells, of standard current and electromotive-force meters must be made with the greatest possible accuracy, errors greater than 1-100 per cent. being often unacceptable.

Of the measurements of precision which occur in practice nearly all are comparisons with standards and not absolute measurements which depend ultimately upon the standards of length, mass and time.

The use of the tangent galvanometer, which was so common a few years ago, has now almost entirely ceased. The instrument itself was burdened with a multitude of correction factors—many of them being of uncertain magnitude. The use of the instrument demanded a knowledge of the instantaneous value of the horizontal component of the earth's magnetization. This quantity varies in magnitude and direction in an uncertain manner. Vagabond trolley and lighting currents, combined with the frequent use of structural steel, assist in the uncertainty.

The standard cell, on the other hand, has come into scientific favor. The Clark cell, although officially standard, has a high temperature coefficient, and under rising temperature, has a time lag due to the slowness of the processes of diffusion and solution. The Carhart cell is convenient to use, and has but half as great a temperature coefficient. Variation of the concentration of its solution, due to evaporation resulting from an imperfect seal or to a local action on its zinc, should be guarded against. The cadmium cell is of almost negligible temperature coefficient, but has an uncertain electromotive force for temperatures below, say, 12 degrees C.

The best of modern standard resistances are made of manganin, which, besides having a very small temperature coefficient, gives very small thermal electromotive forces in combination with copper. Nearly all the alloys of nickel and iron have small temperature coefficients, but give a large thermal electromotive force with copper.

The galvanometers used in measurements of precision are either of the Thomson or of the d'Arsonval type. The former can be made to deflect one millimeter at a meter's scale distance for an impressed potential difference of 1-100 of a microvolt. The best of the latter require one microvolt. The former are trying to the patience of the observer and are prodigal in the use of his time. The d'Arsonval could be made many times more sensitive, if a stronger field could be employed. Some existing types have a flux density of but 100 webers. The diamagnetism of the coil, however, prohibits the use of a very strong field. Perhaps aluminum wire would be less diamagnetic and would in addition furnish a lighter moving system.

The precise comparison of nearly equal resistances is accomplished by means of the Carey-Foster bridge; comparison between two standard resistances, one of which is nominally 10 times the size of the other, can be made by means of three nearly equal auxiliary resistances. They are wound upon the same metal spool, and each has a resistance approximately three times that of the smaller standard. The smaller standard is compared with the three in multiple; the three compared with each other; then all of them in series are compared with the larger standard. The comparisons are made with the Carey-Foster bridge.

Another method makes use of an auxiliary box of five resistances having nominal values of 1, 1½, 2, 3 and 4 times the resistance of the smaller standard. By means of the Carey-Foster bridge these resistances are compared with the smaller standard and with each other in combination. The larger standard is then compared with them in series.

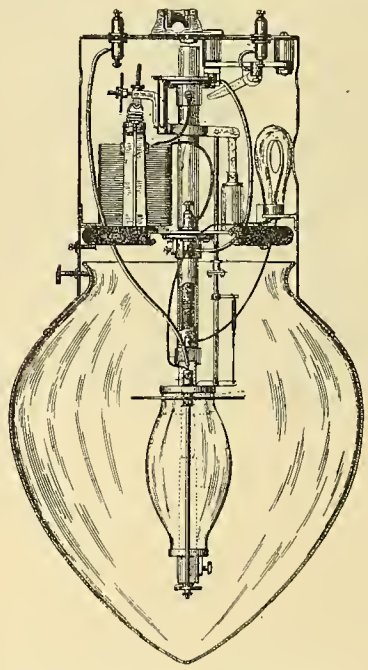
Low-resistance standards may be compared by means of the Thomson double bridge, providing the ratio of the resistances around the contact between the low resistances be adjusted simultaneously with the resistance in the main ratio arms. There may be a distortion of the flow lines in the low resistances.

All electromotive forces are best compared by means of some form of potentiometer.

Currents are measured by sending them through low resistances supplied with side-potential terminals. The potential differnce between these terminals is measured by means of the potentiometer.

Novelty in Arc-lamp Construction.

The lamp represented in the accompanying cut is the invention of Mr. J. H. Hallberg of Peabody, Mass., who assigned it to the Standard Thermometer and Electric company of that city. The lamp is provided with a double-throw switch in the top and a resistance coil of bare wire, with provision for adjustable connection thereto, to adapt it for use on either alternating or direct-current circuits. The case enclosing the mechanism has a small aperture cut in its side, affording a view of an incandescent



NOVELTY IN ARC-LAMP CONSTRUCTION.

lamp inside. A contact is so adjusted in position as to complete a circuit through the incandescent lamp when the upper carbon is nearly consumed. This gives notice of the fact that the lamp needs trimming, and avoids the expenditure of time necessary to remove the outer and inner globes for inspection of the carbons.

La Compania del Alumbrado Electrico y Fuerza de Linares is the title of a new company recently organized at Linares, Nuevo Leon, Mexico. It will install a modern electric-light plant capable of operating 2,000 incandescents, 35 arcs, 100 horsepower in small motors, and 150 fans. A. W. McLimont is the manager, and the plant will be erected under his supervision.

Electric Passenger-coach Lighting.

By Emerson L. Clark.

In solving the problem of lighting railroad passenger coaches by electricity, we meet special conditions which are rarely found elsewhere. There are two different systems, which may be mentioned as the only feasible ones before the engineering public to-day, i. e., that in which the current for the entire train is furnished by one generating unit, and that in which the current for each coach is furnished by a separate unit, independent of the others.

The first-mentioned system possesses several undesirable features. It adds another engine to the care of the engineer, and also demands space where

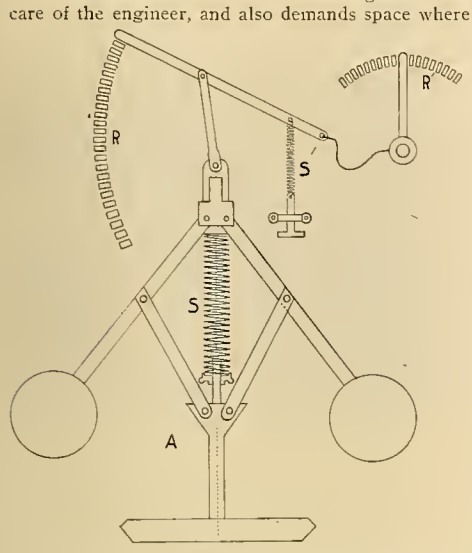


FIG. 1. ELECTRIC PASSENGER-COACH LIGHTING.—VOLTAGE REGULATOR.

there is already little room to spare. Conductors for the current must run the entire length of the train and there would always be danger of reversing the connections when the car was turned with its other end toward the engine. This would make no difference, however, were it not for the fact that storage batteries must be used, as there are often times when light is needed in the coaches while the engine is disconnected. This trouble could be done away with by using an automatic current reverser, but it introduces undesirable complications. The load would also be extremely variable. Added to this is the fact that the locomotive and the coaches, each of which must be fitted with special apparatus, are manufactured by different concerns, and co-

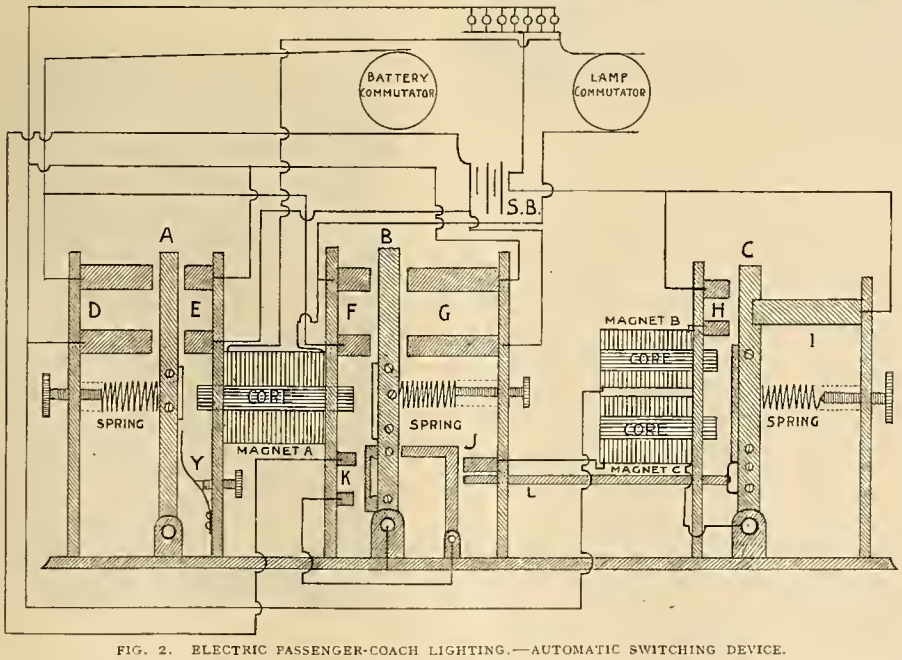


FIG. 2. ELECTRIC PASSENGER-COACH LIGHTING.—AUTOMATIC SWITCHING DEVICE.

operation would be necessary to introduce the system. As opposed to this, the axle-driven system is self-contained and complete in itself, and all of the apparatus is installed in a structure built by one company. In the first system it would be necessary for every engine which hauls passenger cars to have a generating unit installed, in order to get the full benefits of the electric system. With the independent-unit system, however, it matters not what draws the car or what position the car occupies in the train, it being only necessary that the car receive motion.

The special conditions to be met with in this independent-unit system are as follows: The generator must supply constant voltage under great variations of speed. Current must still be supplied to the lamps at normal voltage, when the speed of the train has become so slow as no longer to keep up the dynamo voltage, and also when the train stops; this necessitates the use of storage batteries, and consequently the charging current must always flow in the same direction. The dynamo must generate current regardless of the direction in which its armature rotates. In a successful commercial system it is absolutely essential that all of the foregoing operations be accomplished automatically.

To meet these requirements I have designed the following arrangement of apparatus, which may be of interest to the reader: Fig. 1 represents the voltage regulator, in which a rheostat (R) is actuated by a centrifugal governor (A). This latter device is geared to the main shaft of the dynamo by a reducing gear, and is so designed that at the highest ordinary speeds of the train the balls will still have a slight distance to raise. Sufficient resistance is placed in the rheostat (R) to keep the dynamo voltage normal if it is inserted in series with the field windings while the dynamo is running at its highest ordinary speed. This resistance is so divided among the steps of the rheostat as to produce as little variation in voltage as possible in passing from one speed to another. The rheostat (R') is an auxiliary rheostat used as a regulator when the car is changed to a line over which extraordinarily high or low-speed trains are run. The governor spring (S) is so adjusted that the balls cannot raise until the dynamo has reached a speed high enough to produce normal voltage, this speed being determined by the adjustment of the auxiliary rheostat (R').

The dynamo used with this system has two windings on the armature, one for the storage batteries and the other for the lamps direct. It must be large enough to generate sufficient current and voltage with the fields carrying a high density of magnetism and the armature revolving at a slow rate of speed, and also when the fields are carrying a low density of magnetism and the armature is revolving at a high speed. The dynamo is so large, compared to its output, that the heating has little effect on the voltage.

Fig. 2 represents the switching device that is made necessary by the use of the storage battery. The terminals of the dynamo windings are represented by the rings marked "battery commutator" and "lamp commutator," respectively. The high-resistance magnet (a) is bridged across the circuit of the lamp commutator, and as long as the voltage is normal it holds the switch knife (B) on the contacts (F) by its attraction for the iron armature attached to the switch knife (B). While the switch knife is in this position, the lamps are in circuit with the lamp commutator. The lamps are in circuit with the switch contacts (D) when the knife (A) is closed on that side. Now, when the voltage of the dynamo drops, the magnetism in (a) decreases and its pull upon (B) is overcome by the force of the spring attached to (B). Thus the circuit through the contacts (F) is broken, and that through the storage battery, lamps and contacts (G) is established. When the voltage again rises the magnet overcomes the spring and the lamps are switched from the storage battery back to the dynamo.

We will now turn to the charging of the storage batteries. The charging circuit is in series with the battery commutator, the batteries, the contact points (H), the series magnet (b) and the contact points (D). The switch (C) is designed to prevent the batteries from receiving an overcharge. The counter electromotive force of the batteries rises as the charge increases. When they are fully charged the charging current will have fallen off several amperes if maintained at the same voltage. This allows the spring connected to (C) to break the contact at (H), thus opening the charging circuit. The magnet (b) being in series with the charging circuit could not of itself again close the circuit, hence use is made of the auxiliary magnet (c) below magnet (b). This is bridged across the storage-battery circuit in series with the switch contacts (I) at switch (C), (J) on the right of switch (B) and (K) on the left of switch (B). When the switch (C) closes the contacts (H) the switch (J) is forced open by the rod (L) if it is not already open. The contacts (I) and (J) are so arranged that they are not broken until just after the contacts (H) have been closed.

When the charging current becomes so weak as to release the switch (C), the contact (I) is closed, and if the lamps are run by the dynamo the contacts (K) will also be closed, leaving only the contact (J) to be closed to complete the auxiliary magnet circuit. But, as the batteries are charged, it will be unnecessary to complete the charging circuit until they have been used. As soon as the lamps are thrown on to the battery by the switch (B), however, the switch (J) is closed by the knife pressing against the arm of (J). Now the contacts (K) are open, but when the lamps are again switched back on the dynamo the contacts (K) are closed and the auxiliary circuit completed, which, through the auxiliary magnet, again closes the charging circuit.

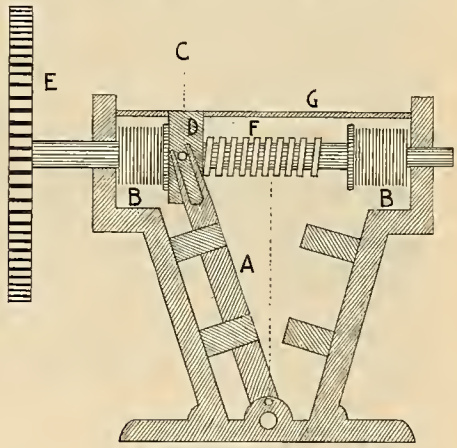


FIG. 3. ELECTRIC PASSENGER COACH LIGHTING — CURRENT REVERSER.

In so doing it opens the switch (J) by means of the bar (L).

A switching device is also used to protect both the batteries and the lamps against excessive voltage should the speed go beyond the control of the governor. It consists of a switch actuated by the other pole of the magnet (a), opposed by the spring attached to (A). When the voltage goes beyond the limit, both the charging and the dynamo-lighting circuits are broken and the lamps are thrown on to the batteries through the contacts (E). As soon as the dynamo circuits are broken the voltage rises still higher. The spring (Y) is designed to compensate for the extra attraction of the magnet, due to this rise in voltage.

All of the contacts should be carefully and accurately made, pliable and free from excessive friction. It is well known that the attractive force of a magnet increases as the distance between it and the object attracted becomes less. The opposing springs are so designed that their tension increases on being stretched out in the same ratio as the attractive force of the magnet increases. In this way the device is well balanced and is regulated as accurately as may be necessary by the variations in the current.

Fig. 3 represents the last special device. Its purpose is to reverse the shunt-field winding when the direction of the motion of the car is reversed. It is well known that after a dynamo has been run in one direction it will not build up when the direction of rotation is reversed, unless the field

connections are also reversed. When the motion of the car is reversed the main current changes its direction. So the wires leading to the storage battery are also wired to the current reverser. This apparatus is not shown in Fig. 2. The reverser consists of a double-pole, double-throw switch, actuated by the threaded mechanism shown in Fig. 3. The slot in the switch arm (A) is engaged by the pin (C) in the block (D), whose threads match (F). The springs (B) (B) keep the block (D) firmly against the threads (F), ready to catch as soon as the motion is reversed. When the motion is reversed, the block moves to the other end of the threads, carrying with it the switch knife (A), thus reversing the current. (E) is geared by suitable reducing gear to the moving parts.

General Electric Company's Expansion in Canada.

[From the Canadian correspondent of the Western Electrician.]

The deal between the Canadian General Electric company of Toronto, Ont., and the Royal Electric company of Montreal, Que., has been fully consummated, and from it the latter company will get upward of $1,000,000 as the result of its disposal of its manufacturing plant. This deal means the establishment of a gigantic electrical manufacturing trust in Canada with a capital of $60,000,000 at its back. The General Electric company acquires the manufacturing establishment only, and the plant and real estate in connection therewith, formerly the property of the Royal company, and will in future carry on the manufacturing business formerly done by the Royal, while the latter company will confine itself to supplying light and power on an extensive by the Royal, while the latter company will confine large expenditures for improvements, and, among other things, will begin putting its wires underground at the opening of spring. It is estimated that three seasons will be required to complete this important work of transformation, the cost of which will probably exceed $1,000,000. In connection with this deal, also, the union of all the lighting companies in the city of Montreal is contemplated, the first move of which will probably be the association of the Montreal Gas and the Royal Electric companies.

Tests of Illumination at Pan-American Exposition.

An elaborate display of electric-lighting effects has been designed for the grounds of the Pan-American Exposition, to be held at Buffalo next year. The many buildings are to be outlined and made brilliant with incandescent lamps and on December 7th the first trial of the lighting scheme was made in the presence of the board of architects and other officials. The trial is said to have been a pronounced success, the many colors upon the tall towers of the Machinery and Transportation building, where the trials were made, showing to excellent advantage. On the evening of the 8th another trial was made with even greater satisfaction to the exposition officials. These trials of the lighting effects mark an important period in the building of the exposition.

The city of Jonesboro, Ga., contemplates the erection of an electric-light plant.

Rotary Converters and Motor-generators.

By Frank C. Perkins.

Part III.

Alternating-direct Motor-generators for Arc Lighting.

One of the most practical and important uses of the motor-generator is that of supplying the necessary constant current for series arc-lighting circuits on our city streets. The most practical form, and that most extensively used, is to connect up arc-lighting machines at both ends of an alternating-current motor. At the Buffalo General Electric lighting power station a large number of these combinations have been installed and have given excellent satisfaction. A 125-light Brush arc dynamo is coupled at each end of a 200-horsepower sychronous motor. The motor operates at 500 revolutions a minute, and is supplied with an alternating current having a frequency of 25 cycles a second at a potential of 350 volts. The arc machines, each having a capacity of 125 lights, supply a constant direct current of 9.6 amperes, at a potential of from 6,000 to 7,000 volts.

While there is no question but that the rotary converter is more satisfactory for many classes of work, it is generally conceded that the motor-generator is better for supplying current for arc-lighting circuits. The reason is that special arc-lighting machines, such as the Thomson-Houston, Brush, Wood and Westinghouse types, may be operated by alternating-current motors without difficulty in many cases.

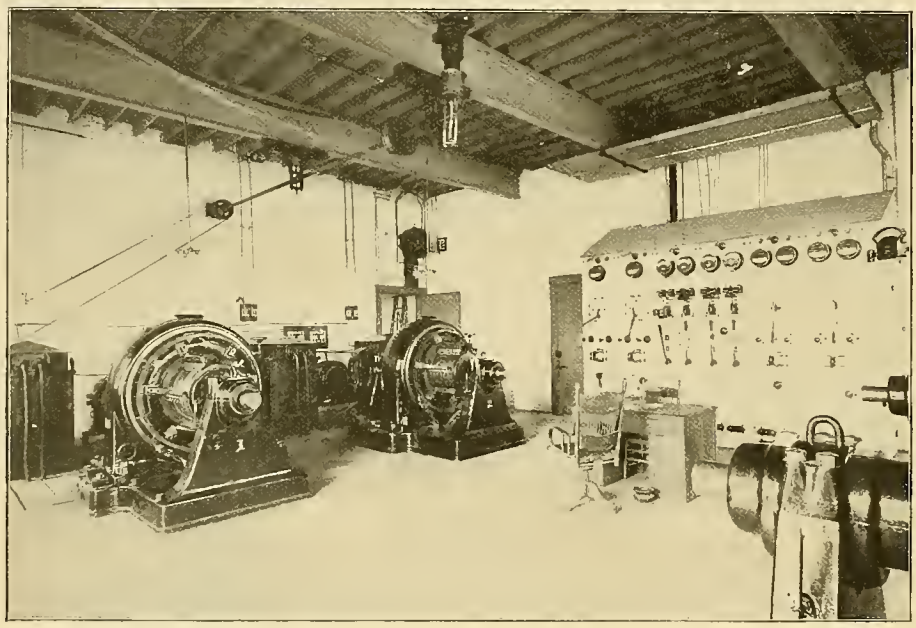


FIG. 9. ROTARY CONVERTERS AND MOTOR-GENERATORS.—ROTARY INSTALLATION AT NIAGARA ELECTRO-CHEMICAL PLANT.

From the point of efficiency, the rotary converter usually has the advantage of any motor-generator set. If the motor and generator of a large and well-supported motor-generator each has an efficiency of 95 per cent., the total efficiency of the apparatus would not exceed 90 per cent., and in smaller equipments the efficiency would run as low as 80 or 85 per cent., while a rotary converter may be constructed at even a higher efficiency than the generator alone, since the weight of the armature may be less, thus resulting in a lower hysteresis loss. Even including the loss of the static transformer used with the rotary converter, the efficiency of the combination may be higher than that of a motor-generator set.

Electrolytic Rotaries.

The electrolytic rotary converter is supplied with alternating current or direct current of the available potential at the receiving terminals and delivers a direct current of the necessary potential for use in electrolytic work. The mechanical design of this rotary generator is usually similar to that of a direct-current generator. The field poles are laminated and held in a cast-iron circular frame. The armature is frequently ironclad, and the core is built up of thin steel plates of the best magnetic quality. Copper of the highest conductivity is required for the winding. The commutator and winding are similar to those of a direct-current generator, but the shaft carries in addition to the commutator a number of collector rings similar to those used in a polyphase alternating-current generator, if the transformation is made from a polyphase alternating power-transmission circuit. Alternating current is supplied to the collector rings and the machine runs as a synchronous polyphase motor. Direct current is then taken from the commutator, precisely as it is collected from the commutator of an ordinary direct-current generator. Fig. 7 shows the armature winding for a 500-kilowatt Westinghouse rotary converter, with the rotor of an induction starting motor on the end of the shaft.

There is a definite relation in any rotary converter between the alternating-current potential applied at the collector rings and the direct-current potential delivered at the commutator. This depends upon the number of phases and upon the wave form of the electromotive force, which in turn is determined

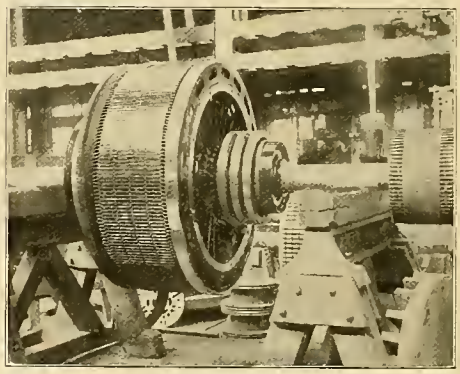


FIG. 7. ROTARY CONVERTERS AND MOTOR-GENERATORS.—ARMATURE FOR 500-KILOWATT ROTARY AND STARTING MOTOR.

by the shape of the pole-pieces, but, in general, the direct-current potential is about 40 per cent. higher than that of the alternating current in two-phase, and about 60 per cent. higher in three-phase rotary converters. The direct-current voltage required for electrolytic purposes varies according to the nature of work in each case, but it is always comparatively low.

In plants for the transmission and distribution of power the potential of the alternating current in the transmitting or distributing circuits is usually much higher than that required at the collector rings of the rotary converter. It is therefore necessary to use step-down transformers, which receive the current from the transmission line and reduce the alternating-current potential to the value which will produce the required direct-current potential at the commutator. The step-down transformers can be readily arranged for delivering a variable voltage. A number of terminals may be provided, to any one

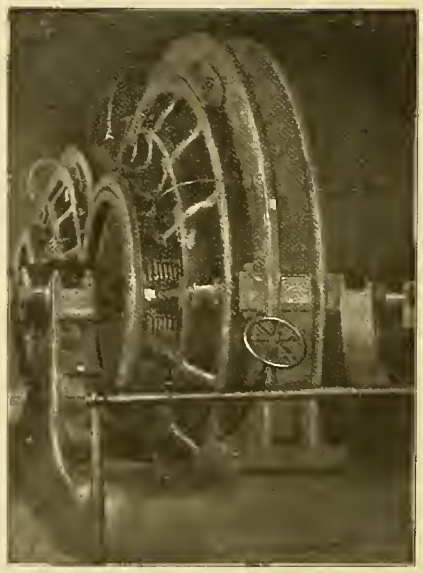


FIG. 8. ROTARY CONVERTERS AND MOTOR-GENERATORS.—600-KILOWATT ROTARY AT PITTSBURG REDUCTION WORKS.

of which the rotary converters may be connected. When it is desired to make changes in the electromotive force while the rotary is in operation, a regulator is provided by which the change from terminals can be readily made, thus enabling the alternating voltage supplied to, and consequently the direct-current voltage delivered by, the rotary converter to be varied at will.

A rotary converter runs at a perfectly definite speed as a synchronous motor. A machine which

is designed for giving the best conditions under normal operation has very poor starting conditions, i. e., a very heavy current is required to start itself. To avoid this heavy current it is the practice of the Westinghouse Electric and Manufacturing company to start the rotary by means of a small induction motor, which requires a comparatively small current.

One of the most interesting installations of rotary converters in the country is that in the works of the Pittsburg Reduction company at Niagara Falls. Each of the five rotaries in this plant (one of which is shown in Fig. 8) is designed to deliver 600 kilowatts at 160 volts direct current. They are driven by a two-phase alternating current, received from the Niagara Falls Power company at 2,200 volts and reduced by step-down transformers to 115 volts.

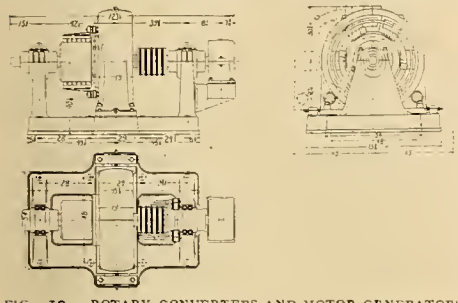


FIG. 10. ROTARY CONVERTERS AND MOTOR-GENERATORS. —175-KILOWATT ROTARY CONVERTER.

These machines have 16 poles and are operated at a speed of 188 revolutions a minute. Their commutators are of very large size, 3,750 amperes being delivered from each machine through carbon brushes. The General Electric company, which built these rotaries, adopted a method of construction by which the commutator is kept cool by ventilation in the following manner: Through the commutator spider air is drawn, and, after passing over an extended surface inside the commutator, it passes out between the laminations of the armature and around the leads from the windings to the commutator. The direct current supplied by these rotaries at 160 volts is used in the manufacture of aluminum by the Hall process.

Niagara Falls furnishes other interesting electrolytic plants, and in all of them the alternating current received from the Niagara Falls Power company's plant is utilized, being stepped down in potential by transformers and converted to direct current by rotary converters. At the plant of the Niagara Electro-chemical company there are four 175-kilowatt rotaries. Two of these machines, the switchboard and the shaft ends of the other two units are shown in Fig. 9. These rotaries operate at 500 revolutions a minute and are supplied by a two-phase current of 3,000 alternations a minute, the transformers receiving their current at 2,200 volts from the distributing circuits of the Niagara Falls Power company. The direct current is used for reducing the metallic sodium from caustic soda and sodium peroxide by the Castner process. The

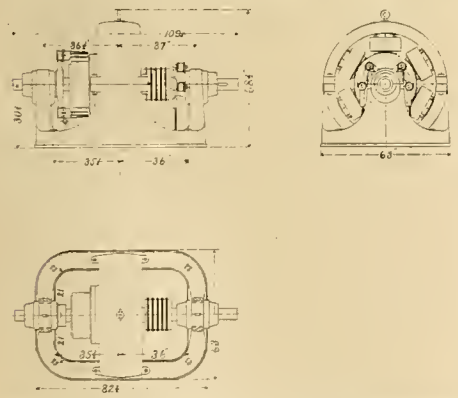


FIG. 12. ROTARY CONVERTERS AND MOTOR-GENERATORS. —126-KILOWATT ROTARY CONVERTER.

direct-current output of each machine is 1,050 amperes at a potential varying from 125 volts to 165 volts.

This variation is obtained by varying the alternating current from 100 to 130 volts. This is accomplished by changing the ratio of the primary and secondary turns in the lowering transformers by means of a special regulating apparatus. The Westinghouse rotary-converter field casting is divided vertically and set upon ways on the bed plate, which is a separate casting. The two sides of the field can be moved away from the armature in a horizontal direction by means of a ratchet, provided for this purpose. This operation is indicated in the end elevation of the outline drawing of one of these machines, shown in Fig. 10. The direct-current brush holders are carried by brackets projecting from a ring concentric with and supported by the field. By means of a hand wheel and worm gear all the brushes may be simultaneously adjusted.

At the Mathieson Alkali Works there are in operation 11 126-kilowatt rotary converters, for use in electrolytic work. A view of these machines is given in Fig. 11. The rotaries operate at 500 revolutions a minute and transform two-phase current from the Niagara Falls Power company's circuits into direct current. The Mathieson Alkali Works manufacture caustic soda, bleaching powder and other chemicals by the Castner electrolytic process. The potential at which the direct current is delivered from the rotaries can be varied from 180 to 230 volts by regulating the potential of the alternating current supplied to the machines. The rotaries are supplied with small pulleys and are started by means of a Tesla polyphase motor mounted upon a portable truck. The transformer and converter room is 125 feet long and 40 feet wide and adjoins the cell room on the north side. Through the rotary converters about 2,000 horsepower is usually converted from 2,200 volts alternating current at a frequency of 25 cycles a second, after being transformed down to 120 volts, to a direct current of about 200 volts. An outline drawing of one of these rotaries is given in Fig. 12. It is necessary to keep the voltage proportional to the number of electrolytic cells in use, and the controllers for this purpose are mounted on switchboards extending the whole length of the

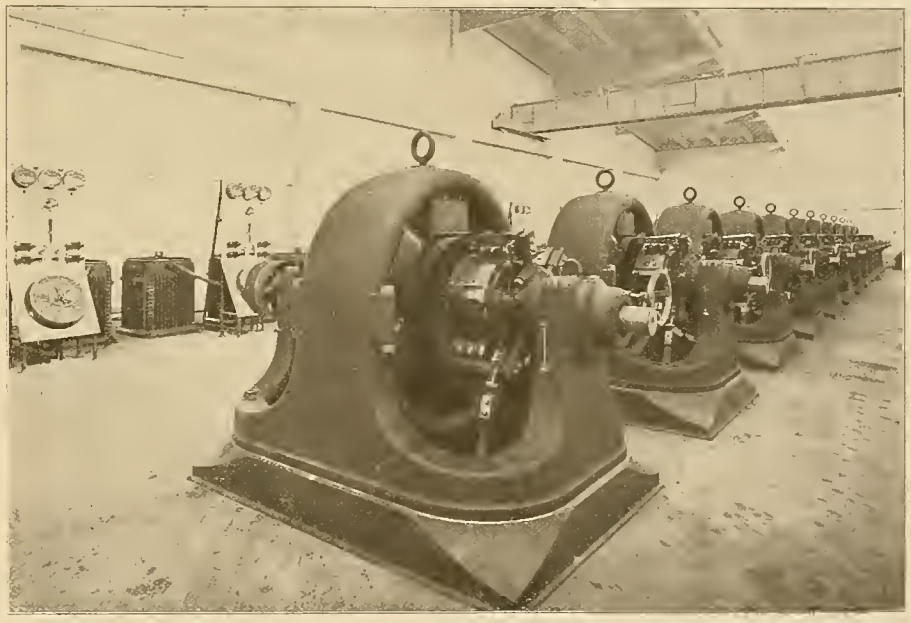


FIG. 11. ROTARY CONVERTERS AND MOTOR-GENERATORS.—ROTARIES AT MATHIESON ALKALI WORKS.

room, in a row between the rotaries and the static transformers. On these switchboards are also mounted the instruments, field rheostats, main primary switches and fuse boxes.

The output of a rotary converter is greater for the same weight than a direct-current generator, particularly if it is operated by a polyphase alternating current. A monophase rotary converter will not give as large an output for the same weight as a polyphase converter. The armature reaction is very slight in the latter, as the reactions in the armature resulting from the alternating and direct currents are equal and opposite. In the monophase converter this is also true to a certain extent, but there exists in addition a turning flux, or a frequency double that of the potentials at the brushes. Good commutation is also more easily obtained in a rotary converter than in a direct-current generator, while the same overload and sparking limits can be considered as in a direct-current generator. If the frequency of the supply system to which the rotary is connected is variable, the speed of the converter will likewise vary. The variations occur rapidly in a supply circuit, and the rotary-converter armature is not able to follow them, causing a pulsation in the speed of the armature called "hunting." It is essential that the generator speed be uniform.

[*To be concluded.*]

The Western Reserve Trust company of Cleveland, Ohio, has bought the Elgin City, Carpentersville and Aurora electric railway for $550,000. The road was capitalized for $500,000. The new owners will take possession January 1st, and will improve and extend the system.

Electric Motors in Foreign Shipbuilding Plants.

In a paper entitled "Notes of Recent Improvements in Foreign Shipbuilding Plants" read before the recent meeting of the Society of Naval Architects and Marine Engineers in New York by Assistant Naval Constructor H. G. Gillmor, the author makes the following reference to the use of electric motors:

"While the gas engine serves very well for many purposes about the shipyard, it is not adapted to the direct driving of the several heavy machines, subject to more or less intermittent working, which have so prominent a place in a shipbuilding plant. In connection, then, with the changes in which the steam engine is supplanted by the gas engine for some purposes it is not surprising to find its place for other purposes being taken by the electric motor. In the general industrial applications of electricity we are in this country well in advance of the old world; but in its application as a medium for the transmission and distribution of power in a shipyard a great deal is being done abroad. Central electrical power stations have been established in or are projected for many, both of the larger and more important yards and of those less prominent in the industry. Dynamos of various types and manufacture are employed, though, so far as observed, they were direct-current machines, working at about 110 volts. They supply current for both light and power and are driven both by steam and by gas engines, though steam-engine driving is at present the more general.

"There are numerous examples of electric motors having taken the place of steam engines for driving all the heavy and fairly widely separated tools of the plating shops. In many cases motor driving has been satisfactorily applied to machines not originally intended to be so driven. The employment of electricity to this purpose seems to have given entire satisfaction, and there are many yards in which, after trial in a small way, they are extending its application as rapidly as circumstances permit, with the intention of ultimately applying it to all the heavy machines of what may be called the shipbuilder's side of the yard. The motors have shown themselves capable of working continuously or intermittently for long periods with at any rate not more attention than is generally required for steam engines employed for the same purposes, and provided with no other protection from the weather and the dust than a light wooden box or house with end panels of finely perforated tin or iron gauze. It may also be mentioned that it has been found practicable to place the care and management of the wiring and motors in the hands of men, in some cases apprentices just out of their time, whose wages certainly would not entitle them to be designated highly paid specialists."

New Central Power Station at Seattle.

The Seattle Electric company of Seattle, Wash., plans to build a central power station at a cost of $750,000 to $1,000,000. The power station will rest on a pile foundation of 3,000 piles, surmounted by eight feet of solid concrete. The station will be built of steel, brick and stone. There will be 1,000 tons of steel used in the framing and columns. The boilers will be located on the third story of the building and will be fed with coal by automatic stokers. There will be two large McIntosh & Seymour engines of 4,000 horsepower each. They will be direct-connected with alternating-current electric generators, each having a total capacity in electric power of 2,300 kilowatts. There will be a large steel traveling crane operated by electricity.

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Before the next issue of the Western Electrician is in the hands of its readers the last Christmas of the century will have been celebrated. We trust that the great holiday of this closing year will bring to each reader of this journal more of peace and good will than any of its predecessors, and that all may join in cheerful earnestness in the heartfelt toast of Tiny Tim.

The next number of the Western Electrician will be the last of the year, and will be issued with the index for the half-yearly volume. The succeeding issue will be the Twentieth Century Souvenir Number, and extensive preparation is making to the end that it may be really worthy of the important turning point which it signalizes.

Even electric-light companies, exemplary corporations as they usually are, sometimes fall out, but it is generally due to competition in the same city, and seldom involves a state boundary, as is the case in an interesting and probably unprecedented case in New England. This contest arises over the right to sell electric light and power in the town of Tiverton, R. I., and is likely to result in litigation between the Fall River Electric Light company, a Massachusetts corporation, and the Tiverton Electric Light company of Tiverton, R. I., a Rhode Island organization. The Tiverton company was granted a charter recently by the town, giving it the exclusive right in that place to sell light and electric power. The Fall River company has been serving the residents of North Tiverton with electricity for some time, and the Tiverton corporation has lodged a protest against such action. Injunction proceedings are promised if the Fall River company persists, and as the charters of two states are likely to be called into question and some important law points involved, the United States courts will probably be called upon to take up the questions at issue.

Independent telephony appears to make as slow progress in New York as in Chicago. What is the trouble? Are there influences at work to make a bluff at competition merely to keep the people quiet? The New York Vigilant, the organ of the Parkhurst society in the warfare against Tammany in that city, appears to take this view of the case in a recent article on telephone subways. The New York Telephone company, the writer says, pays nothing for the valuable franchise of carrying wires under the streets. Testimony taken before the Mazet investigating committee tending to show that the telephone company and the subway company were one concern is reproduced, and the article relates that it was not until after the inquiry had begun that Darwin R. James of the People's Telephone company was able to get a permit to use the subway from Commissioner Kearny. Afterward it appeared that on the day before this permit was issued the Knickerbocker Telephone company, "controlled by Mr. Whitney and his associates," got a permit to the same effect. The writer then asks of Mr. James and his associates: "Is it not a fact that as soon as you were in position to do business you found yourselves confronted, not only with the old telephone company, but with new companies (at least on new paper)? Did not interested persons endeavor to secure control of your company? Did you not beat them off for a time? Did you not finally realize that it was a losing battle? Have you not recently surrendered your People's Telephone company to one of its newly formed rivals, and has not the opposition to the New York Telephone company's expensive monopoly thus been entirely destroyed?"

This charge is indirectly put, and it is not explained how Mr. James and his associates were brought to realize that they were fighting a "losing battle" after having secured permission to use the subways; but it is certain that the telephone situation, both in New York and Chicago, is unsatisfactory from a competitive viewpoint.

A telephone lineman is not indispensable to every household, perhaps; but when a burglar is shut up in a closet near the telephone it is certainly very convenient to have someone who can cut in on the circuit and give the alarm without frightening the burglar to desperation. This curious combination of circumstances actually befell in New York a few days ago, if the newspapers of that town are to be relied upon. A servant discovered a strange man in a closet, and, wielding her broom in an apparently unconcerned manner while cleaning the room, succeeded in closing the door without arousing the suspicions of the intruder. But the telephone was near the closet door and the girl could not summon assistance by its aid without apprising the burglar. It happened that some telephone linemen were in the yard making repairs on a wire that runs to another house on the block. The servant saw them from the window, and knew what they were there for. She went downstairs, told her story to the linemen and asked for suggestions. The men promptly broke a wire, attached a testing instrument and called up a downtown exchange. Then they got the man of the house on the other end of the wire and that surprised individual summoned the police, who captured the still unsuspecting marauder in due form. Such an unusual chain of events would be deemed highly improbable in a novel, but the combination of a plucky and quick-witted servant girl and equally intelligent telephone linemen seems to be irresistible.

The electric-railway situation in Connecticut is of peculiar interest. Owing to conditions that, while they are not confined to Connecticut, have grown out of the great expansion of the electric-railway business to a peculiar degree in that state, the crop of petitions to the Legislature this year will be extraordinary. Nearly every company in the state will have some request to make. There is the possibility of a hard contest between the rival interests in the steam and electric roads of the state. There are at present three sets of contestants for public patronage in the light railways of Connecticut. Of these the locally controlled trolley roads form one class. In a second division is the electrical department of the Consolidated road. The third class is the group of trolley and electric-lighting companies that is owned or controlled by the United Gas Improvement company of Philadelphia and New York. The relations of the steam and electric railways throughout the whole extent of lower New England are complicated, as shown by a recent article by George E. Walsh in the Western Electrician, but Connecticut seems to be the storm center just at present.

Reference was made in this journal a month ago to a suit for damages brought against a New York central-station company by a woman who complained of the noise, smoke and vibration of an adjacent power house. In that case the Appellate Court cut down a substantial verdict for the plaintiff to six cents on purely legal grounds. In a more recent case of the same general nature, in which a perpetual restraining order was asked, Justice Ingraham of the Appellate Division of the Supreme Court of New York refused to grant the injunction desired and pointed out the necessity of electric-light plants and other establishments of like nature. The defendant in this case was the Mount Morris Electric Light company, and the station complained of is at Vandam and Greenwich streets, New York city. It appears that during the last 10 years the neighborhood has changed from one of a residential character to one devoted to manufacturing and business purposes. "Existing modern conditions," says the court, "require the use of steam or other power in conducting the affairs and transacting the business of large cities. In the natural order of things, certain portions of the city are devoted to manufacturing purposes, where machinery is used. For courts of equity to enjoin the use of machinery in such portions of the city, on the complaint of a property owner, who has not seen fit to use his property as the other property in the locality or neighborhood is used, would result in banishing from the city the establishments which are essential to its welfare, the comfort of its inhabitants and the transaction of its business. * * * The furnishing of electricity for lighting and power is recognized as essential for the public welfare and convenience, and if the defendant is enjoined by the court, it does not appear that there is any other situation in the city to which its plant could be removed. If a property owner can obtain an injunction restraining persons using machinery upon property in a locality like that described in this action, all business requiring the use of such machinery would be banished from the city of New York, the production of electricity prevented, and the streets of the city left unlighted." This language is comforting to the downtown central-station man; but the fact remains that the modern tendency to erect large generating plants at points comparatively remote from crowded centers of population is the right one and should be encouraged.

Commercial Automobile Vehicles.

By George E. Walsh.

The automobile industry in the East is just entering on a career that will establish an unprecedented revolution in one phase of transportation. When the new automobile companies were organized two years ago in such numbers that it looked as if the industry bid fair to outdistance nearly all other manufacturing branches in the amount of invested capital, they were formed for the most part without a thorough comprehension of the trade conditions. The automobile had not then reached the stage of perfection where capital was justified in seeking investment to the extent of tens of millions of dollars. The automobile for pleasure had hardly passed out of the experimental era, and the commercial automobile was far from being completed.

The two years of practical demonstration of the value of the motor vehicles for pleasure and business purposes have considerably clarified the atmosphere, and the automobile business was never on a firmer and more practical basis than at present. The automobile shows and exhibitions held in the leading cities of the country are only straws indicating the nature of the trade. In the East there have been radical changes in the last six months, which will illustrate the meaning of the future developments of the trade.

There is first the remarkable demand and manufacture of the motor trucks and vehicles for carrying purposes. The success of these have only recently been demonstrated. At nearly all the former exhibitions it has been the pleasure vehicle that has attracted attention, but now the commercial automobile is pre-eminently the vehicle of the day. It is in this field that the automobile must make its mark if it is to succeed at all. If a good commercial type of motor truck cannot be built, fully one-half the investments now put in companies manufacturing automobiles must fail to earn interest. But there is no question about the success of the light and heavy motor trucks and wagons. In New York city a score of light delivery wagons are constantly employed in delivering articles for the department stores, while fully as many more are owned and operated by other retail concerns, such as shoe, clothing and drug firms. These light delivery wagons have already saved their owners a fair amount over the old expense of operating stables full of horses. In the holiday trade the large department stores are rushed so with their deliveries that it has been the custom to employ all extra express wagons they could find during the month of December. There are 10 new automobile delivery wagons which will be put into service in time for the holiday trade, and it is the opinion of the leading department-store managers that these horseless delivery wagons will facilitate the delivery of Christmas goods so that few extra wagons will have to be employed.

Even more important than these light delivery wagons for the retail stores are the heavy motor trucks which have been ordered by the same large stores for handling heavier goods. Altman & Co., one of the first dry-goods dealers to use the electric wagon, have a type of the new motor trucks in use now for transferring goods from downtown to the uptown districts. This truck is 14 feet long, weighs three tons, and has a battery capacity of upward of 20 miles on one charge. Duplicates of this truck have been ordered by several other stores, and Wanamaker operates one nearly as large for the same purpose. One such truck can carry a load equal to that of several team loads in much less time and at less cost.

The appearance of these heavy trucks in the dry-goods district promises soon to revolutionize the whole business in the downtown region. But it is not alone in the city proper that these big trucks and light delivery wagons are used. One express company makes its deliveries and collections in the suburbs by an electric vehicle which covers nearly 70 miles a day regularly. This one motor wagon does the work of two of the old wagons, and it has been found to pay for the cost of the investment within the first year.

What applies to New York city and vicinity is just as applicable to most of the large eastern cities and country districts where the roads are good. The successful use of the automobile and motor truck presupposes good roads, and this question is receiving more attention than ever before as a result. It is now being realized that the general adoption of the electric-motor trucks and vehicles in the country will save thousands of dollars in road taxes. The lessened wear on the macadamized roads of the country and the asphalt roads of the towns and cities has been appreciated by the taxpayers, and recent town meetings in New England have been signalized by resolutions recommending the more general use of motor trucks where the heavy traffic makes the cost of road repair heavy and burdensome. It looks very much from the general interest that the taxpayers of town and country are taking in the question that the demand for motor trucks and automobiles will increase at an unprecedented rate.

With the companies on a sound basis, and practical working machines in general use to demonstrate their fitness for certain lines of work, the automobile industry in the East will begin the new century with an outlook of the most favorable kind. Competent authorities estimate that from $10,000,000 to $20,000,000 will be spent a year for automobiles and motor trucks from now on. Last year not far from $3,000,000 was spent in purchasing automobiles, and the present year will probably double that amount. Beginning with the first of the year it is believed that the amount will steadily increase for the next five years, bringing up the total for the five years to something like $100,000,000. Such an amount would never be spent for the pleasure vehicles alone. It would be inconceivable that even $3,000,000 a year would be put in purely pleasure vehicles, and for this remarkable increase in the expenditures we must look to the business world.

The business or commercial types of electric vehicles are of two distinct classes. The heavy trucks have become popular only after the light ones demonstrated their fitness and value. The latter have been in use for several years, but the heavy trucks are the outgrowth of the present season's experiments and practical demonstrations. The heavy cost of the latter class of machines has made many houses slow in adopting them. In fact, American manufacturers of automobiles have had to create a demand for their vehicles from the first, while in Europe there was a market for them several years ago. For this reason Europeans have largely set the fashion in automobile shows, experiments and types. With a legitimate boom once started in this country, there is a fair chance for this country to excel all others in the number and variety of motor trucks and pleasure automobiles sold.

One of the eastern steam roads has recently placed an order for six heavy motor trucks to be used in rural districts along the line of competing trolleys to collect freight, express matter and the mails. It is believed that these trucks will furnish the connecting link between the steam roads and the small rural hamlets to make rapid delivery of mail and other packages a reality. One of the difficulties of the steam roads has been met in this way. If the new experiment proves successful other roads will quickly follow suit, and the demand for the trucks will receive a new impulse. Several short stage lines for carrying passengers between important points have already been equipped with large passenger automobiles, to the great comfort and pleasure of the traveling public as well as to the profit of the operating companies.

Franchise of Denver Company Attacked.

An attack has been made on the franchise under which the Lacombe Electric company is installing an electric-light plant in the city of Denver. The franchise provides that at the end of 10 years the city shall acquire possession of the arc plant, a certain amount being paid to the company each year. The company has been proceeding rapidly with the installation since the franchise was granted last spring. The poles have been set throughout the city and work on the power station is well under way. It has been predicted that the company would meet with bitter opposition and a rate war has been threatened by the Denver Gas and Electric company.

The present attack on the company's franchise is brought by a resident of Denver, who sues as a taxpayer. It does not appear what interest, if any, has inspired the suit, of which the title is "The People of the State of Colorado on the Relation of Lillie C. Ames against Charles F. Lacombe, the Lacombe Electric company and the City Construction company." The original franchise was granted to Mr. Lacombe and assigns, and was taken over by the Lacombe Electric company. The construction work was undertaken by the City Construction company, a corporation organized for this purpose by members of the Lacombe Electric company. The bill of complaint sets out that for eight months the defendants have been erecting poles, stringing wires and introducing apparatus for conveying electricity "without right, privilege or authority." It states that the law provides that no such franchise shall be exercised without the consent of the proper authorities and prescribes the means by which such consent shall be obtained. The plaintiff holds that the franchise is illegal because it was not advertised, as the law provides, and that certain changes made in the original ordinance were never advertised or referred back from the Board of Supervisors, where they originated, to the Board of Aldermen. The complaint asks that the defendants be ousted from the exercise of the franchise. A bitter fight is predicted in the litigation.

BOOK TABLE.

The Progress of Invention in the Nineteenth Century. By Edward W. Byrn. New York: Munn & Co. 1900. Pp., x., 474, 6½ by 9½ inches, with 306 illustrations. Price, $3.

It is highly probable that the thirty-first day of this month and the first day of next month will not differ very much from typical December and January days of many years. But as man, with his 10 digits, counts easily in tens and hundreds, it has come to pass that we note the passage of the years in decades, centuries and millenniums. At the end of 10 years we change the date lines on our office stationery and take a census; after 10 decades we squabble about the exact date of the century ending and do a prodigious amount of reviewing and self-congratulation; at the completion of a millenium—but that is a large subject, and it may best be left to the great-grandchildren of the present reader and the present writer as they scan the pages of the Western Electrician of the closing days of the year 2,000. What will those pages be like? To what activities and beneficences will our successors of a hundred years hence devote themselves? No attempt can be made to answer these questions, of course, that is not pure speculation. It is a sobering reflection that the mysterious and impenetrable, yet inevitably magnificent and glorious, Future casts on the Present. It makes it evident that, after all, a review of what has been done in the conveniently computed period of 100 years is worth while as an earnest of the future accomplishment of the human race.

In the flood of "nineteenth century" literature that is now beginning, Mr. Byrn's book occupies an important and useful place. It is a worthy attempt to present a birdseye view of the material, or, more specifically, the mechanical, progress of the world since the year 1800—a period unique in invention, seemingly "a grand climax of discovery rather than an increment of growth," to use the words of the author. The writer of the book set for himself an ambitious task, but his work has been well executed on the lines of the popular volume which he undertook to make. Certainly, the more important electrical inventions have not been neglected. Of the 32 descriptive chapters, eight are devoted to subjects exclusively electrical, and in three others electro-chemistry, electric automobiles and the electrolytic reduction of metals are considered. In the "Chronology of Leading Inventions of the Nineteenth Century" the first entry in 1800 (which was in the eighteenth century, by the way) is Volta's battery, while the next to the last entry, for 1899, relates to wireless telegraphy. In general, electrical inventions are well covered, although there seems to be no specific allusion to electric heating and cooking, the telautograph and the electrical transmission of pictures. Besides the introductory matter and the chronology referred to, the general plan of the book provides for a chapter for each group of inventions, as "The Electric Telegraph," "The Steam Engine," "Chemistry" and the like. The whole field of invention is surveyed, but, necessarily, the descriptions are brief and sketchy. An index is included in the volume and is the more valuable as no page references are given in the table of contents. The book is well printed on paper of good quality, and although the numerous illustrations vary in excellence, most of them are good.

The Management of Dynamos. By G. W. Lummis-Paterson. London: Crosby Lockwood & Son. New York: The Macmillan company. 1900. Second edition. Pp., x., 262, with 103 diagrams and illustrations. Price, in England, 3s. 6d.

This is a second edition of an English work brought out by the author five years ago. The writer has undertaken to revise and bring the volume up to date, and while his success in the accomplishment of this object has been only partial, still he has undoubtedly increased the value of the work considerably. Before taking up the main subject suggested in the title the author considers briefly the elementary theory of the dynamo and the electric and magnetic principles affecting its construction, but only in so far as they relate to the management of the dynamo. The construction and action of the different classes of dynamos in common use are described in four chapters, while Chapters VIII. to XII. treat of regulation, coupling, operation, faults in dynamos and faults in armatures. Considerable information is given in these chapters which would be of much service to dynamo tenders and beginners in the study of electrical engineering. The various troubles and faults likely to occur in dynamo operation have been classified and described fully. The last chapter, which is a new one, deals with the construction and management of motors. Only direct-current machines are considered in the book. The illustrations, which are of fair quality, show dynamo and motor connections and different types of machines. But little modern apparatus is shown or described.

Bids will be received by the city of Litchfield, Ill., until December 31st, for supplying to the city 60 or more 2,000-candlepower open-arc lights for street lighting. Bidders are also requested to submit a proposition for the erection of an electric-light plant of 100 lights' capacity, as above, with 60 or more lights installed. H. Hall, city clerk, may be addressed.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

The Woonsocket and Wessington Springs (S. D.) telephone system, with about 50 miles of line and four stations has been sold to the Dakota Central Telephone company. The line will be extended to Letcher and Mitchell.

The Wisconsin Telephone company has completed a toll line from Holmen to Onalaska, Wis.

The Fox River Valley Telephone company contemplates building an electric railway from Appleton to Seymour, as well as carrying out the telephone projects considered. The matter will be decided at the annual meeting, to be held at Appleton, Wis., in January.

In an interview in Minneapolis Charles P. Burch, the general manager of the Postal Telegraph-cable company of New York, stated that the long-distance telephone had not appreciably affected the use of the telegraph. In fact, he thought it had an educational effect. It taught people the use of quick service, and thereby made them use the telegraph oftener, as well as the telephone.

The Johnson County mutual telephone system has completed a line from Iowa City, Iowa, to Windham. A central station has been established at Sharon Center. The company expects to have a list of 100 subscribers by spring.

Musser Bros. have their new exchange at Atlantic, Iowa, completed, ready for operation. The Iowa Telephone company has notified its patrons that it will meet the rates made by the newcomers, and a lively war is likely. Musser Bros. are constructing a toll line to Adair, where connection will be secured with Des Moines.

The Mazomanie (Wis.) Telephone company has constructed a line to Arena.

The new telephone line between Grand Rapids and Marshfield, Wis., is completed.

The telephone company at Tacoma, Wash., is about to install two new switchboards, to meet the demands of increasing business.

The Battle Creek Telephone company of Battle Creek, Iowa, has been incorporated, with $10,000 capital stock. The incorporators are W. H. James, H. J. Snover and William Warpack.

The central office of the Warren (Minn.) exchange, which was burned out, is being rebuilt.

The rumor of the sale of the Northern Minnesota Telephone company is denied by President Kerlin at Park Rapids, Minn.

The Dane County Telephone company of Madison, Wis., has a list of 1,120 subscribers. Five years ago the company started with 300 connections.

Fred E. Lister, chief inspector for the Northwestern Telephone Exchange company, Minneapolis, has invented a device for lighting pay-station booths. It consists of a two-candlepower electric lamp, which obtains its power from a battery located in the booth. It works automatically. When the user picks up the book in the booth the lamp lights. Should he not lift the book, the removal of the receiver from the hook will also light the lamp. The company will probably equip all its pay stations with these lamps. Mr. Lister has applied for patents on his invention.

The Iowa Telephone company will put its wires in the business portion of Davenport, Iowa, underground, and will erect a new central-exchange building, with other changes and improvements, at a cost of $125,000. The company plans to rebuild and improve its exchanges in other towns in the state also.

The Bell Telephone company will soon move its exchange in Ishpeming, Mich., to new quarters, where a modern switchboard will be put in use.

R.

Ohio Telephone Notes.

From the present outlook, there will be some activity in southern Ohio telephone matters within the next few months. It seems as if the United States Telephone company has been looking around in that section of the state, with a view to extending its lines, and a few days ago the Home telephone line from Gallipolis to Middleport, along the Ohio River, was purchased by the Cleveland company. It is said that it will at once begin the construction of a line up the river from Ironton to Gallipolis and from Middleport to Marietta, the line just purchased forming the connection between them. Then new lines will be built from Point Pleasant, W. Va., to Hartford, and from Point Pleasant to Charleston, thus making other valuable long-distance connections. Telephone interests have been neglected more in that part of the state than any other, and at the same time it is a valuable field to develop.

The stockholders of the Gallipolis Telephone company, Gallipolis, held their annual meeting a few days ago. The board of directors chosen consists of the following-named gentlemen: C. W. Henking, F. M. Bovie, C. F. Stockhoff, T. E. Bradbury, C. D. Kerr, W. W. Morrison and Fred J. Bollmeyer. The board chose C. W. Henking president, and F. M. Bovie, secretary and treasurer.

The Farmers' Mutual Telephone association, Mechanicsburg, Ohio, was incorporated last week, with a capital stock of $10,000, by H. C. Rogers, D. J. Burnham, E. W. Patrick, A. F. Burnham, O. B. Hinton and Charles W. Martin. The new company will build and operate a plant at Mechanicsburg and in the surrounding country.

The Harrison County Telephone company of Cadiz, Ohio, was incorporated a few days ago, with a capital stock of $25,000, to build and operate a plant in the town and in the counties of Harrison, Carroll, Jefferson, Belmont, Tuscarawas and Guernsey. The incorporators are A. J. Vernier, C. D. Juvinal, J. M. Schreiber, W. W. Wright, W. W. Potts and R. Cunningham.

Arrangements have been made to connect the Newark Telephone company with Coshocton, Frayesburg, Warsaw and other towns in Coshocton and Muskingum counties. This will add quite a little to the business of that company, since there are lines aggregating 172 miles in the two counties under one management.

The reported consolidation of the two large telephone companies of the East has caused quite a little comment in this state, as some of the companies have connections with the National Telephone and Telegraph company. This is true of the Federal of Cleveland, and through it the companies at Youngstown and some other places will be affected by a movement of this kind.

E. J. Clapp, who has for some years been the manager of the Warren and Niles Telephone company, Warren, Ohio, has resigned his position, to accept a similar place with a company at Aurora, Ill. E. G. Miller, electrician of the Warren company, will succeed Mr. Clapp as manager.

The Ravenna Home Telephone company, Ravenna, Ohio, has placed a new long-distance switchboard in its plant and a new power generator will also be installed within a short time. This will prove quite an addition to the plant.

O. M. C.

Large Independent Company in Western New York.

The Independent Union Telephone company of Buffalo, N. Y., has filed its certificate of incorporation with the secretary of state in Albany. The purpose of organization therein stated is "to own, control, maintain and operate a line or lines of electrical telephones within and beyond the limits of this (New York) state." The term of the corporate existence of the company is 1,000 years. The company is capitalized at $200,000, the stock being divided into 2,000 shares of $100 each. The states of New York, Pennsylvania and Ohio are represented among the stockholders, but the majority of the nine directors are Ohioans. The directors named are as follows: Samuel B. Rawson, Irving H. Griswold, Addison E. Lord, Frederick W. Martin, Frederick H. Sudro, James A. Duke and Theodore M. Brush, all of Elyria, Ohio; George H. Frost of Buffalo and Albert R. Smith of North Tonawanda. Each of these directors holds five shares of stock. There are other Buffalo stockholders who will be unknown for the present.

The understanding is that the new company is formed for the purpose of connecting a large number of local companies throughout the states of Ohio, Pennsylvania and New York. At present Buffalo is dependent upon the Bell Telephone company for service connections in these three states. The route the company intends to cover begins in the central part of Dunkirk, Chautauqua County, and extends through the following-named towns and cities: Silver Creek, Irving, Farnham, Angola, Derby, Lake View, Blasdell, West Seneca, Buffalo, Tonawanda, North Tonawanda, La Salle, Niagara Falls, Lockport, Medina, Albion, Holley, Brockport, Rochester, Fairport, Palmyra, Alliance, Clyde, Savannah, Weedsport, Memphis, Syracuse, Rome, Utica, Herkimer, Kittle Falls, Fonda, Amsterdam, Schenectady, Albany, Jamestown, Kennedy, Randolph, East Randolph, Salamanca, Little Valley, Olean, Ellicottville, Cattaraugus, Gowanda, Springview, Warsaw, Attica, Batavia, Akron, Lancaster, Depew, Le Roy, Perry, Charlotte, Honeoye Falls, Avon, Geneseo, Dansville, Canaseraga, Angelica, Belmont, Wellsville, Cuba, Friendship, Hornellsville, Canisteo, Addison, Corning, Bath, Penn Yan, Rushville, Geneva, Canandaigua, Clifton Springs, Newark, Williamson, Red Creek, Oswego, Pulaski, Williamstown, Camden, Canastota, Cazenovia, Clinton, Morrisville, Hamilton, Cortland, Marathon, Norwich, Bainbridge, Binghamton, Owego, Elmira, Ithaca, Watkins, Waverly, Deposit, Delhi, Cooperstown, Unadilla, Richfield Springs, Schoharie, Fort Plain, Johnstown, Ballston Spa, Saratoga Springs and Troy.

The Independent telephone movement is acquiring great force and strength in New York state, and it is evident that the people of the Empire State are soon to be greatly benefited by this active, energetic competition. In Niagara Falls the Independent telephone company has several hundred subscribers and is increasing its patronage every day. There the Independent service is said to be admirable, and the people have so long been held down by the high rates of the Bell company that they give the preference to the home company every time.

President Gompers of the American Federation of Labor is reported to have started a movement to organize the telephone operators in Chicago and get them to join the federation.

Two Telephone Men.

[From the Cleveland Leader.]

Cleveland is being made the battleground for one of the most interesting skirmishes of the great telephone war that is being waged over the country. The battle is between the Bell and the non-Bell or Independent telephone companies. Cleveland is one of the largest cities in which the rivals have come in contact with each other.

The generals on both sides of the local fight are interesting men, and, although neither of them is a Clevelander, both are well known here, for they come to this city often to watch and direct the progress of the battle. Both are men whose careers have been interesting and both are among the most prominent figures in the national telephone war of which the Cleveland skirmish is but a part.

Charles J. Glidden is older in the telephone business, having been one of its pioneers, and having been at the head of the company controlling the Bell interests in Cleveland for years before the Independent company now fighting the older one was in existence. Judge James Milton Thomas of Chillicothe, Ohio, is almost equally prominent in the Independent ranks, however, although he is a comparative newcomer in the telephone business. He took up the telephone business when the Independent companies were formed to fight the Bell interests. He is now president of the Independent Telephone association of the United States, and also general manager of the United States Telephone company of Cleveland. He has practically deserted the practice of law for the direction of the telephone interests.

Mr. Glidden was born in Lowell, Mass., in 1857, and that city is still his home. Mr. Thomas was born in Ross County, this state, in 1858, and is a descendant of Samuel Thomas, who came over in the Mayflower. Mr. Thomas is a graduate of the Ohio Wesleyan University, and Mr. Glidden is a graduate from the suit of a messenger boy to the place of president of one of the richest telephone corporations in the country, and he is also talked of as a probability for the presidency of the American Bell Telephone company, the parent company of all the enormous Bell interests. The presidency is vacant because of the death of President Hudson. As it is, he is at the head of what is said to be the greatest operating telephone corporation in the country, the Erie Telegraph and Telephone company, of which the Bell system in Cleveland is a part.

When Mr. Glidden was 14 years of age he went to work as a messenger boy for the old Atlantic and Pacific Telegraph company, so that he has been in the electrical-communication business almost all his life. He became manager of a branch of the telegraph company two years later, and when the establishment of the telephone as a commercial enterprise began in 1877, he was a canvasser for the original telephone company in Lowell. Later he became secretary and treasurer of the Erie company, and progressed through the official grades to the presidency, to which he was elected two years ago. Not long ago it was reported that this company had been sold to the group of New York capitalists of which William C. Whitney is the center, but Mr. Glidden remains at the head of the company. The same capitalists are interested in the Independent telephone schemes themselves, and this caused a situation that has been puzzling outsiders who are interested in the telephone battle, ever since the announcement was made.

Judge Thomas' rise in the telephone world has been equally brilliant. One of the most important, perhaps the most important, Independent or non-Bell telephone corporation outside of New York is the United States Telephone company of this city, the company of which Judge Thomas is general manager. It controls the Independent long-distance business of this state, and through companies with which it has working alliances, it extends all over the middle West, and through recent traffic arrangements with the Pittsburg and Allegheny Telephone company, now connects its territory with practically the whole of the East that has non-Bell systems developed.

Judge Thomas has been a lawyer for 16 years, and in 1893 was elected probate judge of his county. His duties as general manager of the United States Telephone company bring him to this city frequently. The local Cuyahoga Telephone company is the Cleveland factor of the United States company so far as local business is concerned, the United States company being the long-distance company that connects the local companies throughout its territory with the Cleveland exchange.

A device for sterilizing the mouthpieces of telephonic apparatus by electricity has been invented. It consists of a handle something like a telephone receiver, having a hollow at one end, in which is placed some fibrous material, with a pair of electrodes buried in it. Through these can flow a current of electricity, from any convenient source of supply, presumably the telephone battery itself. In the process of cleaning the mouthpiece the current passes through the fibrous material and is supposed to sterilize any bacilli that may be there.

Small Steel Castings Made by the Sargent Company.

Since March, 1900, the Sargent company of Chicago has operated a plant at Chicago Heights, Ill., manufacturing small steel castings, making the steel by what is known as the Tropenas process. This method was adopted after several years of experience with open-hearth and crucible-steel plants and after a careful study of the subject of steel making at home and abroad, where the Tropenas process is in successful operation in some 40 different plants.

The Tropenas process consists in the use of special converters in which pig-iron and selected scrap, previously melted in a cupola, are subjected to an air blast of three to four pounds' pressure per square inch, directed horizontally across the top of the molten bath. This action generates intense heat by the combustion of the metalloids in the pig-iron, and after a period varying from 16 to 20 minutes, depending on the quality of the charge used, there remains in the converter a bath of nearly pure iron. Addition is made of ferro-manganese or ferro-silicon, or both, to bring up the silicon, manganese and carbon contents to the specified proportions, when the metal is drawn off into a ladle and poured. The process is very simple and the product very regular.

The peculiar advantages of the Tropenas process lie in the fact that the resultant metal is much hotter and consequently more fluid than that produced by any other method, and it is this fact which makes it valuable in the manufacture of small and intricate castings, as it can be poured over the lip of the ladle in as small a stream as desired, and will run through thin sections, producing solid castings free from pin-holes and cracks. Any grade of metal is readily produced by varying the additions. It is consequently valuable not only in the production of low-carbon steel of the maximum permeability, so much desired in electrical castings, but also in the production of special grades of hard steel for mining-machinery parts and other purposes.

The plant at Chicago Heights is in successful operation, producing from 20 to 30 tons of castings a day, while it has a much larger capacity. All classes of general machinery, railroad, mining and electrical castings are turned out, fully equaling in physical properties and chemical composition, it is said, the best open-hearth steel. The castings are sound and solid, with a smooth surface, and the metal will stand forging and welding.

Miscellaneous castings, unless otherwise specified, are made of mild steel, which is tough and machines readily, having a tensile strength per square inch of from 65,000 to 75,000 pounds, with an elongation of 20 to 30 per cent. The accompanying group illustration shows a few of the castings made of Tropenas steel. They are solid and true to pattern, equaling in every respect forgings of all kinds, which they are intended to replace, as they can be furnished in much less time and at a lower cost, especially where special dies and appliances for forging are made. Wherever possible all patterns are molded by machinery, which insures uniformity. Every attention is devoted to securing the best result, both in quality and workmanship. All kinds of work in the shape of special castings for automobile construction, general railroad, mining, electrical and machinery parts, where lightness and strength are desired, can be made in Tropenas steel equal in all its respects to forgings.

SMALL STEEL CASTINGS MADE BY THE SARGENT COMPANY.

The Sargent company believes that it has actually made a very great step in advance from a metallurgical point of view, and that its move in this direction will be appreciated when it is generally known. Heretofore, the vast majority of small castings have been supplied by the makers of semi-steel or crucible steel, the former metal, of course, not having the properties of actual steel, and the latter being too expensive, while both of these processes necessitate considerable time for the turning out of even moderate-sized orders. By the Tropenas process the company is able to manufacture small steel castings of excellent quality, machine molded, and the larger the order the quicker the delivery in proportion. These castings do not require annealing, and consequently the day after the pattern is received at the foundry it is possible to turn out a day's work, running from one to several hundred pieces, and the day thereafter the castings may be cleaned and are ready for shipment.

The Sargent company has not, hitherto, exploited itself as a manufacturer of small steel castings nor sought the business in any way. Notwithstanding this fact, it has had a considerable number of orders for work of this character which formerly were filled in crucible steel, or as far as possible in open-hearth steel, and it is through the experience gained in the manufacture of steel by these two processes just named that the company has been led to the adoption of the Tropenas process for small castings. The Sargent company has its offices in the Old Colony building, Chicago.

Electricity in Lead Mining.

What is said to be the first electrical operating equipment to be used in lead mining has just been installed by the St. Louis Smelting and Refining company of Desloge, Mo. The generating apparatus consists of two units, a 350-horsepower Filer & Stowell cross-compound, condensing Corliss engine, direct-connected to a General Electric, 250-kilowatt, 500-volt generator and a similar generator direct-connected to an 850-horsepower engine of the same type, the remainder of the power of this engine being used to drive a long jack-shaft in the mill. The three mines of the company are connected by 1½ miles of trolley line, 20-ton locomotives with double trolleys being used. The complete metallic circuit was employed to avoid danger from grounds on the lighting system, which is supplied from the same generators. The lights in the mines and yards are supplied through a three-wire, 500-volt system, with 250-volt lamps. The switchboard carries two sets of bus-bars, one for the lighting system and the other for power service. The two sets are connected together through a differential booster having its shunt field excited from the lighting bus-bars. Across the power mains is connected a battery of 250 15-plate, type F cells, furnished by the Electric Storage Battery company. The arrangement is such that a sudden increased demand for power on the power mains lowers the voltage on the power bars slightly, so as to allow the battery to supply the demand without causing fluctuation of voltage on the lighting bars. The system is said to give practically perfect regulation. The installation was made under the direction of Floy and Carpenter of New York city.

Recommendations of International Patent Conference.

The Brussels international conference for the protection of industrial property was convened last week. It was called to perfect the work of the convention for the protection of industrial property, concluded at Paris, March 20, 1883. Representatives were in attendance from the leading European countries. The United States was represented by Walter H. Chamberlin, assistant patent commissioner and Lawrence Townsend, United States minister to Belgium. According to an Associated Press dispatch from Brussels, under date of December 13th, the following resolutions were adopted by the conference:

First—The period of exclusive rights, previously fixed at six months for [applications for] patents and three months for industrial designs, models and trademarks, is extended to a year for the first named and four months for the second named.

Second—Countries signing the convention enjoy reciprocally the protection accorded by each country to its own citizens against unfair competition.

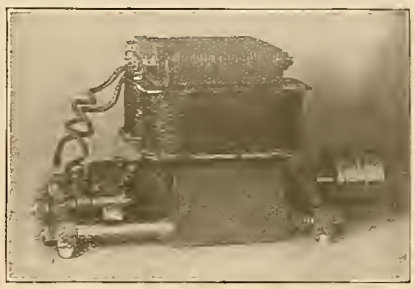
Third—Patents cannot lapse because they are not put in circulation, except after a minimum delay of three years, dating from the first application in countries where the patent is allowed, and in cases in which the conditions of the patent do not justify causes of inaction.

New Model Dynamo and Motor.

The cut herewith illustrates a little machine designed and manufactured by Parsell & Weed of the Franklin Model Works, 129-131 West Thirty-first street, New York, more especially for amateur construction, although the type is most efficient as either dynamo or motor for any practical service where small power or a few lights are required. When run as a motor this little machine will drive a sewing machine, dental engine or watchmaker's lathe. To secure the best results, a 10-volt current should be used. A five-cell storage battery will be found most suitable for this work. When run as a generator it will furnish sufficient current to light four two-candlepower lamps.

The complete machine occupies a space 3½ by 6½ inches, is 3½ inches high and weighs 5¼ pounds.

The wrought-iron field magnets are arranged with alternate long and short-yoke pieces, the two halves of the field being held together by a key pin passing through the long pieces of the yoke. This construction allows the two field coils to be wound in the lathe and afterward fitted together and held solidly in position by the key pin.



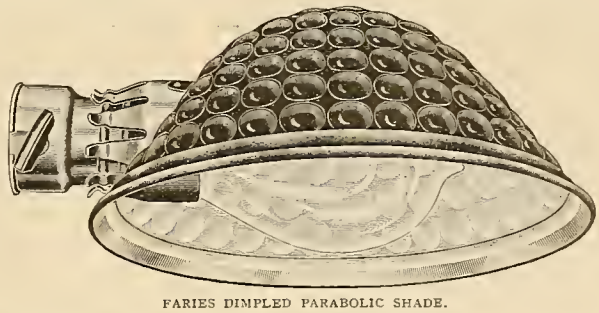
NEW MODEL DYNAMO AND MOTOR.

The armature, as well as the fields, is formed of punchings of sheet-iron and contains eight slots for armature coils. The commutator is one easily constructed by the amateur builder. The bearings are cast and support the weight of the entire machine in such a manner that the vibration of the parts is reduced to a minimum. The journals are long and are composed of a composition to withstand wear.

One important feature relative to an amateur's interest in such a machine lies in the fact that, as some amateur constructors may not be equipped with the necessary tools to finish all the parts, Messrs. Parsell & Weed have arranged the castings and materials in sets, which may be ordered according to the stage of completion desired. One set contains all the material required to complete the machine, but all castings, etc., are in the rough. The punchings for the field magnets and armature are all ready to assemble and require no machine work. All screws and nuts required are included, together with the necessary wire for winding. Another set includes all the above parts and has the shaft and side-bearing rods turned, threaded and finished. The bearing castings are drilled and reamed for shaft and side-bearing rods. A third set includes all the foregoing parts, with the additional machine work completed. The commutator is finished; driving pulley turned, grooved and tapped for set-screw; brush holders finished, etc. All parts are ready to assemble and wind. All sets contain complete working drawings and instructions for finishing and winding. Full-size detail blue-prints are furnished with each set of material.

Faries Dimpled Parabolic Shade.

A decided objection to the use of metallic shades and reflectors for portable desk and table lights up to this time has been the tendency on the part of such shades to produce streaks of light on objects near by. The Faries Manufacturing company of Decatur, Ill., manufacturer of electrical fixtures of all kinds, has overcome this difficulty in its new reflector, which it calls the "dimpled parabola," a cut of which is shown herewith. The construction of the shade is evident from the picture. The dimpling breaks up the reflections and gives a clear light, free from streaks. The reflector is also made much stiffer and stronger than a plain shade of the same metal. Aluminum is the metal employed, because of its lightness and the high polish which it takes, and the reflectors are made in seven-inch and eight-inch sizes and in parabolic and conical styles.



FARIES DIMPLED PARABOLIC SHADE.

DOINGS OF SOCIETIES.

Roentgen Society.

The first regular meeting of the Roentgen Society of the United States was held in New York city on December 13th and 14th, at the Grand Central Palace. One room was exclusively devoted to the exhibition of X-ray apparatus and a very interesting display was made. There were a large number of interesting papers read. A paper by Dr. Weston A. Pierce of Cleveland on "Skiagraphy in Oral and Dental Surgery" was one of seevral that showed the considerable advance that has been made in Roentgen-ray work, while "A Review of Cases of X-ray Burns," by Dr. E. A. Florentine of Saginaw, Mich., treated a topic about which there has been widespread preiudice.

Northwestern Electrical Association.

Secretary Thomas R. Mercein has issued an announcement that the Northwestern Electrical association will hold its ninth annual convention at the Hotel Pfister, Milwaukee, commencing on Wednesday morning, January 16th next. Reports and papers on subjects of special interest to central-station men will be read and discussed. An attractive entertainment programme has been arranged, and a pleasant and prontable time is assured to all who attend the convention. Special hotel and railroad rates have been obtained and a large attendance is expected. Information in regard to railroad rates, special train and car arrangements may be obtained from James Wolff, 320 Dearborn street, Chicago. A cordial invitation is extended to all electrical men. Mr. Mercein may be addressed at 85 Michigan street, Milwaukee.

League of American Municipalities.

The annual convention of the League of American Municipalities was held in Charleston, S. C., from December 12th to 15th. Many city officials were in attendance from different parts of the country, and a very profitable meeting was held. Several interesting papers were read and discussed, among which were the following: "Some Present English Municipal Conditions," by Professor Edward Bemis; "The Electric-lighting Plant of Chicago: Its Progress and Economy Under Municipal Ownership," by Edward B. Ellicott, city electrician of Chicago; "Remuneration to Cities for Franchise Rights In, Over and Under Public Streets and Alleys: What Remuneration, If Any, Should Be Extracted from Light, Water, Street-railway, Telephone and Subway Corporations, and How Should It Be Collected?" by Bird S. Coler, comptroller of New York city. This last-mentioned paper was followed by another one on the same subject by C. W. Toke, professor of law at the University of Illinois. At the closing session a paper was read by Mayor Jones of Toledo on "Obstacles in the Way of Municipal Ownership." The next convention of the league will be held at Jamestown, N. Y. The following-named officers were elected for the ensuing year: President, J. A. Johnson, Fargo, N. D.; vice-presidents, Mayors Ashley, New Bedford, Mass.; Smythe, Charleston; Stephens, East St. Louis; secretary, John McVicar, Des Moines; treasurer, T. P. Taylor, Bridgeport, Conn.; trustees, Mayor Head, Nashville; Ald, Goodman, New York, and Mayor Weakley, Florence, Ala.

New York Electrical Society.

President Martin of the New York Electrical society, at the meeting of December 12th, exhibited some 40 or 50 slides, chiefly night views, illustrative of lighting effects of the Paris Exposition. The day and night aspects of the same scenes were shown, and a great variety of details was given in regard to the manner in which the effects were secured. These Paris views were compared critically with a number relative to the same kind of work at Chicago, Atlanta and Omaha, and the different methods taken to obtain the same results were pointed out. It was shown that while in this country at large exhibitions there had been a remarkable advance in the use of the incandescent lamp outdoors, not merely for defining structures, but for general illumination, at Paris, there had been a marked retrogression in the wholesale employment of gas. In fact, so far did the use of gas at Paris go, the Champ de Mars was full of it, and its lamps were carried right up to the very portals of Electricity building. The two methods of lighting, instead of harmonizing, clashed; and the effect was even worse when the colored electric fountains were playing. It was noted as to the fountains that, whereas at Chicago, in 1893, arcs were employed burning in a horizontal plane, with revolving umbrella colored screens above them, at Paris vertical arcs were employed with inclined mirrors and with an apparent loss of intensity. The general absence of searchlights was commented upon. In regard to the illuminated front of Electricity building, assuming the correctness of the principle that decorative lighting should be to a building at night what bunting is by day, Mr. Martin thought that the French were to be congratulated on securing that very effect so happily. Before the days of electric lighting, the lamps were fixed and practically unchanging in color. On this Paris building the electric lamps were continually changing in color, grouping and effect, with slow and rapid movement, their own changes being supplemented by colored projectors from behind. The speaker thought that decorative lighting would be likely to develop along these lines.

The following resolution was unanimously adopted:

Whereas, It is proposed to establish a national standardizing bureau, and

Whereas, Such a bureau would be of the greatest value and benefit to electrical science and industry in the United States, and assist in the further development of export electrical trade; be it

Resolved, That the New York Electrical society hereby expresses its approval of the legislation in furtherance of such an object, and

Resolved, That the society associate itself with kindred bodies to secure the establishment of the bureau.

Development of Space Telegraphy.

Marconi has made a statement regarding the condition of affairs between himself and the British government with regard to the introduction of space telegraphy in that country. The government claims an absolute monopoly of the telegraphic systems of whatever kind used within the united kingdom. At this point the government runs against the patents that cover the Marconi system. Unless a satisfactory financial arrangement with the Marconi company is arrived at the wireless telegraph as a means of communication within the united kingdom appears to be an impossibility.

The Marconi interests have been successful, however, in persuading the Congo Free State to adopt their system for communication between the military stations. The trials will be made between Boma and Matadi.

A project is on foot to establish stations along the route from Great Britain to Australia to maintain communication with the vessels in that trade. In connection with this the experiments on the English Channel are of interest. A note from the United States consul at Brussels states that recently a message was sent from the packet Princess Clementine to Dover Court, over 90 miles of cliffs and sea.

Appraisal of Railroad and Other Properties in Michigan.

Since Setember 1st a special commission has been at work appraising properties in Michigan that pay specific taxes. The work is in charge of Professor M. E. Cooley of the University of Michigan, who is chief appraiser of these properties, and includes all railroad properties in the state; also telephone, telegraph, plank-road, river-improvement and express companies. The commission, which has its headquarters in Detroit, employs about 90 men, most of them engineers. When the work is completed it will have involved a personal inspection of every mile of railroad in Michigan, nearly all of 9,000 locomotives, 30,000 out of 50,000 freight cars, all of the passenger equipment, shops and machinery, buildings, etc. The commission will also have inspected all of the telephone and telegraph lines and the offices and central stations in the state. All of the 200 plank roads and 90 or 100 river improvements will have been looked up. Some of the data collected was presented by Governor Pingree to the extra session of the Legislature that was recently called, but the complete report won't be presented until the new Legislature meets in January.

Powerful Induction Coils.

An exhibition was given recently in New York of what are said to be the most powerful sending coils for wireless telegraphy yet made. These instruments were made especially for the Japanese government. There are two of them and they will be installed on two of the fastest Japanese cruisers. It is expected that they will be able to transmit messages 100 miles or over. The machines were constructed for the Marconi system according to Marconi principles. The coils, it is estimated, develop a potential of about 2,000,000 volts and contain over 125 miles of copper wire and weigh 1,500 pounds. A spark 45 inches long has been drawn from them, and at six inches, at which distance the balls will be set when in use, the flashes resemble the flame of an arc light. A piece of four-inch plate glass was perforated by the discharge.

Westinghouse Plans.

The Westinghouse Electric and Manufacturing company has called a meeting of shareholders for February 20th, according to a Pittsburg report. The company has announced that the meeting is called on recommendation of President George Westinghouse, who, in a letter to the directors, advised an increase of capital stock, in view of the approaching completion of new buildings at East Pittsburg, the necessity of providing for investments heretofore made and others that might still be required to take care of the growing trade. The present capitalization is $15,000,000. The board of directors will meet before the stockholders' meeting to recommend the amount of the proposed increase of capital.

The City Council of Kenosha, Wis., has refused to grant a franchise to the Milwaukee Electric Railway and Light company to build a line through that city. This blocks the completion of the company's projected line between Milwaukee and Chicago.

CORRESPONDENCE.

London Letter.

London, December 4.—The system of applying wireless telegraphy as a means of warning vessels approaching dangerous points on our coasts is shortly to be put to a practical test at Southend, when experts from the Board of Trade, Trinity House and Lloyds will attend. A mast 30 feet high has been erected on Southend pier, by means of which a continuously repeated message will automatically be sent seaward. All vessels equipped with receivers will be warned of their danger by the ringing of a bell on board when they come within the seven-mile zone, the limit at present suggested.

The Pacific Cable committee has accepted on behalf of the government and of the government of New South Wales, Victoria, Queensland and New Zealand the tender of the Telegraph Construction and Maintenance company for the manufacture and laying of the projected Pacific cable. The amount of the tender is $8,975,000 and the work is to be completed by the end of 1902. The cable will run from Vancouver to Queensland and New Zealand, via Fanning Island, Fiji and Norfolk Island. The tender does not include the cost of preliminary surveys or other expenses, which will probably add some $880,000 to the total cost. The annual expense of the cable was set down at $724,435, of which total $350,000, it is estimated, will be necessary for maintenance, $114,435 for working expenses and $260,000 for interest charges. On a basis of about 80 cents a word, the committee calculated that the revenue carned by the cable during the first year of working would amount to $892,185, or $167,750 over and above the annual expenses, while on the extremely low basis of 50 cents a word, there would be a loss on the first three years' working aggregating less than $100,000, and a profit in the fourth year of about $6,000.

The Charing Cross, Euston and Hampstead Railway Construction company was registered at Somerset House by Mr. R. W. Perks, M. P., yesterday. The capital is $5,000,000. The company will construct the new underground railway, and when the work is finished another company will take over the line. It will be seen that Mr. Yerkes is following the plan which he has found so successful in railway construction. He first organizes a construction company, after which a second company is created to take over and operate the property. The construction company is a very close affair and none of its stock will be floated here, as the syndicate which is backing Mr. Yerkes considers that the investment is too good to share.

The scheme of electric lighting and duct destruction inaugurated by the Beckenham Rural District Council will, it is claimed, solve the problem of how to obtain electric lighting without any of the generally anticipated loss of the first few years falling upon the rates. As the result of the agreement that has been entered into between the council and the British Insulated Wire company for a period of five years, the whole of the house refuse of the district will be destroyed and the ratepayers supplied with electricity at not exceeding 12 cents a unit, and no charge whatever, it is claimed, will fall upon the rates. At the end of five years the council will take over the undertaking and the council will have paid no premium or consideration whatever beyond the initial contract price.

It is announced that an arc lamp is being brought out here that will take a current of only 2½ to three amperes. It is 17 inches in length and only weighs 10 pounds. The carbon is five-sixteenths of an inch in diameter and the lamp is stated to be eminently suitable for a number of purposes and positions where an incandescent lamp would be less desirable.

Smoke in the form of a black fog is indeed not merely an intolerable nuisance, but a waste, since it comes of unburnt carbon. Although it cannot be denied that the mechanical engineer has done much to effect the more thorough combustion of fuel and that a multitude of "smoke-consuming" appliances are in the market, yet the fact remains that the only real effectual check against the pollution of the atmosphere is the use of smokeless coal. Electrical science, however, has suggested a remedy of quite a new character. The characteristic London fog is, as we most of us have reason to know, compounded chiefly of soot. A number of experiments have led to the discovery that these particles will become electrified by induced electricity through an electric current of a high-discharge rate, when they are attracted by each other, cling together and are precipitated to the ground. It is suggested, therefore, that an electrical precipitating plant should be placed in or near the mouth of every factory chimney. Not only would the atmosphere be cleaner, but the manufacturer would have the satisfaction of recovering fuel that would otherwise be lost to him.

W. H. B.

New York Notes.

New York, December 15.—The annual report of the Brooklyn Rapid Transit company has been made public. In his report to the directors, President C. L. Rossiter says: "The general result of the business of the system comprising the Brooklyn Rapid Transit company and constituent companies for the fiscal year showed gross earnings from passengers, freight, mail and express, advertising, rents and miscellaneous income of $11,768,550; ex-

penses of $7,106,373, net earnings of $4,662,177, fixed charges and taxes of $4,135,405, yielding a surplus of $526,772. Adding to this the surplus of June 30, 1899, $96,654, gives a total surplus on June 30, 1900, of $623,426. To the 8,076 employes upon its payrolls at the close of the year the company had paid in salaries and wages $4,691,878.50. There was paid during the year in the settlement of negligence claims $797,789.91, or 6¾ per cent. of the gross receipts, and in addition, for legal expenses in connection with negligence claims, the sum of $106,068.06, making a total of $903,857.97. The number of passengers carried during the year, including transfers, was 272,560,074, as against 265,280,728 in the previous fiscal year. Large additions have been made during the year to the equipment of the surface lines, including 330 open-car bodies and trucks, 250 closed-car bodies and trucks, 1,652 motors and controllers, and five snow plows. To the elevated equipment has been added during the year 25 cars and trucks, 48 motors and controllers, and a considerable sum expended in the electrical equipment of cars. Your company has pursued the policy of not taking into court actions which should and could be compromised, and the wisdom of this policy is shown by the fact that out of the 565 actions disposed of in court during the year, 407, or over 72 per cent., were victories for the company. Notwithstanding this success, however, suits multiply, and the evils with which we are obliged to contend in negligence litigation are sufficiently great to demand rebuke from the courts and self-respecting members of the bar. For all damages for which your company is responsible it expects to make ample compensation, and it is sparing no efforts to reduce to a minimum the necessity for such expenditure; but against the scandalous attempts of unscrupulous attorneys to mulct the company by the prosecution of fraudulent suits, your company needs and asks the co-operation and assistance of the courts and the public. The evils which exist are a menace to justice and taint the good name of an honorable profession." The receipts for freight, mail and express show an increase of 67 per cent. over those for the previous year.

The concerns which control the electric-cab service have clashed with the Hack Owners' association. An ordinance exists providing that all cabs which pick up fares in the street shall be numbered and licensed. As many of the customers of the automobile concerns object to riding in numbered cabs, the numbers have been removed, and as a result the Hack Owners' association has employed men to watch the electric vehicles, and in a number of instances customers of the latter have been obliged to get out of cabs in which they were riding, and the drivers warned that further violations of the ordinance would result in arrests. An ordinance was drawn up to remedy this, which would allow the drivers of electric cabs to pick up customers in the street without carrying numbers on their lamps, but the requirements demanded for its passage by the Municipal Assembly were greater than warranted by the advantages sought. At present the electric vehicles are sent out only on special orders which come in through the offices.

The Brooklyn Rapid Transit company is to operate motor trains instead of the present single trolley cars on the line between the Brooklyn Bridge and Bath Beach, through Borough Park. These trains will be run on to the elevated structure between the Thirty-ninth street and Twenty-fifth street stoos, and from Twenty-fifth street will continue to the bridge on the elevated structure.

Construction work on the Metropolitan system has been discontinued until next spring. Many changes will then be made, including the installation of conduit systems for the Broadway, Columbus avenue and Lexington avenue lines, to displace the present cables. This will enable some cars from the Second avenue, Third avenue and Madison avenue lines to run past the Park Row terminal directly to South Ferry. The cars of the Sixth and Eighth avenue lines will run direct to the bridge through Canal street.

Work on the big subway is progressing satisfactorily and President Orr of the Rapid Transit commission says that the work will undoubtedly be done within the contract time.

A system of colored train signals has been inaugurated at the transfer station of the Brooklyn Rapid Transit company to enable passengers to identify their trains at a distance. Large illuminated signs bearing a set of the different combinations are placed in the stations, and passengers can easily compare the lights on an approaching train with those on the sign board, and thus avoid much confusion.

Wall Street reports a persistent rumor that if the plans of the Brady interests in the Brooklyn Rapid Transit company suffer no change, Edward A. Maher, president of the Union railway, or "Huckleberry road," will on January 17th succeed Clinton L. Rossiter as president of the Brooklyn company.

M. L. G.

Canadian Intelligence.

Ottawa, Ont., December 15.—The monthly earnings of the Toronto (Ont.) electric street railway again show a phenomenal increase. The city treasurer has received a check for $10,250, being the city's share of $128,132, the November earnings of the railway. The earnings for November, last year, were $102,535.

The Brandon (Man.) Electric Light company is now building a power dam on the Little Saskatchewan River, about 10 miles from Brandon. By this means about 800 horsepower can be developed, and this can be increased later. Dynamos are to be put in next spring, when both power and light will be furnished.

The Power and Light company of West Kootenay, B. C., purposes increasing the capacity of its plant at Bonnington by 10,000 horsepower. The cost of the new works is estimated at $1,000,000.

Shipment was made, recently, of the largest motor that has yet been built in Canada. The motor was consigned to the British America corporation of Rossland, B. C., and the shipment was made by the Royal Electric company of Montreal, Que. The motor is an S. K. C., two-phase machine, and its capacity is over 1,000 horsepower, and it is to be used to drive the compressors and hoists at the mines. The total weight of the motor, boxed, ready for shipment, was 52½ tons. The weight complete of the motor, with its accessories, was over 60 tons, requiring two full cars to transport it across the continent.

The Cataract Power company at DeCew Falls, Ont., has just completed the installation in its power house of one of the largest electric generators for light and power purposes built in Canada. The generator has a capacity of 2,000 kilowatts, with a large overload capacity. The weight of this generator complete is oved 110 tons. The capacity of the Cataract Power company's electric plant is now over 10,000 horsepower. The two lines from DeCew Falls to Hamilton, Ont., a distance of 35 miles, are now in daily successful operation.

The city of Ottawa, at the last civic elections, voted largely in favor of municipal ownership and operation of an electric-light plant. The special committee, appointed by the City Council to report upon the feasibility of purchasing a municipal electric plant from the Ottawa Electric company, has advised that no action be taken at present, because of the terms which that company demands. The committee reports that the company does not want to sell its entire lighting plant, but is willing to sell its street-lighting plant, on condition that the city agrees to buy the power from the company for a period of 10 years. The city should not enter into a contract to take power for such a length of time. It is recommended that the city apply to the Ontario Legislature for such an amendment to the existing laws as will enable the city to arbitrate in its efforts to get a civic lighting plant, it being now debarred by the statute from so doing, when a contract, as in the present instance, is still in force between a municipality and an electric company.

W.

From the Buckeye State.

Columbus, December 17.—For some years Columbus has been admired by visitors from almost every other city in the United States for the unique manner in which its principal thoroughfare, High street, is lighted. It has a system of arches extending entirely across from curb to curb, and these are set thickly with incandescent lights, giving the appearance from a distance of a long hallway brilliantly lighted overhead. The idea was conceived from arches erected several years ago for decoration purposes, and when the plan was perfected the temporary wooden affairs were replaced with handsome iron structures. However, every year it has been a task to secure enough money to keep them lighted the year around, and this year it seems more difficult than ever to secure funds. The contract expired on Friday, and on Saturday night the street was dark. Out of about $3,200 required, only $1,200 had been secured. The city pays $2,500, about the amount that it would cost to light the street in the ordinary way. Traveling men who visit the city say that it will not pay to let the arches go if they cost $20,000 a year, as they are the best advertisement the city has ever had.

The new storage battery of the Cincinnati Edison Electric Light company has been installed and was charged for the first time last week. It takes about 20,000 gallons of acid to fill the tanks and the battery is said to have a capacity of supplying 20,000 incandescent lights for eight hours. The battery will be charged regularly between 12 and six o'clock a. m., hereafter, as there is less demand then than at any other time upon the plant. The battery, complete, cost $130,000.

The county commissioners of Allen County have granted a franchise to a company to build a line from Lima to Findlay. This makes the second line between the two towns.

It is stated that General Sanderson, who is a director in the Richland and Mahoning Railway company, says that the line will pass through Mansfield, Wooster, Canton, Alliance and Niles, its termini being Shelby and Youngstown. He further says it will be operated altogether by electricity.

The steel for the Youngstown-Sharon electric railway has been ordered from the National Steel company and 24 modern and up-to-date cars have been ordered from the Jackson-Sharp company.

The piers for the Ohio Valley Electric Railway company's bridge over the Big Sandy, near Huntington, W. Va., are almost completed. It is said that the offices of this company will be moved to Ironton, Ohio.

The Champion Iron company, the Ohio Machine Tool company and the Kenton Waterworks company, Kenton, Ohio, have put in private electric-lighting plants. A. G. Wessling will also put in a plant for his own use.

The Urbana, Mechanicsburg and Columbus Railway company will not begin work on its lines until early in the spring, an extension of time having been granted because of the bad weather.

The citizens of Norwood, near Cincinnati, are anxious for better street-railway facilities, and say they have a 25-year franchise for any responsible company that will build a good system in what is known as East Norwood. Orris P. Cobb and John S. Hoover of East Norwood are interested in the matter.

At a meeting held in Middletown a few days ago it was decided to build a line of road from Miamisburg to Germantown, a distance of five miles, as soon as possible. The power for the line will be furnished by the Southern Ohio Traction company. Samuel Mays, W. L. Dodds and Al Mays, all of Miamisburg, are interested in the company, and they will look after the construction of the road instead of contracting it.

The Scioto Valley Traction company of Columbus has increased its capital stock from $100,000 to $1,000,000, and at a meeting held a few days ago, B. Maher of Cleveland was chosen president of the company. An office has been opened in the Board of Trade building at Columbus and the business of the company will be pushed. H. A. Everett, E. W. Moore and some other Cleveland gentlemen are interested in the enterprise. The line proposed will extend from Columbus to Chillicothe.

It is said that the extension of the Northern Ohio Traction company's line from Akron to Barberton will be completed. The line will be double-tracked, according to what one of the officials said a few days ago.

The Dover Construction company will begin laying rails on the Fostoria and Findlay line soon. It is now thought that the road will be completed by April 1st.

The Toledo Interurban Railway company has been granted a franchise by the Lucas county commissioners to build a road from Bancroft street, Toledo, to Ketcham's Corners.

Judge Bigger of Columbus has refused to grant George W. Van Sceiver an injunction to prevent Adam Grant from building his electric road along the highway in front of his farm. Judge Bigger held that property owners must prove that their property is substantially injured by the construction of a road before courts will have authority to grant injunctions to prevent their construction. Such allegations as the obstruction of view, the possibility of scaring horses and other equally trivial matters will not do. It must be shown that a road will be an additional burden to the soil, that the grade will damage property and crops, or something of that kind, before any court will be warranted in acting.

Luther Allen, president of the Toledo and Western Railway company, says that his road now being built from Toledo to Sylvania will be extended to the Indiana line at an early date and eventually it will be built on west to Chicago. The track is completed to within three miles of Sylvania.

O. M. C.

Information from Indiana.

Indianapolis, December 15.—The commissioners of Sullivan County are considering applications for electric-railway franchises covering 200 miles.

The commissioners of Morgan County have extended the Indianapolis and Martinsville Traction company's franchise to September 1, 1901, and required a bond of $20,000 for the completion of the work by that time.

Work has begun on the "Oil Belt Line," known as the Fort Wayne and Southwestern railway. A corps of surveyors is engaged along the towpath of the Wabash and Erie Canal from Fort Wayne to Roanoke. The promoters have announced that the road would be completed between Fort Wayne and Huntington by May 1st. A. N. Dukes, a former alleged owner of the towpath, has secured a temporary injunction against the sale of the canal bed to the company, and this litigation may retard progress.

An application is pending before the City Council of Decatur for an electric line between Fort Wayne and Richmond passing through Decatur.

The county commissioners of Putnam County have granted a franchise to W. R. Vestal and others of Greencastle, to operate electric lines on the principal thoroughfares in Putnam County. It is proposed to first build an east and west line.

A corps of engineers is now at work on a second survey of the proposed electric line from Eaton to Richmond. It is understood that the franchise granted over the roads in Wayne County, Ind., and Preble County, Ohio, to W. Pruden and others of Dayton is to be transferred to the Dayton and Western Traction company, which owns and operates the line between Dayton and Eaton.

A mass meeting of citizens of Marion was recently held and a petition started to the Union Traction company asking that it either make the one-cent fare placed on lines paralleled by the Marion Transit company for all lines in the city or take off the one-cent fare altogether. The petition is largely signed and the people do not uphold such unfair competition.

The Indianapolis Street Railway company has put a number of its new combination cars into use. The new cars have a convenient seating arrangement. An 11-foot smoking compartment is a feature. The main sections have seats arranged crosswise, while the remainder have the seats arranged lengthwise.

Long-distance passengers are requested to take the former seats and the short-distance passengers the lengthwise seats.

The Noiseless Wheel company of Indianapolis, of which C. E. Kreglo is president and A. W. Wishard, secretary, has equipped a number of street cars on the Indianapolis electric lines, and the wheels are noiseless. The chief advantages of the wheel are not alone its noiselessness, but also the ease with which repairs may be made. When an old-style wheel becomes flat it must go out of use, and several days are required to make the change. With the patent-tire wheel the work can be done in two hours, it is said.

A new electric-lighting device is being installed as an experiment on a passenger coach on the I. and V. railroad. Power is to be derived from the car axles and conveyed to storage batteries. The illumination is said to be steady.

One-half of the $150,000 stock has been subscribed for a new electric power plant at Indianapolis. The promoters propose to furnish power to any industry desiring it in the city, in addition to those occupying space in the main power-house plant.

An elaborate plan of uniform decoration of downtown streets during the holidays is being carried out by Indianapolis merchants. Arches of electric light, intertwined with evergreen, and stringers of electric lights along either side and from building to building, crossing the streets and festooned along the curb, are being put in place. The decorations promise to excel those of the late fall carnival.

It is given out that one of the large agricultural manufacturers of this state is completing arrangements to engage in the manufacture of the Borsig electric plow for the American market.

The city of Knightstown is preparing to own and operate its own electric-light plant. The plant now in operation, owned by private parties, has been offered to the city for $3,500.

Custodian Vest of the statehouse, Indianapolis, recommends to the Legislature the advisability of putting in an independent electric-light plant and also equipping the elevators with electric power.

The Union Traction company is preparing to furnish illumination by electricity to the various towns along the lines of its interurban system from its central power station at Anderson. The method is to conduct the power from the trolley and feeder wires to special wires, to which lights will be attached for illuminating business houses, residences and the public streets; also to furnish power for industries in the several towns along its system.

Northwestern Notations.

Minneapolis, December 15.—Collisions in fogs are becoming frequent occurrences on the street-car systems of the coast cities. Two Pacific avenue cars in Tacoma, Wash., met on a single track in a fog, resulting in painful and possibly serious injuries to one of the motormen.

The final hearing in the case of the St. Paul, Minneapolis and Manitoba railway against the Western Union and Northwestern Telegraph companies has been set for December 19th, by Judge Lochren of the United States District Court. The case involves the ownership of the telegraph lines along the right-of-way of the Great Northern railway. The railroad company claims to own the lines, while the telegraph companies claim ownership by special contract.

The council of Council Bluffs, Iowa, voted down a resolution providing for a city electrician.

The dam holding an artificial lake above the power house at Kearney, Neb., gave way and the station of the City Electric company was wrecked. The plant had lately been rebuilt throughout, and the loss will amount to $20,000.

The demurrer filed by the city of Marshalltown, Iowa, in its suit against the Marshalltown, Light Power and Railway company has been overruled, and the case will be tried on its merits. The city urged that the case was not one for the Federal Court to try. It involves the city's right to make the rates for lighting.

Some time ago the electric-light plant at O'Neill, Neb., was moved to Alliance, Neb. Now a Sioux City (Iowa) capitalist has made a proposition to establish a new plant for O'Neill.

Thomas Kirk and others have been granted a franchise by the council of Walla Walla, Wash., to bring electricity into the city. The plans of the company provide for a large electrical plant, to be constructed at the forks of the Walla Walla River, about 12 miles south. The waterpower is said to be almost unlimited. It will be necessary to bring the water in a flume a distance of 14,500 feet, and a head of 200 feet can be obtained. This will give 4,000 horsepower. The plant complete will cost in the neighborhood of $250,000.

Mrs. J. B. Barnes of Spokane, Wash., sues the Washington Water and Power company for $20,248 damages, for injuries alleged to have been incurred by the motorman stopping his car, on which she was a passenger so abruptly as to throw her against the end of the car. It was an emergency stop, as it occurred at a crossing with a railway line, and a train was approaching at a high rate of speed.

The Story City Electric Light and Power company of Story City, Iowa, has been incorporated, with $10,000 capital stock.

The Big Fork Electric Power and Light company has been granted a franchise into Kalispell, Mont.

A. E. Parmenter of Scotland, S. D., has received plans for his projected electric-light plant. He has secured nearly enough business to justify putting in the plant.

The Gas and Electric company of Fargo, N. D., plans extensive improvements to its entire system next spring. New boilers have already been purchased and will soon be installed. The electric plant will be rebuilt. New engines have been ordered. A heating system is planned also.

The council of Sioux Falls, S. D., contemplates abandoning the use of gas for street lighting, and using electricity entirely.

It is understood that a syndicate of Cleveland (Ohio) men is behind the proposed electric railway from Des Moines to Newton, Iowa, and that it also seeks a franchise for a local system in Des Moines. It will ask that a special election be held to vote on the award of a franchise.

It is announced that the projected electric railway to run between Albert Lea and Geneva, Minn., is to be taken up soon, and the preliminary work pushed at an early date.

The council of St. Paul has ordered a five-minute service on the interurban line morning, noon and night. An effort will be made to substitute for the proposed owl-car ordinance a requirement that the last car on each line leave the downtown district as late as one o'clock in the morning.

A rumor has been current in Minneapolis and St. Paul that the Twin City Rapid Transit company system had been sold to eastern parties. Thomas Lowry, the president, denies that there is any truth in the rumor.

The Northwestern Improvement company of Roslyn, Wash., is installing a duplicate plant for its electric-lighting system. The rapid increase of patronage has overloaded the present system, making the addition necessary.

Edward P. Burch of Minneapolis has been granted a franchise for an electric railway and lighting system at Everett, Wash. Litigation is threatened by the present company, which claims an exclusive franchise. Mr. Burch was formerly electrical engineer for the Twin City Rapid Transit company of Minneapolis and St. Paul.

Mrs. F. G. Webster, who owns and operates the electric-light plant at Eveleth, Minn., will largely increase the capacity of the plant, and will add a 400-horsepower Corliss engine. Mr. Webster was killed at the plant just as it was starting up under his management, a few months ago. His widow took hold of the business and is making a marked success of it.

The St. Paul Gas Light company secured the contract to furnish 108 arc lights for the streets of St. Paul at $90 a light per annum, and for 42 new arcs at $110 each. The contract runs for a year.

The General Electric company of Minneapolis announces a reduction in rates for incandescent lighting. The old rate was 20 cents a kilowatt-hour. Hereafter the consumer will pay 20 cents for the first hour and 10 cents for each additional hour.

The council of Des Moines, Ia., compromised the matter of taxes with the Des Moines City Railway company. In consideration of the company selling six tickets for 25 cents, the council agreed to reduce the company's assessment for 1897 and 1898 from $148,000 to $100,000. The county officials, however, refuse to indorse the compromise, and as the county is vitally interested, the deal is probably off.

The state of Minnesota has a law taxing the franchises of foreign corporations doing business within its borders, on the basis of the proportion of their capital stock used in the state. The Twin City Rapid Transit company, operating the street-railway lines of Minneapolis and St. Paul, is incorporated under the laws of New Jersey, with $20,000,000 capital stock. All the property of the company is within Minnesota. The company attempted to comply with the law by filing articles showing $2,000,000 as the capital stock for this state, and sought to pay the tax of $1,025 on that basis. The state treasurer refused to accept the payment. After repeated attempts had been made to force the acceptance, a compromise was effected, and the company agreed to pay taxes on the basis of its assessed valuation, $4,600,000.

The St. Paul Gas Light company and the St. Paul City Railway company have advised the board of water commissioners that they do not have any electric wires attached to the city water mains. This was in reply to a peremptory order from the water board, which forbade making any further such connections, and ordered all such connections now existing to be removed.

A committee of telegraphers recently waited on Vice-president Kendrick of the Northern Pacific Railway company, and it is understood sought to have the road recognize the telegraphers as an organized body.

It is proposed to form a separate corporation from the Des Moines City Railway company to build the projected line from Des Moines to Indianola, Iowa. Stock subscriptions are being solicited from local capitalists now.

Fred E. Sander has secured a franchise from the County Board at Seattle, Wash., for the proposed Seattle-Tacoma electric line.

Frank Savaresy has been granted a franchise for a local lighting system at Billings, Mont., and proposes to establish a $25,000 plant as soon as possible.

It is reported that American capitalists are figuring on developing the power from Saganaga Falls, in the Rainy River, between Minnesota and Canada, with a view to securing power for an electric railway, to run from the Gun Flint iron mine in the northern part of Cook County, Minn., to Grand Marais, Minn., 45 miles south on Lake Superior. The falls have a capacity for 15,000 horsepower, and there are numerous supplemental powers available.

R.

Gleanings from Colorado.

Denver, December 15.—Now that work on the installation of machinery in the power station of the Lacombe Electric company in Denver has been begun, the probability of a contest between that company and the Denver Gas and Electric company, which now has control of lighting in the city, has been predicted. The officials of the latter company do not hesitate to predict a rate war. F. W. Frueauff, secretary of the company, made the statement that if the Lacombe company cut prices, his company would offer still lower rates.

According to City Electrician Sayer, there are 40,000 poles for electric wires in the city of Denver.

The Pueblo Traction and Lighting company of Pueblo has just been incorporated, to succeed the Pueblo Traction and Electric company. The new company has a capitalization of $1,500,000, three times that of the old company. The company operates the trolley system of the city and controls all the electric lighting. General Irving Hale of the General Electric company of Denver is a member of the new board of directors, the others being Ward Rice, Charles E. Gast, John F. Vail, T. H. Devine and M. D. Thatcher. The company contemplates extensions in the trolley system and will enlarge the lighting plant.

The commissioners of the State Insane Asylum at Pueblo have decided to recommend to the Legislature the installation of an electric-light plant in the institution at a cost of $18,000. The asylum is now lighted by gas, and the commissioners assert that no modern institution is unprovided with electric lights.

The Modern Machinery and Electrical company of Denver has been incorporated, with a capital stock of $25,000. The incorporators are Hiram C. Russell, Adrian V. S. Saunders and Edward S. McKinley.

The Ferris-Haggerty company is planning to install an electric plant at Grand Encampment, Wyo., to light the town and supply power for the mines.

The Health Board of Pueblo has instructed the city attorney to prepare an ordinance to prescribe a penalty for expectoration in street cars. The need of such a regulation is obvious in every city, and this is particularly true in Colorado, where so many victims of consumption come for their health. The adoption of such regulations is general, but their enforcement is very lax. Denver cars carry signs announcing that the practice of expectoration on the floors is forbidden by the Board of Health, but unfortunately little attention is paid to enforcing compliance with the rule.

The Denver Tramway company has been given a permit to reconstruct the roadbed on West Thirty-second avenue. The line on this street was a part of the West End system, which is now owned by the Tramway company. The track was broad gauge, but it is to be changed to narrow gauge to conform to the gauge prevailing on the rest of the tramway system.

The Telluride Power Transmission company of Telluride, Colo., is making extensive additions to its plant. Improvements are being made in the station at Ames. The transformer station has been enlarged and poles have been set to Vance Junction, where the new station is being built. The plant at this point will double the generating capacity. The Ames plant supplies at the present time power for mines in Gold King, Alta, Marshall and Savage Basins, and transmits to Camp Bird, a distance of 14 miles. It also supplies the lights for Telluride and Ophir.

A consumers' electric-light company may be organized in Leadville and build a new plant. It was expected that an electric-light and power station would be constructed by the 1st of January, under a franchise granted last spring by the council to Gilbert Wilkes of Denver. Subsequently the gas and electric interests of Leadville were consolidated and Mr. Wilkes was appointed manager. No action was taken under the franchise, and the Board of Trade took up the matter and decided to form a consumers' company. An understanding was reached with the City Council that a 10 years' franchise, similar to that granted to Mr. Wilkes, should be given to the new company. All the $75,000 capital stock was subscribed for. According to the franchise obtained by Mr. Wilkes, the plant was to be in operation by January 1st. After that date it is probable that the consumers' company will begin active work.

The Postal Telegraph company will occupy new quarters in the Ernest & Cranmer building, Denver, after January 1st, and will install a new generating plant. The new quarters will provide three times the space now available. The enlargement of the equipment is demanded by reason of the fact that Denver is the important relay point between the Missouri River and the Pacific coast.

Mr. Thomas B. Whitted, resident engineer of the General Electric company in Denver, will be in the East during the next few weeks, enjoying an outing.

W. A. Ramsay and Frank Lawton, secretary and superintendent of the Colorado Springs Rapid

Transit company, recently returned from an eastern trip, during which they inspected a number of street railways in different cities. Ten new cars were ordered of the Laclede company in St. Louis. The new cars will be equipped with motors by the General Electric company. The type of motor will be the G. E. 67. Each of the four on each car is of 38 horsepower. The cars are 41 feet over all and will be mounted on double trucks. They will be equipped with the latest appliances of every kind. They are designed for a speed of from 30 to 35 miles an hour and will be provided with air brakes. They will be delivered complete about March 1st.

A correspondent writes to a Denver paper that the town of Amarillo, Texas, needs and would support an electric-light plant. It is stated that at first 600 incandescent lights and 25 arc lamps would be required.

Henry M. Wisler, president of the Yaryan Consolidated company of Chicago, was recently in Colorado Springs. He stated that he expected to organize a company to install the Yaryan system of lighting and heating in the city, and would apply to the City Council for a franchise. The system uses electricity for lighting and heat is distributed by hot water.

It is announced that $250,000 will be expended on the Rio Grande Western shops at Salt Lake City next year. The plant will be electrically operated throughout.

Postmaster Twombly of Denver has recommended in a communication to the Postoffice Department that a street-railway postal car be provided. The application, it is believed, will be favorably acted upon, as increased facilities for handling the mail are urgently needed.

General Irving Hale, manager of the Denver office of the General Electric company, has just returned from New York, where he attended the meeting of the local managers of the General Electric company, on December 11th and 12th.

The installation of machinery in the plant of the Gardner Drill company on Blake street, Denver, will commence in a few days. About 100 men will be employed in the construction of the electric drill.

In the budget submitted to the City Council of Denver, Mayor Johnson recommends an appropriation of $90,000 for 1901 for electric lighting for streets and public buildings outside the fire and police departments. This is the same amount appropriated for 1900. J. W. D.

PERSONAL.

Mr. C. O. Mailloux, the well-known electrical engineer of New York, was in Chicago for a flying visit last week.

C. W. Woodward has been appointed purchasing agent of the Electric Storage Battery company of Philadelphia, to succeed the late John B. Falkner, Jr.

Robert T. Tighe died recently in New York at the age of 58 years. Mr. Tighe, while in the employment of Adrian C. Morse, installed the first telegraph system in South America, and afterward established other systems in Chile and Peru.

Dr. S. Hoepfner, a prominent engineer and chemist of Hamilton, Ont., died at Denver on December 15th, of typhoid fever. He was well known in mining circles through his invention of an electrolytic treatment of refractory ores now in use in a number of smelters in Europe and Great Britain.

It is reported from London that H. F. Parshall, the American electrical engineer, has been appointed constructing director of the Yerkes underground road. Mr. Parshall was intimately connected with the designing and construction of the Central London underground railway, and is well known on both sides of the Atlantic.

George A. Fuller, founder and head of the George A. Fuller company, pioneer in the construction of steel-skeleton buildings, died in New York city on December 14th. Over 30 of the largest business buildings in Chicago were constructed by the Fuller company, and besides these the firm erected as many, if not more, in Boston, New York, Baltimore, St. Louis and Pittsburg. Mr. Fuller, who was a graduate of the Massachusetts Institute of Technology, had a wide acquaintance among electrical contractors, and the news of his death was received with regret.

ELECTRIC LIGHTING.

A $19,000 electric-light plant has been contracted for by Brazil, Ind.

An electric-light and power plant will be built at Blue Rapids, Kan.

About $18,000 will be expended in the new electric-lighting plant at Galena, Ill.

The town of Crowley, La., has purchased and will enlarge the electric-light plant of H. Widmer.

The Peoria (Ill.) Gas and Electric company has increased its capital stock from $500,000 to $1,000,000.

The F. L. Smith Electric company of Harvard, Ill., has been incorporated, with $10,000 capital stock, to furnish electric light, heat and power. The incorporators are F. L. Smith, Eugene B. Smith and Leslie H. Smith.

B. E. Lennard, C. W. Smith, W. H. Greene and M. F. Home will establish an electric-light plant at Jasper, Fla.

In Dawson City the streets are now lighted by electricity and electric trolley cars are promised by January 1st.

The Gainesboro Telephone company of Sparta, Tenn., wishes prices on the installation of an arc-lighting plant.

Plans are being arranged for the establishing of a modern electric-light plant in Tipton, Ind., to be owned by the city.

The E. L. Shuford Manufacturing company of Hickory, N. C., wants estimates on a lighting plant for its cotton mill.

A conduit ordinance has been passed at Battle Creek, Mich., and all wires must be underground before January 1, 1902.

A new addition will be erected to the electric-lighting plant at Sea Isle City, N. J., under the direction of T. E. Ludlam.

The Laurel Light and Power company of Laurel, Miss., wishes to correspond with manufacturers of electric-light appliances and equipment.

The Durant Light and Power company of Bonham, Texas, has been incorporated for $10,000, by Z. Smith, R. S. Semple and M. Watson.

The Bristol Light and Power company of Bristol, Tenn., with capital of $25,000, has been chartered by E. J. Samford, C. D. Caldwell and others.

The contract for the new municipal electric-light plant in Richmond, Ohio, will be let on January 3d and construction will be commenced at once.

Plans and specifications for a lighting plant have been prepared and a franchise for its installation granted to Mr. Parmenter of Scotland, S. D.

The United Light and Power company of New York has been incorporated, with $1,500,000 capital, to furnish electric light, power and gas.

The Moore Mill and Gin company of Mangum, Okla., wants information and estimates on an electric-light plant for a town of 1,200 inhabitants.

W. G. Hyslop is at the head of a movement to have an electric-light plant installed at Blair, Wis. The citizens have raised $2,000 for the purpose.

The Vicksburg Water, Light and Power company of Vicksburg, S. D., has been incorporated, with $1,000,000, capital by M. O. Crumpler, S. S. Hudson and C. V. Pattison.

The government is to erect an electric-lighting plant at Fort Sheridan military post, Fort Sheridan, Ill. A. G. McPherson of Highland Park, Ill., will prepare plans and specifications.

The Southern Light and Power company of Vicksburg, Miss., with capital stock of $100,000, has been incorporated by B. W. Griffith, A. J. Grief, J. C. Shaffer and F. S. Mordaunt.

The Boise Payette River Electric Power company of Boise, Idaho, has been incorporated, to build and operate a railway and lighting plant. The authorized capital stock is $1,000,000.

The Crossville (Tenn.) Electric Light and Power company has been incorporated, with J. E. Burnett, president, for the establishment of an electric-light plant. O. W. Moore may be addressed.

The Arcadia (Fla.) Electric Light and Telephone company has been formed. A site has been selected and contracts let for buildings for its lighting plant. J. L. Jones may be addressed for information.

The Consumers' Heat, Light and Power company of Newport News, Va., which is building a plant in that city, will shortly ask the Hampton Town Council for a franchise to operate in that place.

The mayor of Covington, Ky., has signed an ordinance passed by the General Council, providing for issuing $75,000 four per cent. bonds for the purpose of erecting an electric-light plant in that city.

A charter was granted the Chickasha Water and Electric Light company to put in a plant at Chickasha, I. T. The capital stock is $250,000 and the incorporators are A. J. Campbell, H. B. Johnson and E. E. Blake.

The New York capitalists who have secured a controlling interest in the Universal Conduit, Light, Heat and Power company of Wilmington, Del., will shortly begin laying conduits in that city and erecting an electric-light plant there.

The Keswick (Cal.) Electric Power company recently purchased property on Mill Seat Creek, and has placed an order for a 2,000-horsepower electric plant. The company will supply power and light to Anderson, Redding, Keswick and other places.

The Merchants' Electric company of New Orleans, La., has been incorporated, with capital stock of $100,000, for the establishment of electric-light, heat and power plants. C. D. Crandall is president; L. C. Quintero, vice-president and M. Berr, secretary and treasurer.

The city of Nashville, Tenn., will want bids next spring on a plant having a capacity of 400 2,000-candlepower arcs and 5,000 incandescent lamps, to cost not more than $150,000. Mayor J. M. Head will furnish additional information and receive bids.

The Citizens' Electric Light, Gas, Heat and Power company of Danville, Ill., has been incorporated, with capital of $100,000, to operate light, heat and power plants. The incorporators are William V. Tobey, George L. Barney and Charles M. Lewis.

The National Manufacturing and Electric company of Assumption, Ill., has been incorporated by C. C. Corzine, A. Casalett and I. H. Cushing, with capital stock amounting to $25,000. The company will operate an electric-lighting and steam-heating plant, and manufacture brick and tile.

A 20-year franchise for an electric-light plant has been granted by the town of Steamboat Springs, Colo., to G. H. Smedley. A 440-volt, three-wire system will be installed, using 220-volt lamps. Construction has already been commenced and the plant is expected to be in operation within three months.

Sealed proposals will be received by the Department of the Interior, through the commissioner of Indian Affairs, up to December 27th, for the complete installation of an electric-lighting plant at the Chilocco Indian School, Oklahoma. Information will be furnished bidders by C. W. Goodman, superintendent of the school.

The property of the Suburban Electric company of Covington, Ky., has been sold at auction for $181,000 to a member of Senator Foraker's law firm. The purchaser is believed to represent the Cincinnati Edison Electric company. The company has a seven-year contract to light Covington, and it may attempt to compete with the Cincinnati company.

Mayor Moss of Newport News, Va., has vetoed the ordinance contracting with the new Consumers' Light, Heat and Power company to furnish 50 of the 100 new arcs that are to be installed for street lighting. His action was due to a proposition made by the old company to furnish the new lights and make a uniform rate of $50 a year on all arcs. The Consumers' company will fight the case in the courts.

The moving of the heavy machinery to the new power house of the Franklin (Ind.) Water, Light and Power company is progressing smoothly under the direction of General Superintendent A. M. Barron. The absence of the electric lights and the necessity of putting up with gas and oil lamps is having a most salutary effect in emphasizing the value of the former, and the starting up of the plant will be hailed with delight by all the citizens.

The advent of the new Evanston Yaryan Electric Light company in the lighting field at Evanston, Ill., has created a strong competition between it and the old Evanston Electric Illuminating company and the Northwestern Gaslight and Coke company. In order to meet this competition, the latter company has announced a reduction in the price of illuminating gas from $1.75 a 1,000 feet to $1.25, thus making the price of fuel and illuminating gas the same.

A recent issue of the New York Sun contained the following interesting data in regard to the expenditure of various cities for street lighting: Chicago spends $600,000 a year in street lighting; Boston, $650,000; Cincinnati, $425,000; Baltimore, $350,000; San Francisco, $245,000; Providence, $250,000; New Orleans, $230,000; Cleveland, $325,000, and Washington, a city of long distances, low houses and wide streets, $235,000. New York will expend for street lighting in 1901 $2,745,000 for gas and electricity. Of this total Manhattan uses $960,000; Brooklyn, $950,000; The Bronx, $350,000; Queens, $355,000, and Richmond, $130,000.

ELECTRIC RAILWAYS.

A railway power plant is to be built at Beaumont, Texas. I. D. Polk will furnish information to those interested.

The Chambersburg and Gettysburg (Pa.) Electric Railway company has been incorporated, with $50,000 capital stock.

The Bristol (Tenn.) Light and Power company will build a large electric-power plant for operating street cars and for other purposes.

The City Electric Street Railway company of Rome, Ga., will expend $25,000 in increasing its power and purchasing new equipment.

Electric traction throughout the Valley of Mexico, says Modern Mexico, is rapidly filling up the gaps between the city and its numerous suburbs.

The council of Kent, Ohio, has granted a franchise to the Portage Lakes Traction company for an electric line on Cherry and Mogadore streets.

The Nankin (Mich.) Township Board has granted to J. A. Russel and his associates a franchise for the Detroit, Plymouth and Ann Arbor railway.

A company has been incorporated under the laws of New Jersey to build a line from Delaware, Ohio, to Magnetic Springs and other lines leading to Richwood and Marysville. The capital stock of the

company is $400,000, and T. N. Kerr of Columbus is interested.

The Fort Wayne, Dayton and Cincinnati Traction company of Dayton, Ohio, has been incorporated for $20,000, by S. F. George, C. W. Gerhart, C. E. Swayne and C. A. Lucine.

The Natchez (Miss.) Electric Street Railway and Power company has been organized, with $150,000 capital stock, by A. G. Campbell, Captain J. W Lambert, T. Reber and P. W. Mulvihill.

B. P. Foster of Cleveland, Ohio, associated with other Cleveland capitalists, has applied for a franchise for an electric railroad between Painesville, Ohio, and Fairport Harbor, three miles north.

Extensive construction of street-railway lines is about to take place in Gothenburg, Sweden, under the direction of J. Sigfrid Edström, who has had charge of the reconstruction of the Zurich tramways.

The ordinance granting W. J. Canham and J. B. McIlwain a franchise through the city of Port Huron, Mich., for the proposed Port Huron and Lexington electric railway has been passed by the council.

The American Street Railway, Generating and Power company of East Orange, N. J., has been incorporated, with $2,500,000 capital stock. The incorporators are E. G. Johnson, F. D. Palmer and L. F. Vion.

The Uxbridge and Blackstone Street Railway company, which has lately received a franchise, will build a road which will constitute the completing link in the trolley line between Worcester, Mass., and Providence, R. I.

The Wurzburg electric railway of Wurzburg, Germany, has lately been put in operation. All the former horse-car lines have been absorbed and suburban extensions are planned for next spring. The fare is 10 pfennigs (2½ cents).

The Chicago Federation of Labor has declared itself in favor of municipal ownership of street railways in Chicago, mainly because it would help the working people by making it possible for them to get a uniform cheap fare to outlying districts for a radius of 20 to 50 miles.

A charter was granted to the Warren and Sheffield Street Railway company of Warren, Pa., with $66,000 capital stock, to build a street railway 11 miles long, from Glade Run, Warren County. The directors are D. H. Siggins, H. A. Jamison, W. W. Rankin and H. A. Siggins.

The Atlanta (Ga.) Railway and Power company contemplates constructing a track to Marietta. The company has applied to the board of county commissioners for the right to construct a single or double track along the Marietta road, northwest from a point near Exposition Mills.

The Chicago City Railway company contemplates the erection of large car barns on a tract of 15 acres at the southern terminus of the Wentworth avenue electric line in Auburn Park. Plans for the structures are now being completed. About $100,000 will be expended on the improvement.

The Calcutta Tramway company of Calcutta, India, is preparing to change its lines from horsepower to electricity, and the contract for the power station has been given to Dick, Kerr & Co. of London. The first shipments for the plant are expected to arrive in Calcutta in December of this year.

The St. Joseph and Benton Harbor Street Railway company, the Benton Harbor and Eastman Springs Electric Railway company and the Benton Harbor and St. Joseph Electric Light company have been consolidated, under the name of the Benton Harbor and St. Joseph Electric Railway and Light company.

The county commissioners have granted a franchise for the construction of an electric railroad on the Lafayette pike from Indianapolis, Ind., to Lebanon. The petitioners are J. M. Manker, A. A. McKain, E. Dawson and others. The road is to be called the Indianapolis and Lebanon Traction company.

The street-railway companies of Detroit, Mich., have again been reorganized under a new consolidation which will be known as the Detroit United Railway company. The new company will have a capital of $12,500,000, and Henry A. Everett of Cleveland and his friends will control 40 per cent. of the stock.

The Capitol Traction company of Washington, D. C., is rushing work on its extension on Pennsylvania avenue east from Eighth street. Other extensions will be begun as soon as this is completed, including a loop connecting the present Baltimore and Ohio depot with the site of the proposed new depot of that railroad.

A reorganization of the Muskegon (Mich.) Street Railway company has been effected, Theodore Barber and Liddon Flick of Wilkesbarre, Pa., purchasing a controlling interest in the property. The entire system will be relaid with 70-pound rails, additional power will be added at the power house, and eight new 50-passenger cars will be obtained. The interurban electric line that is being built from Grand Rapids to Muskegon will run its cars over the tracks of the Muskegon system as far as the Union depot.

Frank W. Hawley, vice-president of the Erie Canal Electric Traction company, is credited with the statement that a syndicate, having from £1,000,000 to £4,000,000 to invest, has been formed to connect London with places within a radius of 30 miles by electric surface lines, running in conjunction with the London underground lines.

At a meeting of the Decatur (Ind.) City Council last week an application for a franchise was presented by A. L. Scott, president of the Fort Wayne Traction company, J. W. Tyndall of Decatur and W. H. Harkins of Portland. The company wants to build an electric railroad from Fort Wayne to Portland and later on to Richmond.

The gross earnings of the Toronto Railway company last year were $1,333,542, an increase of $122,924 over those of the preceding year. After providing interest at from 4½ to six per cent. on bonds to the value of $3,000,000, the company was able last year to show a net profit of $432,816.43, as compared with $404,738.80 the year before.

The Town Board of Cicero, Ill., has prevented the laying of extensions to tracks in Oak Park by the Lake Street Elevated Railway company. The board claims that the railway company is using from two to three feet of the street without proper authority, and demands that the railway company pave the street in return for the use of a part of it.

The contract for building the Cherry Hill, Elkton and Chesapeake City (Md.) electric railway has been awarded to Thomas Deegan & Co. for $126,000. The tools for constructing the road are now at Elkton and the work of building the road will be begun at once and rapidly pushed to completion. It is very probable that the power house will be built at Elkton.

M. Fabre has submitted to the French government plans for a railroad to the summit of Mont Blanc. The most favored plan is to start the line from Les Houches, on the Savoy side, whence it is 11 miles to the summit of the mountain. The plans provide for 12 stations with every convenience for travelers. The trains will be propelled electrically, power being derived from the River Arve.

Negotiations have been begun in Grand Rapids, Mich., looking toward the extension of the Grand Rapids-Holland interurban line to Hammond, Ind., to connect with the South Chicago City Railway company's lines. B. S. Hanchett, secretary of the Grand Rapids Railway company, is representing the Grand Rapids' interests in the deal, and is mentioned as the probable president of the new consolidated company.

The famous new Cascade tunnel of the Great Northern railway in the Cascade range was recently opened for traffic. This three-mile tunnel was constructed from both ends at the same time, and when the engineering crews met they were within a small fraction of an inch in the working out of the plans. The new large 150-ton engines will be used in the tunnel for the present, using coal from Crow's Nest Pass, which is almost entirely free from sulphur, and therefore well fitted for tunnel use. Later electricity will probably be used through the tunnel, but the plans have not yet been perfected to that end.

It is reported that the Chicago, Evanston and Northern Street Railway company, which has asked for a 50-year franchise from the Evanston City Council, may effect plants with the Northwestern Elevated company for the use of the inclined plane at Wilson avenue, the terminus structure at that point, and the elevated tracks to the downtown district. A 10-cent fare will be charged between points north of Wilson avenue and the downtown district, five cents to be paid to the car conductor before reaching the incline, and a second fare to be collected by the elevated-railway company. The road is to run between Lake View and Grosse Point.

The Twin City Rapid Transit company of St. Paul was recently crippled for seevral hours by a lack of power. The street-railway company has its power house and dam below the falls, and for power relies upon the water that escapes through the tailraces of the flour mills or makes its way over the upper dam. The mills all shut down at 7:30 in the morning, which is something very unusual. It was less than five minutes later that the wheels at the power house below the falls ceased running, for the river between the lower dam and the falls was practically dry. The water coming down the river was checked by the dam, and nearly four hours elapsed before it rose to the crest and flowed over and provided power for the power house below.

The Larchmont (N. Y.) Railway company is abandoning its old horse cars, which have been running for 10 years, and putting electric cars in their places. The president, Charles Singer, has bought the most expensive cars in the market for use in the Manor section, which extends from the New Haven railroad to Long Island Sound, a distance of about a mile. They are the finest ever seen in Westchester County. Each car is vestibuled, all the railings are of polished brass and nickel, and an electric push-button is placed at each window, so that the passenger can stop the car without calling the conductor. Ten incandescent lights will illuminate each car at night, so that the passengers can see to read. Instead of the regulation uniforms the motormen and conductors will wear black suits and black silk caps bound with gold braid.

The British Westinghouse company has recently acquired the patents of the Newell electro-magnetic track brake. The brake consists of a horseshoe magnet suspended by heavy spiral springs and excited by current supplied from the car motors driven as generators by the momentum of the car. While the ordinary track brake has a tendency to lift the car from the track and thus reduce the effect of the wheel-rim hand brake, this brake operates by its attraction for the rail, and by a simple arrangement of levers the reaction of the magnetic brake is applied to the shoes on the wheel rim, thus increasing their effectiveness. The brake is put in operation by a backward movement of the controller handle.

AUTOMOBILES.

The Westchester Automobile Club has been formed by a number of New York men, among whom are W. K. Vanderbilt, W. K. Vanderbilt, Jr., Worthington Whitehouse and Albert G. Bostwick. The club proposes to establish supply stations for automobiles on the country roads leading to the Ardsley Casino, Knollwood Country Club and the Westchester Country Club.

PUBLICATIONS.

The Ashton Valve company, 271 Franklin street, Boston, Mass., has issued for the new year an attractive calendar, which bears an excellent photogravure reproduction entitled "Please Bite."

B. E. Buell, Havana, Cuba, agent for the insulating products of the Philip Carey Manufacturing company of Lockland, Ohio, has issued a pamphlet containing testimonial letters from customers in Cuba. The pamphlet is printed in Spanish and is entitled "Larga Experiencia."

A new illustrated catalogue of the Sturtevant engines for electric-light plants and general high-grade work has recently been issued by the B. F. Sturtevant company of Boston. Various types of high-speed vertical and horizontal, simple and compound engines are illustrated and described.

The General Incandescent Arc Light company of New York city has issued bulletins numbered 50, 82 and 83, devoted to illustrated descriptions and price-lists respectively of G. I. pure drawn-copper knife switches, alternating multiple enclosed-arc lamps and alternating series enclosed-arc lamps and regulators.

The Joseph Dixon Crucible company, Jersey City, N. J., has issued a very interesting pamphlet, the leading article of which is entitled "Where the New Century Will Really Begin," by John Ritchie, Jr., it being reprinted from the Ladies' Home Journal. The rest of the booklet treats of the evolution of school pencils and describes the Dixon pencils and crayons.

"A Study of Certain Shades and Globes for Electric Lights as Used in Interior Illumination," by William Lincoln Smith, originally appearing in the September number of the Technology Quarterly, has been reprinted in pamphlet form. From the results obtained in his investigations, it is the author's opinion that the Holophane type of shade is greatly superior in general results to any other investigated.

The C. W. Hunt company of West New Brighton, N. Y., has recently issued a catalogue descriptive of the Hunt noiseless conveyor and other machinery for handling coal, ashes and similar materials in power stations. Illustrations and sectional elevations are given of a number of power stations equipped with the Hunt system and all the details of the conveying apparatus are fully explained and exceedingly well illustrated.

The official report of the nineteenth annual meeting of the American Street Railway association, held in Kansas City last October, has been issued by Secretary T. C. Penington from the office of the association at Chicago. The pamphlet contains a full account of the proceedings of the convention, a portrait of the retiring president, John M. Roach, and illustrations of the original Convention Hall at Kansas City, before and after it was destroyed by fire.

The Westinghouse motor-driven air compressors built by the Westinghouse Air Brake company of Pittsburg are treated in a catalogue recently issued from the press of the Westinghouse companies' publishing department. The machines described have been designed to supply the demand for small electrically operated air compressors to be used on electric cars for car-brake and train-signal operation. Three views of the combined pump and motor are shown in the illustrations, while the reading matter covers a full description of the apparatus.

SOCIETIES AND SCHOOLS.

The annual meeting of the Underwriters' National Electrical association was held in New York city on December 11th and 12th. A large number of delegates were in attendance from all over the country, and some important decisions were reached, which will be embodied in changes in the National Electrical Code for 1901.

ELECTRICAL SECURITIES.

The Metropolitan Street Railroad company of New York has declared the regular quarterly dividend of 1¾ per cent., payable January 15th.

The Westinghouse Electric and Manufacturing company has declared the regular quarterly dividend of 1¾ per cent. on its preferred stock, payable January 2d.

A dividend of four per cent. is to be paid to the holders of the preferred stock of the Nassau Electric Railroad company of Brooklyn, on December 31st. This is the first dividend ever declared by the company, which was leased two years ago by the Brooklyn Rapid Transit company. At that time it had $6,500,000 preferred stock, $8,500,000 common stock and $13,000,000 bonds.

The mortgage debt of the Chicago City Railway company, amounting to $4,619,500, due July 1, 1901, is to be liquidated by the issue of stock to the amount of $5,000,000, according to officials of the company. Stock of the company is now quoted at 260. The total capitalization is $14,000,000, of which all but $1,000,000 is outstanding. The increase in capitalization may reduce the dividends on the securities from 12 to eight per cent. per annum. The average earnings on the capital stock have been slightly more than 13 per cent. In 1893 the earnings amounted to a little more than 23½ per cent.

MISCELLANEOUS.

Several German firms have acquired waterpowers in Norway of from 20,000 to 40,000 horsepower each, for the production of calcium carbide.

Commissioner Peck has submitted his report of expenditures in connection with the Paris Exposition. The items include $8,960 for electrical installation, $7,238 for telegrams and cablegrams and $4,593 for electric lights.

In Boston recently a vault door of chrome steel three inches thick was opened with the aid of the electric arc. Although many safes have been opened by this method, this is said to be the first time that a vault has been so operated upon.

Charles H. Dickey of Baltimore is the inventor of an electric protective device for elevators, providing for the automatic stopping of the cage if a parcel or body of any kind should happen to be projecting so as to strike a floor in passing. A company has been capitalized for $100,000, to manufacture the device in Baltimore.

H. H. Humphrey, the well-known electrical engineer of St. Louis, is preparing plans for a lighting and power plant for the DeBeers Explosives Works at Cape Town, South Africa. This installation will consist of a power-generating plant and about 1,000 horsepower in motors to drive air compressors, waterworks pumps and a refrigerating outfit.

There was recently made in the foundry of the Edward P. Allis company of Milwaukee what is believed to be the largest single casting ever poured. The casting weighs 110,000 pounds and is to serve as the bed plate for a blowing engine for the Carnegie Steel company at Pittsburg. In the process of its construction there was poured about 126,000 pounds of metal. The plate is 23 feet 10 inches long, nine feet 9½ inches wide and has an extreme length of five feet in the center.

A base-measuring apparatus which has been perfected in connection with the summer-school work of the civil-engineering department of the Massachusetts Institute of Technology has recently been tested by the Coast and Geodetic Survey in Washington, and is about to be used in the important Lampasas base in Texas. One part of the apparatus determines very accurately the mean temperature of the tape by measuring its electrical resistance by means of a special form of thermophone devised by two graduates.

A method of manufacturing glass by means of the electric arc is said to have been devised in Germany. The furnace consists of a series of successive steps, made of refractory material, upon each of which rest the terminals of carbon rods between which the arc is to be struck. The raw material is filled, in a powdered form, into a funnel, and flows upon the highest step of the stairway, where it is fused by the electric arc. To clear and purify the liquid mass of glass it is run down two other steps, and is there acted upon again by electric arcs; the operation is continuous.

The windpower electric station of the little Prussian town of Wittkiel, near Kappeln, is said to have an efficiency hitherto quite unlooked for in a plant of the kind. Its success is attributed to a local engineer's improvements in the windmill, which is made of large size, and is kept at its normal speed of 11 revolutions per minute by an automatic adjustment of the vanes. This windmill is 39 feet in diameter, with an effective wind area of about 1,000 square feet, and can develop more than 30 horsepower. The power is used to drive a dynamo, which, at 700 revolutions, gives 120 amperes at 160 volts, the full electromotive force being reached with a wind velocity of eight feet a second.

Witherbee, Sherman & Co. of Port Henry, N. Y., are about to undertake some very interesting experiments in the concentration of the magnetic ores which they mine. The fines of the high-grade "Old Bed" ore, which runs about 61 per cent. in iron, are to be screened from the coarse ore and then subjected to crushing and magnetic separation, the idea being to carry them up in grade and subsequently work up the tailings so as to secure a high phosphorus product, suitable for fertilizer trade. At the same time it is expected that the value of the coarse ore will be increased to about 68 per cent. in metallic iron, and that the phosphorus will be reduced to near the Bessemer limit.

TRADE NEWS.

The Freeman Power Supply company of Libertyville, Ill., has been incorporated, with a capital of $20,000. The company will produce and sell electrical and mechanical power. The incorporators are Ernest Freeman, M. M. Harms and Theodore K. Jackson.

A fire which started in the varnish room of the Elwell-Parker Electric company of Cleveland early in the week resulted in a loss of about $100,000 to that company, and about $400,000 worth of property of the Brown Hoisting and Conveying Machine company was destroyed. The loss is said to be largely covered by insurance.

The Kentucky Electrical company, Owensboro, Ky., manufacturer of incandescent lamps, motors and dynamos, is among the first to present its friends and patrons with a calendar for the first year of the new century. The calendar is made very attractive with the handsome face of a young lady wreathed with lilac blooms.

Shipments of electrical machinery from the United States to various parts of the world are attracting attention by reason of their unusual size and value. The Westinghouse and General Electric companies are foremost in this export trade. The greatest demand at present seems to come from Italy. The steamship Aller, on her last trip cast, had over $30,000 worth of electrical machinery for Genoa, as well as electrical goods and laundry apparatus for Milan.

A decree was entered on December 5th in the United States Circuit Court for the Eastern District of Pennsylvania in a recent action of the Diehl Manufacturing company against the Marietta Manufacturing company and H. Burd Cassel, receiver, for infringement of letters patent (Nos. 465,360, 465,361, 537,679 and 585,250) relating to electric ceiling fans. This decree declares these patents to be valid and to have been infringed by the Marietta company, and orders that a perpetual injunction be issued enjoining the defendants from further infringement.

The Sturtevant Engineering company has recently moved its London (England) office to 147 Queen Victoria street, that city, in order to secure the increased accommodation necessary for its rapidly growing business as the European representative of the B. F. Sturtevant company of Boston, Mass. A new branch office has been established at 31 Rue de Provence, Paris, and a change made in the location of the Glasgow office to 45 Hope street. The offices at Berlin, Stockholm, Amsterdam and Milan remain the same. In order to provide facilities for conducting its growing local business, the B. F. Sturtevant company has removed its Chicago office to much larger quarters at 281-289 South Clinton street.

The Storey General Electric company, successor to the Storey Motor and Tool company, has just completed the removal of its offices and factory from Trenton, N. J., to a larger and newly equipped factory at Harrison, N. J. The new company, which is capitalized at $3,500,000, is the outgrowth of the steadily increasing demand for the well-known Storey motors, and with the larger facilities in shop room, machinery, etc., which are at its disposal, the company will soon be in a position to handle a greater volume of work. I. E. Storey, the former proprietor of the Storey Motor and Tool company, is president of the new concern, and has associated with him men who have both the ability and capital to push the new company forward to a prominent position in the electrical manufacturing field.

The following interesting letter from F. E. Drake, director of machinery and electricity for the United States commission at the Paris Exposition, addressed to the Ball Engine company, Erie, Pa., explains itself: "The end of the exposition having arrived, I feel it my duty and privilege to inform you, officially, concerning the operation of the 300-horsepower, tandem-compound engine which you supplied this department for the operation of the power generator at the United States Machinery building at Vincennes. Our plant was the first of the entire exposition to be put in active service, and since the starting of your engine we have never had a moment's shutdown or the least difficulty which could, in any way, be traceable to your engine. It has operated noiselessly and continuously, and has made many friends among the foreigners who have visited the plant. I must congratulate you upon the workmanship and execution, in all directions, of the engine, as was evidenced by the fact that we procured for you at the hands of the International Jury of Award a gold medal, which is an exceedingly high honor for an engine of this size and class."

BUSINESS.

The Electric Appliance company, Chicago, is extremely proud of the fact that its Packard lamps were adopted by the United States government to light its exhibit at the Paris Exposition. The company states that these lamps are being adopted by a greater number of users in both the local and foreign markets than ever before in their history.

An interesting exhibition of the fire-fighting qualities of Kilfyre, the dry fire extinguisher put on the market by the Monarch Fire Appliance company, was given near the Chicago City Hall on December 15th. A pine structure, closed on three sides and on top, was filled with papers, laths and other combustible material and the whole saturated with oil. When ignited the structure was enveloped in a fierce blaze, and the heat was intense, but a little of the powder thrown into the fire at the bottom quickly extinguished the whole blaze. The test was a very satisfactory one in all respects.

The Emerson Electric Manufacturing company, St. Louis, Mo., announces that it is designing several new types of alternating-current desk and bracket fans and one new type of alternating-current ceiling fan, which it expects will combine advantages not found in motors of these types at present on the market. These new types will be suitable for operation on low-frequency current, and the manufacturer will be pleased to send samples of them to any responsible electrical dealer or central station for examination and test, freight charges prepaid. The manufacturer expects that these samples will be ready for examination within a few weeks.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 11, 1900.

663,412. Telephone System. William W. Bennett, Mesquite, Texas. Application filed February 2, 1900.

The system covered by this patent comprises a receiver switch connected through contacts with the line wire and the ground, the ground connection containing a signal. The switch is adapted to engage the contacts when the receiver is in place, and a second series of contacts is provided for engagement by the receiver switch when the receiver is disengaged. A primary induction circuit includes two of the contacts, the secondary having one terminal grounded beyond the signal, and its opposite terminal connected with one terminal of the receiver. The second terminal of the receiver is connected through a third contact of the second series to the receiver switch, and a finger lever is in circuit with the receiver switch. There are separate contacts for alternate engagement by the finger lever and separate line wires connected with the contacts.

663,420. Arc-light Hanger. George Cutter, assignor to George Cutter company, Chicago, Ill. Application filed April 17, 1900.

This hanger comprises a pair of switching devices, each consisting of a pivotally supported swinging lever provided with a horizontally extending arm or extension arranged on the sides of the pivotal support opposite the lever, and contacts with which the levers can make connection. Springs normally hold the levers against the contacts. The bracket is adapted to support the lamp, being provided at its upper end with lateral projections and conductors extended on the lamp bracket or hanger from the lamp upwardly to the lateral projections and beneath them, and having the insulation removed from their lower surface below the projections, whereby the conductors can engage and rest upon the arms or extensions of the switching devices and can operate the devices when suspended therefrom.

663,454. Electric Arc Lamp. Frederick W. Martin and Frank Stewart, Hamilton, Canada, assignors of one-half to Brown, Boggs & Co., Hamilton, Canada. Application filed May 12, 1900.

A centrally suspended main supporting tube is provided with a vertical bearing with horizontal flange at its lower end, and carries upper and lower nuts against the bearing to fasten it. Side tubes, a lower ring and an intermediate rine are secured to the bearing, and flange collars on the tubes and upper nuts fasten the rings and flange together and suspend the side tubes. The lower globe support has a horizontal flange, and lower collars on the side tubes fit against the upper side of the flange. The ends of the tubes are screwed into the flange and are flush with its lower side.

663,460. Telegraph Repeater. Charles D. Olsen and Thomas W. Carroll, Denver, Colo. Application filed August 17, 1899.

This instrument has two main magnets and two auxiliary magnets, one main and one auxiliary magnet forming a set. There are make-and-break devices for the magnet circuits in each set, each device comprising a pivoted lever carrying the armature of both magnets in the set and a small pivoted movable lever controlled by the first lever. The device is operated by one set of magnets controlling the circuits of the other set.

663,461. Maximum-demand Meter. Eustace Oxley, Lynn, Mass., assignor to the General Electric company of New York. Application filed July 31, 1899.

The meter described comprises a conducting liquid communicating with a reservoir on one side and a tube on the

other and traversing a magnetic field at a suitable point. Electrodes within the field communicate with a consumption circuit, and a valve prevents back-flow of the liquid when raised above a predetermined height, the valve being provided with a hand-controlled restoring device to permit back-flow of the liquid to reset the meter.

663,465. Programme Clock. Karl Puttkammer and Friedrich Orthmann, Charlottenburg, Germany. Application filed January 9, 1900.

A clock is fitted with a rotating division disk. Pins are adapted to be inserted into the holes in the disk corresponding to the times at which one or more electric circuits are to be closed, there being as many rows of holes for pins on the division disk as there are electric circuits. A number of toothed wheels continually rotate with the division disk. Levers are mounted to fall into the teeth of the wheels, and another set of levers interferes with the first set, and is actuated by the pins to release the latter and close the respective electric circuits at the predetermined times.

663,466. Workman's Time Check. Karl Puttkammer and Friedrich Orthmann, Charlottenburg, Germany. Application filed January 9, 1900.

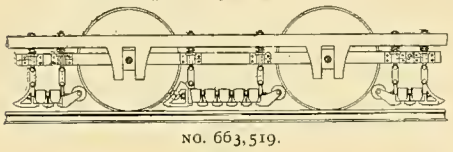
The invention covers an apparatus for checking workmen's time, in which a guide chute is pivotally supported and provided with controlling pins. An electromagnet and armature control the guide chute by means of the pins. Counters are received from the chute, and channels conduct them to their receptacles.

663,467. Process of Producing Electric Arc Lights. Ewald Rasch, Nuremberg, Germany. Application filed May 7, 1900.

A process of producing light is described which consists in bringing electrodes into arcing juxtaposition, one, at least, of the electrodes being composed of a length of a good conductor and a mass of second-class conductor non-conducting when cold and conductive when heated, passing current through the good conductor of such intensity as to maintain an arc and melt off the good conductor in the neighborhood of the arc, thereby heating the second-class conductor in the neighborhood of the arc to a conducting temperature, and thereupon maintaining the arc between the second-class conductor and the other electrode, and maintaining the current at such intensity as to sustain the arcing portion of the second-class conductor at a luminous temperature.

663,489. Electrical Connection. William B. Cleveland, Cleveland, Ohio. Application filed February 7, 1900.

Two conductors are shown, the one homogeneously incorporated in the other, the incorporating conductor being compressed upon the end of the incorporated conductor and surrounding it at its point of entrance.



NO. 663,519.

663,490. Method of Forming Electrical Connections. William B. Cleveland, Cleveland, Ohio. Application filed July 12, 1900.

The claims cover the method of forming an electrical connection between two conductors which consists in surrounding the one with the other or in inserting the two ends in a sleeve of ductile metal, and uniting the two in varying degrees of intimacy by pressure, such pressure being in substantially regular variation and sufficient to cause a portion only of the inclosing conductor to form a homogeneous structure with the inclosed conductor.

663,491. Controller for Electric Motors. Charles A. Dresser, Chicago, Ill., assignor to G. A. Edward Kohler and Franklin W. Kohler, Chicago, Ill. Application filed May 10, 1900.

The movable element of a rheostat is controlled by a solenoid and core and adapted in the retracted position of the core to open the circuit. An electromagnet controls a part, adapted to be interposed in the path of the core to prevent the same from moving to the circuit-opening position. A main switch is controlled by an electromagnet or solenoid, and a switch controls the circuit through the electromagnets, opening it so as to de-energize the latter and thereby first open the circuit at the switch and subsequently at the rheostat.

663,496. Electric Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed February 11, 1899.

The essential part of this invention is a punched clip formed of an integral strip of conductive metal doubled upon itself and having its closed end bent at an angle against the back of the switchboard, the free ends projecting through the switchboard and held in place by a slotted plate through which they pass and a block placed between them and secured in position.

663,510. Telephone Switchboard. William S. Paca, Erie, Pa., assignor of one-half to Peter H. Adams, Erie, Pa. Application filed February 16, 1900.

A jack for telephone switchboards is constructed of a spool of magnetic metal, an arm extending backward therefrom carrying three insulated contact tongues, one of which forms part of one side of the line circuit, while the jack frame forms the other and the other two forming connections for a normally open local-battery circuit, and a coil surrounding the spool and connected with the tongues in the local-battery circuit. The contacts are adapted to be closed by means of a switch plug, both as to the line circuit and the local-battery circuit.

663,511. Telephone Switchboard Apparatus. William S. Paca, Erie, Pa., assignor of one-half to Peter H. Adams, Erie, Pa. Application filed February 16, 1900.

Each subscriber's line is connected to jacks on each of several duplicate sections of a multiple switchboard connected up in circuit with a local battery. Switch plugs are adapted, when inserted in any jack of a series, to connect a subscriber's circuit, and also connect with one side of the local circuit all the jacks of the series so plugged upon, and a coil in the switch plug is connected with one side of the local-battery circuit and adapted to complete such local circuit through any jack of the series plugged in upon, by bringing the tip of such plug into contact therewith, whereby the point of such plug becomes magnetized.

663,519. Electric Rail Brake. Rudolf W. M. Schiemann, Dresden, Germany. Application filed May 22, 1899.

A multipolar electromagnet comprises a conductive core, conductive spools carrying the wire coils threaded on the core, and coils wound and interconnected to form a multipolar electromagnet with alternating positive and negative poles. Brakeshoes are secured to the core between the flanges of the spools and partly surrounding the latter, in combination with outer brakeshoes secured to and partly surrounding the end spools of the electromagnet. The outer brakeshoes have segmental faces and are provided with anti-friction rollers. (See cut.)

663,524. Incandescent Lamp. Samuel D. Washburn, Boston, and Clarence H. Tinkham, Cambridge, Mass., Mr. Tinkham being assignor to Fred F. Rhodes, Boston, Mass. Application filed March 12, 1900.

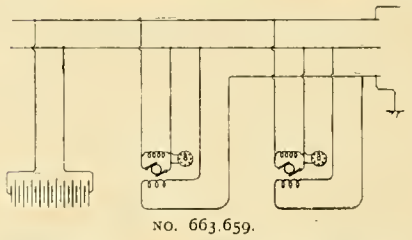
The subject of this patent is an improved incandescent lamp comprising an exhausted bulb containing a glass tube extending into the bulb and sealed to its neck, at the outer end, and at the inner end sealed around the wires which support the filament. A disk of metal within the exhausted bulb is mounted on the glass tube near its inner end.

663,528. Electrically Operated Clip for Tentering Machines. William Whiteley and William Whiteley, Jr., Huddersfield, England. Application filed July 27, 1900.

A traveling chain and a clip moving with the chain and provided with a pivoted jaw are combined with a catch also traveling with the chain and normally holding the jaws open, and a stationary electromagnet arranged adjacent to the path of the catch and operating when opposite to it and energized, to retract it and thereby release the pivoted jaw.

663,532. Flexible Supporting Structure for Electric Lamps. William F. Brewster, New York, N. Y. Application filed June 12, 1900.

Each receptacle consists of two parts, one part connected to the electrical conductors and carrying a socket for the lamps, and the other part connected to an adjustable connecting device. A series of adjustable connecting devices are provided and means for defining the position of the receptacles relative to each other.



NO. 663,659.

663,600. Electric Railway. Theophilus P. Chandler, Philadelphia, Pa. Application filed October, 22, 1900.

A suspended conductor is sustained at intervals by laterally projecting thin brackets or plates of less thickness than the diameter of the conductor. The trolley device consists of a vertically movable frame and two grooved collector wheels pivoted to the frame, one being arranged above and the other below the conductor, and in which the flanges of the two wheels on the side of the conductor most distant from the bracket or supporting plate are normally closer together than are the corresponding flanges of the wheels on the side of the conductor adjacent to the supporting bracket or plate.

663,609. Dynamo or Motor. George L. Martin, New York, N. Y. Application filed August 24, 1900.

The claim describes a machine with a rectangular casing having rounded corners and edges and provided with poles, the poles comprising a shell integral with the casing, and an inserted steel core extending through the shell and forming part of the face of the pole.

663,625. System of Electric Traction. Marco T. de Felice, Rome, Italy. Application filed June 9, 1900.

Contacts at intervals along a track and adapted to be rubbed by a shoe on a passing car are connected to a current-supplying conductor, a branch working conductor and an electromagnetic switch between the supply conductor and each of the contacts. Each switch has a coil normally communicating with the corresponding contact and with a return conductor. A second coil is located in the branch working conductor and holds the branch closed while in use, and a differential coil in a shunt to ground or a return conductor from the branch working conductor is employed for retracting the switch.

663,659. System of Electrical Distribution. Henry R. Kent, New York, N. Y., assignor to the Westinghouse Machine company of Pennsylvania. Application filed May 1, 1900.

A system of parallel operation is described in which a secondary battery and one or more compound-wound dynamo-electric generators are connected in parallel. The positive terminals of the battery and the armature or armatures are connected to one bus-bar, a second bus-bar carries one terminal of each series field winding and an equalizing bar is in connection with the other terminal of each series field winding and the negative terminals of the battery and the armature or armatures. (See cut.)

663,695. Electrical Interrupter. James M. Davidson, London, England. Application filed June 7, 1900.

A tank contains a fluid conductor and a fluid dielectric. A disk of insulating material carries contacts completely immersed in the fluids, and is mounted upon an inclined shaft. Means are provided for rotating the shaft.

663,698. Electric Arc Lamp. Josef H. Hallberg, Peabody, Mass., assignor to the Standard Thermometer and Electric company, Peabody, Mass. Application filed July 16, 1898.

(See description and cut on page 394.)

663,719. Electrolytic Apparatus. Hermann Becker, Paris, France. Application filed June 26, 1899.

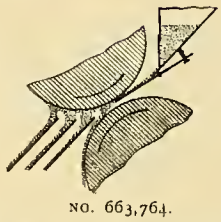
This apparatus is for the separation of metals lighter than the electrolytes from which they are extracted. A collecting device of metal of a recessed conical form has its internal face in position to be immersed in the electrolyte in fusion above the cathode, with its upper face uncovered by the electrolyte, and has a chamber for receiving a current of cooling water. A vessel has a contracted part at its lower end and means for cooling the contracted part. It also contains an insulating stopper traversed by a support for the cathode, a cathode having a tapering external surface for facilitating the rise of the globules of metal, an anode surrounding the cathode, suitable electric conductors for connecting the anode and the cathode with the means for producing the electricity, and a conductor for connecting the collector in shunt with the current conductor feeding the cathode.

663,740. Trolley for Electric Cars. William H. Earl, Painesville, Ohio. Application filed August 14, 1900.

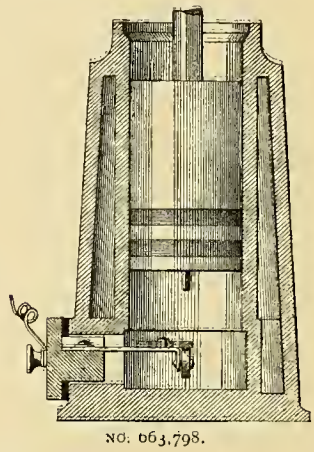
An arm is hinged to the upper end of the trolley pole to swing laterally, and the support for the trolley wheel has a pivotal connection with the arm and is adapted to turn about a vertical axis.

663,750. Electric Contact or Current-taking Device. Ernest Greil and Emile Andiger, Paris, France, assignors to the Electric Lighting Boards, Limited, London, England. Application filed January 10, 1900.

Parallel conducting bands are laid in the grooves of a table or other support and connected alternately to the positive and negative poles of an electric generator. A pair of conducting projections are secured to an insulating block and each is adapted to penetrate one of the contacts. A separate contact plate is suitably connected to each of the projections.



NO. 663,764.



NO. 663,798.

663,764. Magnetic Separator. Emil Kreuser and Hugo E. Langguth, Mechernich, Germany, assignors to Mechernicher Bergwerks-Actien-Verein, Mechernich, Germany. Application filed June 11, 1900.

This patent covers an apparatus for separating substances of different magnetic susceptibility, consisting of two magnets arranged one above the other, the upper one comprising a rotatable cylindrical magnet, a pivoted inclined slide or chute having no magnetic susceptibility, the lowermost end of the slide or chute being projected between the magnets into the center of the magnetic field at the point of least distance between the magnetic surfaces, and a spring arranged to hold the lower end of the slide in yielding contact with the upper rotatable magnet. (See cut.)

663,781. Circuit-breaker. George W. Parsons, La Grange, Ill. Application filed April 6, 1900.

The important feature of this magnetic circuit-breaker is an electrically controlled dashpot containing oil which operates to damp the motion of the movable magnetic core.

663,783. Selective Signal System. Frank A. Pickernell, Newark, N. J., assignor to the American Telephone and Telegraph company of New York. Application filed August 14, 1900.

Two main conductors of a telephone circuit connect four substations with a central station; a source of alternating current is provided, also a source of pulsatory or intermittent current. An electromagnetic bell is installed at each of the substations, two connected in normally open-earth branches of one main conductor, and two in similar branches of the other main conductor, the two bells of each set being respectively organized or adjusted to respond to pulsatory or intermittent currents of diverse direction. An alternating-current relay at each station is connected in an earth branch independent of that containing the bell, the relay branch at each substation being associated with the main conductor which at such substation is not associated with the bell branch, and the relays being each arranged to close, through the attraction of its armature, the normally open branch at its own station. Each of four keys, all at the central station, controls a different relation of the terminals of the main conductors and sources of current, in such manner as to transmit an alternating current over a determinate one of the main conductors, and a pulsatory or intermittent current of determinate direction simultaneously over the other main conductor.

663,788. Trolley Pole. William Schroeter and August Kautzmann, Dallas, Texas. Application filed June 11, 1900.

A peripherally grooved trolley is carried by the pole, and a vertically swinging wire-finding arm is mounted at one side of the trolley and concentrically with respect thereto, and has a lateral finger arranged in the peripheral groove of the trolley, and means connected with the wire-finding arm whereby it may be adjusted by a person on the car.

663,798. Igniter for Explosive Engines. Gustavus A. Tuerk, Chicago, Ill. Original application filed March 23, 1899. Divided and this application filed December 29, 1899.

A contact pin is carried by the piston, and a spring-insulated finger by the cylinder. A rotatable contact disk on the finger is so placed with relation to the contact pin that the pin will contact with the disk near the margin thereof. (See cut.)

Western Electrician.

EVERY SATURDAY.

Vol. XXVII. CHICAGO, DECEMBER 29, 1900. No. 26

Evanston Central Station for Heating and Lighting.

There are probably but few instances in this country where it may be truthfully said that electricity is produced simply as a by-product. However, the combination in Evanston, Ill., of a hot-water system, supplying heat to a territory of perhaps six or eight square miles in area, and an electric-lighting system, both distributing from the same central station, does seem to furnish an interesting case of this kind.

The Evanston Yaryan company was granted a franchise by the City Council of Evanston in February of this year, which permitted the company to use the streets and alleys for the running of its pipes and wires. A site for the station was selected on Grove avenue, just east of the Chicago and Northwestern railroad tracks, and construction work was commenced on June 30th. The installation of the station equipment and the laying of the hot-water mains and the electric-lighting cables were hurried forward, so that heat was put on the pipe system on October 6th and the lights were started on October 20th. Since that time the station has been in continuous operation.

The station building has a pleasing exterior, as may be judged by the illustration, Fig. 2, on the next page. The building is constructed of brick, on six and eight-foot foundations resting on concrete footings. Pressed brick is used for the exterior, while a selected Illinois brick forms the interior walls. A steel-trussed roof covers the entire building. The station is 75 feet wide and 90 feet deep and is divided into an engine room 50 by 40 feet in size, a pump room 25 by 40 feet and a boiler room 50 feet wide and 75 feet deep. In the boiler room are installed two 350-horsepower, Sterling water-tube boilers equipped with Jones underfeed, mechanical stokers. A working pressure of 120 pounds is carried. A forced draft is used in connection with the boilers, the hot gases and smoke being exhausted through a steel stack 60 inches in diameter and rising 40 feet above the boiler breeching. The draft is furnished by means of an American Blower company's equipment, consisting of a 100-inch fan, directly driven by a six by six-inch vertical engine. As an auxiliary source of power, a Crocker-Wheeler, 9½-horsepower motor is installed to take the place of the engine in case of accident. Illinois Riverton coal screenings are used as fuel. Two 700-horsepower pumps supply the boiler feed water. Water to supply the leakage in the hot-water heating system and also to add to the boiler supply is drawn from a 315-foot artesian well.

The boilers are connected by a 10-inch main steam header, from which lead a six and a four-inch bend to the engines in the engine room and a five and a three-inch pipe line to the pump room. The steam equipment in the engine room, a view of which is shown in Fig. 1, consists of two direct-connected units. The unit seen in the foreground is an 18 by 20-inch, four-valve, Russell engine, connected to a 150-kilowatt, 220-volt, direct-current, Western Electric generator. The other unit consists of a 14 by 14-inch, single-valve, Russell engine and a 75-kilowatt, 220-volt, direct-current, Siemens & Halske generator, of the external-armature type.

A three-wire, 220-volt system, with compensator and 110-volt lamps, is used for the lighting circuits. The compensator, seen in the foreground of Fig. 1, is a 13-kilowatt, Crocker-Wheeler machine. The switchboard (18 by eight feet in size) is of Italian white marble and consists of eight panels. At present the board has three generator panels, a compensator panel and two feeder panels, the two blank panels being reserved, one for an additional generator and one for extra feeder circuits. But two generator panels are in use, they being connected to the two 220-volt generators. The third panel is designed for a 110-volt generator, which the company plans to install in the near future. To use this low-voltage machine, the board has been designed so that the three-wire feeder system can be changed to a two-wire system. This is accomplished by using the neutral as a positive wire and the two outside wires as the negative part of the circuit. This 110-volt circuit, with a small generator, will be used only in the daytime, when the load is light.

There are three feeder circuits leading from the switchboard, and as one of the circuits carries a much heavier load during the evening hours than the other two, two sets of bus-bars have been provided, so as to keep the voltage on the circuits about the same. The upper or low-pressure bus is connected to the two lighter circuits and is carried on one machine, while the lower or high-pressure bus carries the heavy circuit on the other machine. In this manner the voltage of the two generators can be adjusted so as to maintain an even potential at the distribution points on the feeder

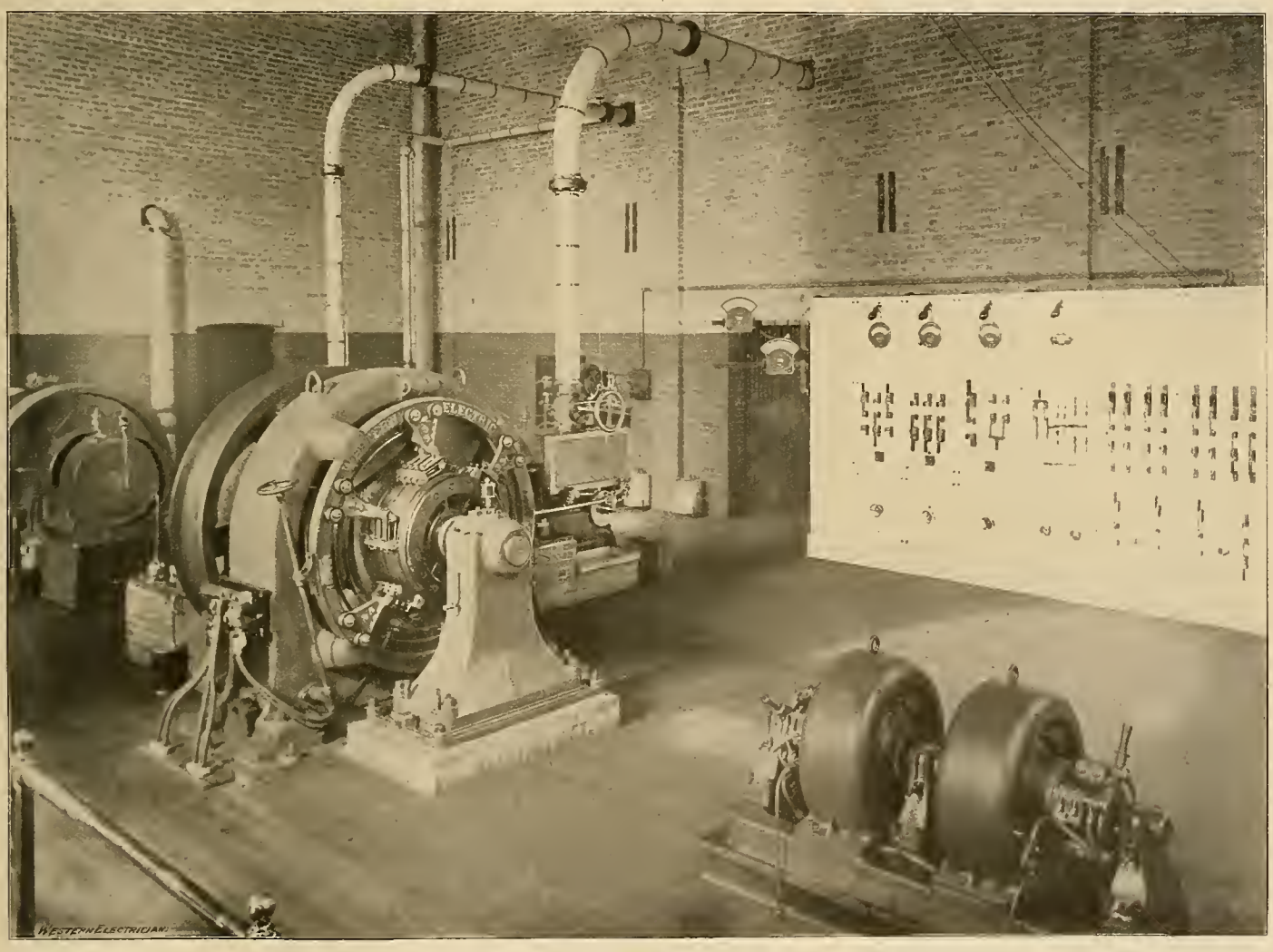


FIG. 1. EVANSTON CENTRAL STATION FOR HEATING AND LIGHTING.—ENGINE ROOM.

circuits. Pressure wires are carried back from all the manholes at which the mains branch, so as to indicate the potential at those points.

In equipment, each of the two generator panels at the left of the board contains an ammeter, three single-pole, double-throw switches, a rheostat handle and push switch for voltmeter readings. The third panel provides for the 110-volt machine not yet installed, while the fourth is the compensator panel. On this latter are mounted a differential ammeter, compensator switch, starting box and rheostat switch, a switch for the station lights and a switch for a bank of 100 incandescent lamps, installed in the engine room, which provides a 50-ampere load in case the compensator fails. The two

FIG. 2. EVANSTON CENTRAL STATION FOR HEATING AND LIGHTING.

feeder panels provide for four circuits, one not being in use. Two 12-point voltmeter switches are used to give readings of the pressure wires running from the manholes. Three voltmeters are suspended on swinging brackets at the left of the board (one being temporarily removed when the photograph was taken). One of these is a differential voltmeter, reading to 300 volts each way, and is used in throwing in the machines in multiple. The other two voltmeters read to 150 volts and indicate the voltage on the two legs of the compensator and are also used for the line pressures. Weston instruments are used on the board, with G. I. switches.

The three feeder circuits consist of 400,000-circular-mil cable, each circuit being about 1,600 feet long. The wires are carried underground across streets and where there are no alleys. About one-third of the system is underground, the wires consisting of Standard underground, paper-insulated cable, ran in McRoy vitrified-clay conduits of two, four and six-duct sections. The distribution points are located in manholes, where the mains are connected to the feeder branches by Tailleur junction boxes. One feature of the underground work was the requirements laid down in the company's franchise that no more than 500 feet of ditch should be open at any one time. The spirit of the franchise was strictly adhered to, the repairing of the streets being very carefully done. The ditches were filled

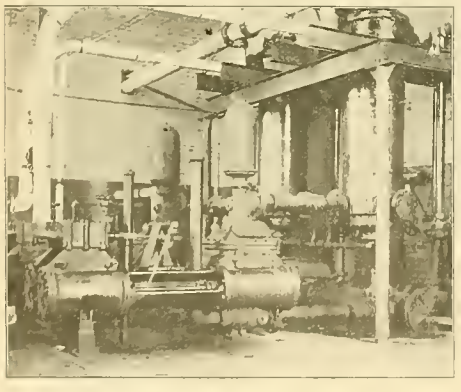


FIG. 3. EVANSTON CENTRAL STATION FOR HEATING AND LIGHTING.—PUMP ROOM.

as fast as the conduit was laid, and as a rule no ditches were left open over night. The load on the lighting system carried at present consists of about 1,600 incandescents and 25 arc lamps. A small motor load is also carried. J. A. Erner & Co. of Columbus, Ohio, were the contractors for the electrical and underground equipment, the work being installed by C. D. Jones and H. H. Dickinson, who also designed the switchboard.

The hot-water-heating system is what is known as the Yaryan system, it having been designed by H. T. Yaryan of Toledo, Ohio. A similar system was first used in Toledo over five years ago by the Toledo Heating and Lighting company, which now has two stations in operation, supplying heat to 230 customers and lighting 500 houses. In principle, the distribution system may be compared with a multiple electric-lighting system. The water is raised to the desired temperature by heaters and is forced out by pumps through the pipe line, emptying into a large tank on its return to the station from which it is drawn, to repeat its cycle through the heaters, pumps and pipes. The leading-out pipe and the return pipe are laid side by side and small service pipes are tapped off at the residences to be heated, the water returning through the return main to the station.

In the Evanston station there are two heaters of the tubular type, each seven feet long, 24 inches in diameter and containing 500 square feet of condensing surface. The exhaust steam from the engines passes through the heaters, and when this is not sufficient to heat the water to the desired temperature, live steam is taken from the boilers. The present installation is sufficient to take care of 100 houses, while room is provided for an equipment for 250 houses. There is an equipment of 95 houses being heated from the station at the present time, each having an average of from 700 to 800 square feet of radiating surface. The two circulating pumps are 10 by 12 by 18 inches in size and of the Laidlaw-Dunn-Gordon type. Fig. 3 gives a view in the pump room, showing the pumps and heaters.

The circulating system consists of two eight-inch wrought-iron pipes, leading from the station and branching by six and four-inch pipes to the different localities heated. The house-service pipes are all one inch in size. The longest line extends three-fourths mile from the station and there is a total of nearly 15,000 feet of pipe, or 7,500 feet of mains, in use. A pressure of 60 pounds is maintained on the feed line during cold weather and 40 pounds during moderate weather. Sufficient radiation is provided in the houses to heat to a temperature of 70 degrees Fahrenheit, with water entering at 160 degrees Fahrenheit when the temperature outside is freezing. By raising or lowering the temperature of the water one degree for each degree of variation in the outside temperature, a constant temperature is maintained in the houses during all kinds of weather. There is no occasion for the consumer to regulate the flow of water during the entire winter. The extreme limits of temperature of the water are from 130 degrees in moderate weather to 212 degrees in the coldest.

Insulation for the pipes is secured by enclosing them in specially constructed wooden boxes, which provide a number of air spaces on all four sides. Expansion on the mains is provided for by using 90-degree bends at corners and by ordinary U's where the run is straight. The expansion tank, which is located in the boiler room, is 10 feet high and 10 feet in diameter and has a capacity of 7,500 gallons. It is used as an expansion tank to take up the loss on the line and to receive additional water to make up for the leakage.

The company's charge for heating is one-third cent a year for every cubic foot of space to be heated. The cubical space is measured from the foundation to the ceiling of the second story and within the outside walls. For a third floor the rate is one-half what it is for the first two stories. For a 40 by 50-foot house, with 11 and 10-foot ceilings, the cubical space would be 42,000 cubic feet and the charge for a year would amount to $140. The heating season, as a rule, lasts from September 20th to June 1st. As experience has proven in the case of the Toledo plant, the expenses of operating such a system are more than met by the income from the heating, so that the electric lighting can be supplied at comparatively low rates. At Evanston the company is furnishing electricity for lighting to meter customers at 7½ cents a kilowatt-hour and for power as low as five cents a kilowatt-hour. The company has about 100 customers for light, and most of them are supplied on a flat-rate basis.

The Evanston Yaryan company has as its president H. T. Yaryan, and as secretary, I. B. Hiett. E. B. Yaryan, the manager of the company, had charge of the construction of the plant. The station was installed by the Yaryan Heating and Lighting company of Toledo. The Evanston installation cost about $100,000, and it is asserted that the plant will pay for itself in its first year.

Supervisor Mitchell of Denver is agitating the question of abolishing overhead wires. He believes that the city should install the conduits and rent them to the electric companies. Under the charter the city must give five years' warning of its intention to order all wires underground, but Mr. Mitchell advocates placing a prohibitive tax on poles in streets and alleys in the business district, and believes that the desired result may be obtained legitimately in a less time than five years.

The Accurate Measurement of Alternating and Multiphase Currents.[1]

By G. L. Addenbrooke.

For many years past I have given much attention to this subject, and I have now the honor to lay the results of my experience and work before the International Congress. One main point which struck me several years ago was the desirability of looking at the question as a whole. In measuring alternating currents it is necessary to take into account the fact that if there is inductance or capacity in the circuit, as is usually the case, the current which flows is influenced by three factors: (1) The resistance of the circuit and the work done within it; (2) the inductance of the circuit; (3) the capacity of the circuit. The inductance and capacity effects being exactly opposite in phase, counterbalance each other as far as they can, the larger factor predominating, the phase of which will be either 90 degrees behind or in advance of the phase of the energy current, according as the self-induction or capacity of the circuit predominates. This current, when further combined with the energy current, produces a resultant current, which is that actually flowing in the circuit, and which I prefer to call the "total" current, rather than the "apparent" current, and which, it is clear, will not be in phase with either of its components.

In carrying out measurements in practice, the wattmeter principle has come to be almost universally used in practice. Assuming that this principle is the one employed, there are three measurements which must be made to obtain the fundamental factors of an alternating current. When these factors are known, other characteristics of the current can be deduced. A measurement must be made of (1) the impressed volts, (2) the apparent amperes, or, as I prefer to call them, the "total" amperes, and (3) the effective amperes or watts. (If the effective watts

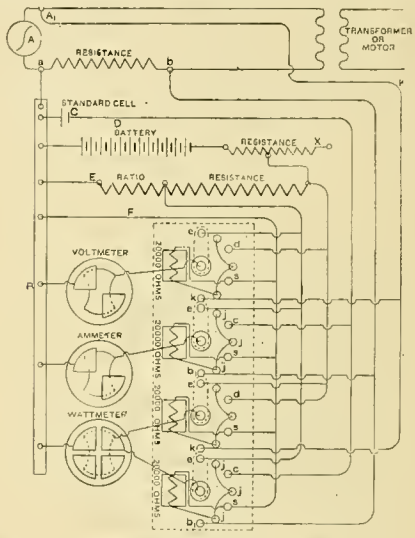


FIG. 1. MEASUREMENT OF ALTERNATING AND MULTIPHASE CURRENTS.

are measured, knowing the impressed volts, we can directly deduce the effective amperes.)

Having these quantities, we can directly deduce in addition the power factor, the angle of lag and the magnetizing or capacity current or their resultant, if both are present. Also, if we know the periodicity, the coefficient of self-induction of the circuit and other characteristics may also be obtained without further observations. Finally, if both inductance and capacity are present, by measuring the capacity we can, with the above data, find the inductance.

To adapt the electrometer for use as a wattmeter I insert a series non-inductive resistance in the circuit to be measured, across which the quadrants are connected, while the needle is connected to the other side of the circuit so that the potential difference of the circuit is established between the needle and the quadrants. By arranging the instrument in this way and calibrating it properly, it is possible, under the right conditions, to make the electrometer a direct-reading wattmeter. Having the above-mentioned resistance necessarily in the circuit, it was clear that if it were possible to make an electrostatic voltmeter sufficiently sensitive to measure the drop of volts across this non-inductive resistance, such an instrument so coupled would become a very handy form of ammeter. I have been able to attain such sensitiveness in the instrument employed as an ammeter that it is possible to get good readings with a drop of from one volt to two volts across the non-inductive resistance inserted in the circuit. As a matter of fact, I am arranging my instruments in practice now so that the non-inductive resistance inserted in the circuit shall cause a fall of potential of about 1½ volts as an average, which answers very well for the wattmeter also; this is a handy drop, because it approximates to the electromotive force of a Clark cell, which is used for standardizing the instruments, and consequently the readings come near the portion of the

1. Abstract of a paper read at the International Electrical Congress of 1900 in Paris.

scale for which the instruments have been standardized. To attain this object—namely, to obtain always a good deflection on the instrument—a set of non-inductive resistances formed of strips of manganin are used. The strips in practice are about a meter long, and a handy way to arrange them is by beginning with a wire or strip to carry, say, one ampere, to make the next strip carry about two amperes, and the third four amperes, so that about 10 strips will usually cover the full range of currents which are likely to be required in practice. For special purposes, of course, higher or lower resistances can be made, and since the instruments take infinitesimal currents, the same set of instruments will measure currents varying from, say, one-one-thousandth of an ampere to 1,000 amperes or more, with equal percentage of accuracy in each direction, if required; consequently the instruments are practically universal in this respect. By arranging these resistances so that they can be placed in parallel, the same deflection, approximately, on the instruments may, if desired, always be worked to.

As regards the measurement of currents of high voltages, there are two ways of proceeding. The instruments themselves can be made so that they can be directly connected to the high-voltage circuit, but I usually prefer to employ instruments standardized for working direct on circuits of from 100 volts to 200 volts as a standard; and for higher voltages, to connect a high non-inductive resistance across the circuit, making the instrument connections across some known fraction of this over which there is a fall of 100 volts or 200 volts.

It now remains to describe this method and the design of the apparatus and instruments, and to show how they are used and applied to the purpose in view. Fig. 1 is a diagram showing the method of connecting the instruments in practice to a circuit on which measurements are to be made, and the figure also shows diagrammatically the method of standardizing the instruments and the switching arrangements by which the different connections are made. This is done by merely turning certain handles after the instruments are once set up.

In the diagram, (A) indicates the alternating-current generating machine having a main circuit (A_1), wherein is placed a non-inductive resistance (ab), as mentioned above. From the point (a) a connection is shown to an omnibus bar or common-terminal bar (B), to which most of the circuits hereinafter mentioned are joined. These are best arranged in the following order: (C) is a standard Clark cell. (D) is a battery of sufficient power to give rather more than the maximum voltage required for standardizing the instruments. I find a battery of small accumulators very convenient for this purpose, but if such a battery is not accessible, the instruments can be standardized by making use of an electric-lighting circuit instead, provided that readings are taken at similar pressures, which can be observed by connecting the electric-light circuit to the voltmeter while readings on the wattmeter are being taken. (X) is a variable resistance in series with the battery. (E) is a box of resistance coils, so arranged that a resistance of 100,000 ohms is always maintained between the terminals, but by means of movable switches a third connection can be made to the resistance at any point desired. The outside terminals of this, which I call the "ratio" resistance, are connected to the common bar and to the resistance (X), so that the ratio resistance forms a shunt across the battery and the resistance (X). Let us suppose that the electromotive force of the battery is 105 volts. By altering the resistance (X) suitably we can so arrange matters that there is exactly 100 volts' pressure between the outside terminals of the ratio resistance (E), under which circumstances we can, by setting the switches of the ratio resistance to the proper points, obtain any voltage we like accurately between 0 and 100 volts. (F) is a short-circuit connection between the bar (B) and a terminal (s) in each of the switches indicated below, whereby any of the instruments may be short-circuited and their zeros adjusted. The electrostatic voltmeter, ammeter and wattmeter are also connected to this bar. The voltmeter switch has four terminals, (e), (d), (s) and (k), the terminal (s) short-circuiting the instrument, as above stated. With the switch in contact with the terminal (d), the instrument is connected to the battery (D); and, similarly, when in contact with the terminal (e), the switch puts the instrument in connection with the ratio resistance (E), so that a desired part or ratio of the whole resistance can be measured off and any required voltage within the limit of the battery put upon the needle (g) of the voltmeter (G), its quadrant plates (s_1) being connected to the bar (B). By this means the voltmeter can be calibrated throughout the whole length of its scale. The terminal (k) serves to place the needle (g) in connection with the circuit (K), on which measurements are to be made.

The ammeter switch (s_1) is provided with four similar terminals, indicated by the reference letters (e), (c), (s) and (b_1). The terminal (c) is for connecting the needle (h_1) with the standard cell (C). The terminals (e) and (s) correspond to the similar terminals of the voltmeter switch, and the remaining terminal (b_1) connects the ammeter to the main circuit (A_1), at the (b) end of the measured non-inductive resistance (ab). The wattmeter has a double set of switch terminals, one set, (e), (d), (s), (k), being exactly the same, and with the same circuit connections as for the voltmeter, and the other set, (e), (c), (s), (b_1), being similar to those of the ammeter switch.

In changing the instruments from one set of connections over to the other, it is very desirable to have a means of separately short-circuiting each of the instruments through a high resistance of about 20,000 ohms while the operation is performed, otherwise the quadrants must be left unconnected for a period of time, which sometimes leads to violent deflections of the needles when connected to alternating currents and from charges on the ebonite or other adjacent surfaces otherwise difficult to avoid. This is provided for by the intermediate contacts (jj) in each of the switches, as shown in the figure, which are connected to coils containing a resistance of about 20,000 ohms, one for each set of switch contacts.

We now come to the instruments themselves. They are electrostatic, and are all built on the same general lines, which can best be seen by referring to Fig. 2, which represents the wattmeter. It may be noted that this one instrument will perform also the functions of a voltmeter and of an ammeter or low-reading voltmeter, by simply altering the suspension of the needle and appropriately adjusting the quadrants. The instrument as shown is provided with a very high insulation, so that it can be used for measuring high resistances, capacities, etc., but such insulation is not specially necessary where the instrument is to be used for measuring currents only, or as a low-pressure voltmeter.

The suspension consists usually of a flat phosphor-bronze strip of the kind which was brought into use by Messrs. Ayrton and Perry, and which is so largely used in connection with the d'Arsonval galvanometer. This, of course, forms an excellent connection to the needle, so that there is no necessity to use sulphuric acid. Further, by using a specially light needle, I find that I can get sufficient decrement without any other form of damping, and consequently the needle may hang perfectly free in air, and there is nothing which can interfere with its proper movement in any way. It will be noticed that the quadrants are not made in the form of a box, as is usually the case, but consist of two sets of flat plates, the one set of which, usually the upper, is adjustable, and can even be taken off altogether, if required. This simple improvement, while it does not interfere with the action of the instrument in any way, greatly increases its range, adjustability and portability; in fact, it is much like adding a universal shunt to a galvanometer. Te needle, it will be noticed, can be moved up and down by means of a rack motion, and can thus be set in the center of the quadrants whatever the action of the upper and lower plates. For high voltages the upper plates can be removed altogether, and the needle removed some distance from the lower set of quadrants. On the other hand, the needle may be brought down close to the bottom set of quadrants and the top set brought down until the space between is not more than a millimeter. Under these conditions, a deflection of 50 millimeters to 100 millimeters, with the scale at a distance of two meters, can be obtained with the most sensitive strip with a pressure of one volt only when the instrument is connected up idiostatically, or as a simple voltmeter, and it is in this sensitive form that the instrument can be used as an ammeter by coupling it across a resistance in which from one volt to two volts is lost, as mentioned above. If we take this ammeter as our basis instrument, then the wattmeter to go with it must have a thicker suspension and can be used with the quadrants further apart; in fact, it should be about one one-hundredth of the sensitiveness of the ammeter. Then, again, the voltmeter requires to be much less sensitive still, this reduction in sensitiveness being obtained by the use of only one set of quadrants and a much thicker and shorter strip, and in the latter case, owing to the strength of the torque, it is best to reduce the period by damping with oil. In each of the instruments, by taking off one or more of the top quadrants and unscrewing the centering screws of the head, the head can be lifted off, carrying with it the needle, which can thus easily be changed. For carriage it is merely necessary to let down the needle on the bottom quadrants and let down the top quadrants on the needle, which firmly clamp it, so that the instrument can be shaken or turned upside down without any damage resulting. Owing to the fact that the needles are flat and very light, they are exceedingly little affected by vibration, so that the instruments can be used on upper floors and near moving machinery. In use it is well to put in the circuit of each needle a 250-volt lamp of five-candle-power. I find this better than any form of fuse, as the current which can then pass through the instrument is too small to hurt the strip or needle, and at the same time instant warning is given by the lighting of the lamp if by any chance the needle should get attracted to the quadrants. The instruments are reflecting, and I usually arrange the scales at a distance of about two meters from the instruments.

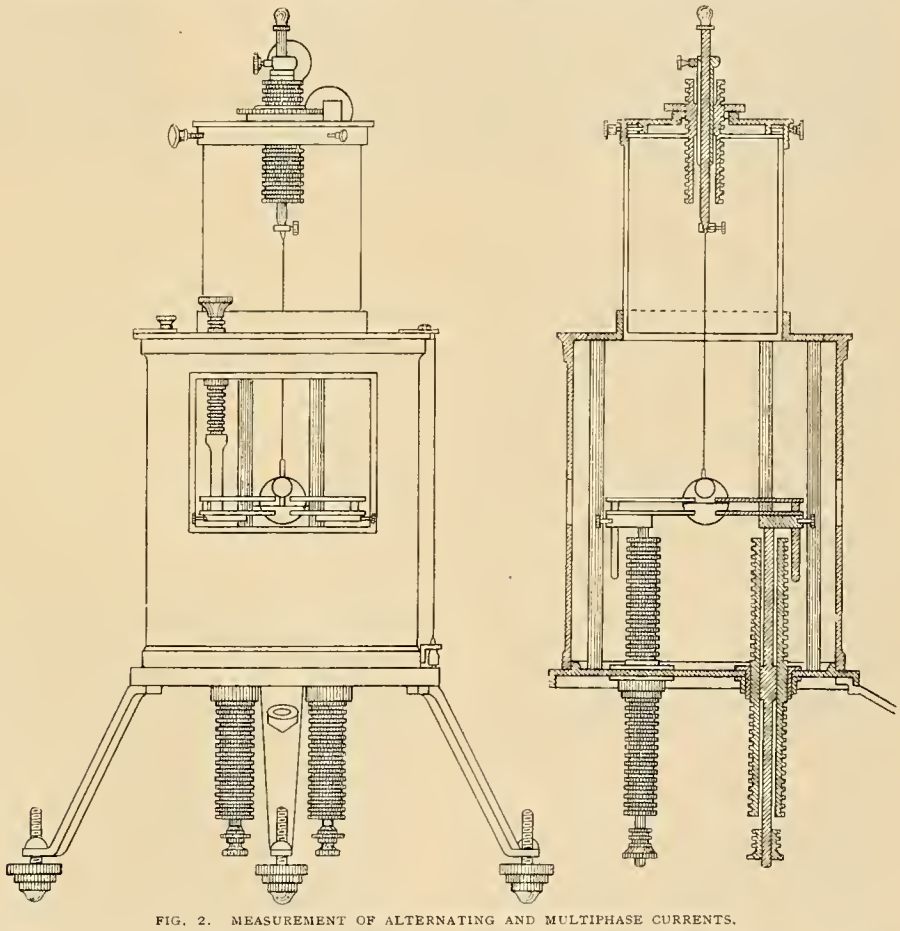


FIG. 2. MEASUREMENT OF ALTERNATING AND MULTIPHASE CURRENTS.

With the help of the standardizing arrangements, approximate deflections are taken on them for the scale readings they are intended to give with given voltages on the needles and quadrants. The requisite sensitiveness is then obtained approximately by varying the distance between the upper and lower quadrants in two of the instruments and the distance of the needle from the quadrants in the voltmeter till very nearly the deflections required are obtained. The scales themselves are on sliding supports, and the final adjustment is made by sliding the scales nearer to or further from the instruments until the given voltages produce deflections of the right length on the scales. In this way the instruments can be made to read watts, volts and amperes directly.

To standardize the wattmeter, the needle switch is turned to the battery connection (d), and the quadrant switch to the Clark cell connection (c), the ratio resistance being set to 1,140 (supposing the resistance is 100,000 ohms as a total and that the voltage across the ends of it is 100 volts). The quadrant switch is then turned so that the quadrants are connected to the positive end of this ratio instead of to the positive of the Clark cell, and the resist-

ance (X) is adjusted so that whether the electrometer is connected to the Clark cell or to the point of ratio resistance, the deflection is the same. It is obvious that, under these circumstances, the voltage across the outside terminals of the ratio resistance must be 100 volts. Consequently we know the voltage on the needle and the voltage on the quadrants which are the factors requiste for obtaining the constant of the electrometer. If the scale is graduated in millimeters it is now convenient to adjust the instrument and the distance of the scale, so that the reading is 144 millimeters. If this is done, then if the quadrants are connected across a resistance, the value of which is known in ohms or fractions of an ohm inserted in a circuit, and the needle is connected to the other side of the circuit, presuming the voltage does not fall very much below 100 volts, then the instrument will read directly in watts when multiplied by the reciprocal of the resistance. or if the resistances are numbered by their conductivities, instead of by their resistances, then we have simply to multiply the reading by the conductivity, so that the instrument becomes a direct-reading wattmeter of almost universal range. Having now got 100 volts exactly across the battery, by altering the value of the ratio in the resistance, the calibration of the electrometer throughout its whole scale can be made by simply turning the resistance switches to the appropriate points. If this is done, it will be found that the scale is proportionate within half per cent. over a range of about 200 millimeters, and is within one per cent. over 300 millimeters. It will be observed that by calibrating under the exact conditions of use we do away with the necessity of applying any formula to the deflections of the instruments.

To calibrate the voltmeter, all we have obviously to do is to put it across the whole of the ratio resistance, since the drop across this is 100 volts exactly. The sensitiveness of the instrument should then be so adjusted by raising the needle or lowering it and by moving the scale in or out that when the instrument is so connected it deflects to the point marked 100 volts on the scale. The instrument can be calibrated for any lower reading than this throughout the scale by altering the ratio point by the proper amount.

The sensitive electrostatic voltmeter which is used as an ammeter is now calibrated by connecting it directly by means of its proper switch across the poles of the Clark cell or the corresponding points on the ratio resistance, and this instrument also can further be calibrated in the same way throughout its whole scale by using the ratio. Owing to its delicacy and construction, however, the scale of this instrument is not quite so proportionate as in the case of the other two, and therefore it is well to construct a scale for it by setting the ratio resistance at the required points and noting the corresponding deflections. This can be quickly done, and when once the scale is made the instrument can afterward be adjusted to read to this accurately, as described for the other instruments.

The instruments are now all calibrated, and nothing remains to be done but to turn their switches to the circuit connection, when they will give direct readings on any circuit to which they may be connected, the reading of the voltmeter being, of course, multiplied by the ratio of the high resistance across the circuit (if such is used), the reading of the ammeter being multiplied by the value of the known resistance (its conductivity) in the circuit, and the wattmeter reading being multiplied by both these factors.

If the circuit is non-inductive the ammeter and voltmeter readings, when multiplied together, correspond with the wattmeter reading. If the circuit is inductive, this, of course, will not be the case, and if we divide the watts as shown by the wattmeter by the volts as shown by the voltmeter, then we get the effective amperes flowing in the circuit. On the other hand, the ammeter gives us the total, or, as they are sometimes called, the "apparent," amperes flowing in the circuit. The ratio of these two gives us the power factor, from which, by merely consulting a table of sines or cosines, we find at once the angle of lag. If we know the periodicity of the circuit, the coefficient of self-induction can be obtained without further observation.

By having a revolving contact connected to a small synchronous motor, it is obvious that by the aid of the above instruments it is also easy to take a set of readings from which the actual curve of electromotive force and current in the circuit can be plotted, with their lag or lead.

Where great accuracy is required in the readings, it is obvious that all we have to do is to take a set of readings on any circuit and then turn over the switches one by one on to the ratio resistance, altering this until the deflections of the instruments on the circuit are reproduced. We then can read off directly and without calculation the continuous electromotive forces necessary to produce these deflections from which the value of the electromotive force and the current in the circuit (the resistance across which measurements were made being known) is at once deduced.

It is obvious that the instruments are equally suitable for measuring continuous currents over almost any range, so that the instruments practically form a universal set of measuring instruments, whether for alternating or continuous currents. They can also be used for hysteresis and permeability tests, and for a number of other purposes to which I need not more directly allude.

For multiphase work, when the circuits may be unequally loaded, two sets of resistances may be used and the instruments can be quickly switched from one to the other. Or two sets of instruments may be used. Or instruments, particularly as wattmeters, may be employed with a double set of quadrants and double needle, the top needle being insulated from the lower, which receives its charge through a jar of acid. By means of the adjustable quadrants, it is easy to make both needles deflect equally for equal charges, so that when both are employed to read together their readings are added. For other purposes it is possible to use this double instrument as a zero instrument, and balance a known continuous against an alternating voltage.

Electrical Industries in Bangkok.

United States Consul King, writing from Bangkok, Siam, gives some interesting facts concerning developments there. The Bangkok Tramways company, which controls all of the concessions so far for street railways in Bangkok, and the Siam Electricity company, which has secured the concessions for lighting the entire city, are being consolidated under the name of the latter company. The lighting company will now furnish power in the daytime, and this will likely create a demand for electrical supplies. The company contemplates introducing electric automobiles, for which the city is well suited, being level and well paved. Extensions will be made to the existing railway system as soon as concessions can be secured.

The consul states that American goods are in favor and that the prices suit, but that importers claim that American firms are slow in attending to business, that many of them have no cable address, and that the delays are often so annoying that it is advisable for the importer to order slightly inferior goods in Europe or pay a little more for them to avoid delay and uncertainty. The leading importers of electrical supplies in Bangkok are the Siam Electricity company, the Siam-American Trading company and the Bangkok Dock company.

Opportunities in Mexico.

It may not be out of place again to call the attention of electrical-equipment manufacturers to the almost undeveloped field that awaits patient work in Mexico. The report of the British consul, Jerome, especially calls the attention of his countrymen to the fact that electricity is being very largely used in the development of the various industries being established throughout Mexico, as well as for lighting purposes and for street-railroad systems. Electric batteries imported into Mexico during the last year amounted to a total weight of 100 tons, at a total value of $45,547.92, and he also does not fail to call their attention to the further fact, a matter of congratulation to American manufacturers, that of that amount and value, no less than 72 tons were imported from the United States, and of the remainder only 1½ tons were imported from England. The imports of incandescent lamps during the year were valued at $77,269.14. More than half of these were supplied by the United States; the remainder, with the exception of an insignificant number from England, were all shipped from Germany. There will always be a demand for these and other electric lamps, as nearly every town in the republic is lighted by electricity.

A New Automatic Block Signal.

C. H. Storm, the electrician for the Waterloo and Cedar Falls Rapid Transit company, has invented a signal for blocking out a single-track railway. The line from Waterloo, Iowa, to Cedar Falls has been divided into three blocks. An incandescent light was placed at each block division, to be lighted by the conductor of an outbound car, which also lighted a lamp at the other end of the block. Returning cars were thus notified that the block was in use. Mr. Storm has now arranged a device which is automatic in its use and can be set while the car is in motion. Mr. Storm and his brother, E. M. Storm, will arrange for the manufacture of the signal in Chicago.

Rotary Converters and Motor-generators.

By Frank C. Perkins.

Part IV.

Alternating-direct Motor-generators for Railways.

Street-railway circuits up to quite recently have been almost exclusively supplied with continuous currents of a potential of about 500 volts. Lately polyphase railway installations have been made in Europe with more or less success. In this country the employment of alternating current for supplying power for electric-railway systems has been to use either rotary converters or motor-generators for changing the alternating current at various substations to a direct current of 500 volts and to use

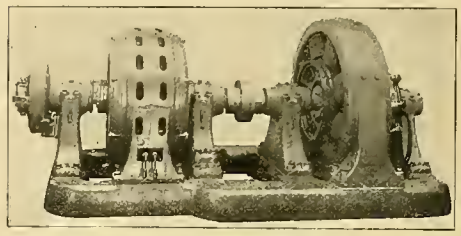


FIG. 13. ROTARY CONVERTERS AND MOTOR-GENERATORS.—ALTERNATING-DIRECT MOTOR-GENERATOR AT BUENOS AYRES.

the present highly efficient direct-current railway motors. Motor-generators have been successfully used for this purpose, but experience has shown that they are as a rule inferior to the rotary converter, since the latter combines both an alternating-current motor and a direct-current generator in one machine with one system of field magnets and only one armature.

At Buenos Ayres a number of General Electric motor-generators have been installed for supplying a 500-volt direct current for street-railway purposes. These outfits consist of eight-pole generators of 500-kilowatt capacity, operating at 375 revolutions a minute by means of direct connection to 530-horsepower, synchronous motors of the 16-pole, General Electric type. The motors receive their current direct from the high-tension, alternating-current transmission line at a potential of 3,300 volts without the use of step-down transformers. One of these sets is shown in Fig. 13.

Alternating-direct Rotary Converters for Railways.

It has been found highly economical where a large central station is favorably located and operated by either steam or waterpower to install very large multiphase generating units. By conducting current at high potential to sub-stations and transforming it down to low potential, rotary converters may be employed to change the energy to a direct current of 550 volts for supplying the railway feeder circuits. It is absolutely essential to use high-tension, alternating currents, in order to concentrate the various loads on one large generating station. It is also essential that direct current be supplied for street-railway operation, under conditions existing at the present time. Some sort of converting device is therefore necessary to receive the power as an alternating current and deliver it as a direct current with economy and at moderate cost. Electric polyphase railway motors are used to some extent abroad and have some advantages which are bound to receive attention, and this railway system will, without question, be devel-

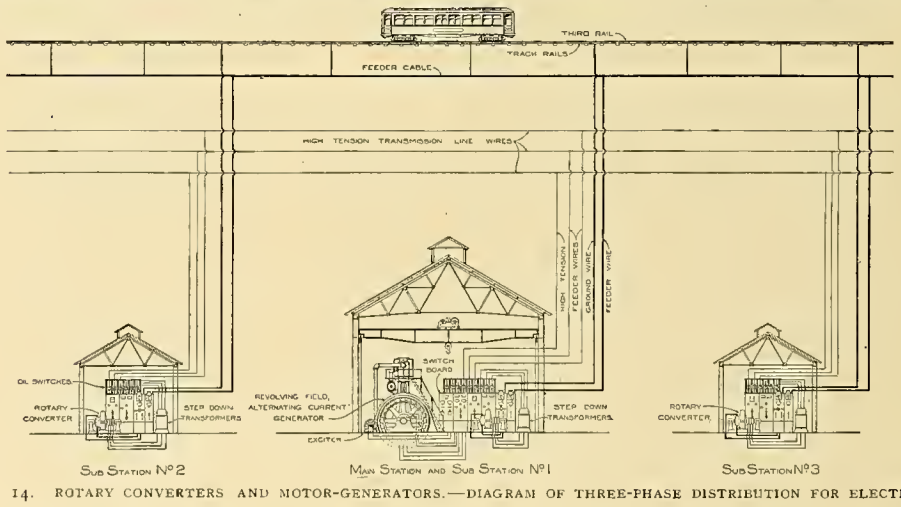


FIG. 14. ROTARY CONVERTERS AND MOTOR-GENERATORS.—DIAGRAM OF THREE-PHASE DISTRIBUTION FOR ELECTRIC RAILWAYS.

oped during the near future. No transformers, converters, or other more or less complicated devices are used, but there is the disadvantage that two trolley wires are necessary, which complicates the overhead system of conductors. The present solution for the problem in this country is in the use of rotary converters at the main power house and at the various sub-stations. A diagram of three-phase distribution for electric railways, with a main station and three sub-stations, is given in Fig. 14. The feeder wires in this particular instance are shown attached to a third rail instead of a trolley wire.

As an example of this alternating-transmission and direct-distribution system using steam as the motive power, it is interesting to notice the Metropolitan Street Railway company's system of New York city. The Metropolitan system embraces all of the surface lines of the Island of Manhattan, and is the largest and most elaborate of this character in the world. The main power station is located on the East River at Ninety-sixth street, and contains 11 3,500-kilowatt, three-phase, General Electric, revolving-field generators, which are among the largest dynamos ever constructed. Each generator is wound for a potential of 6,600 volts, and is direct-connected to a 5,000-horsepower, vertical, cross-compound, condensing engine. The switchboard is located at one end of the main station, and the various panels, bearing the necessary instruments and switches, are distributed among several galleries, in order to separate them widely from each other and give plenty of room for working around them. Pneumatically controlled oil circuit-breakers are used to switch in or out each generator and also each individual high-tension feeder. Each oil circuit-breaker is located in a separate brick compartment, which acts as a protection against fire in case of an arc in any one of the switches. The sub-stations are five in number, one being placed in the generating station and the others located at convenient points on the lines, the most southern being located at Front street and the most northern at One-hundred-and-forty-sixth street. In each sub-station are located from three to six General Electric 990-kilowatt, rotary converters, with suitable air-blast transformers for reducing the alternating potential. These rotary converters supply a 550-volt direct-current, to the contact rails in the underground-conduit system. The alternating-current switchboard arrangements of the sub-stations are practically duplicates on a small scale of the switching arrangements in the power station. The Metropolitan company now operates 1,200 electric cars on 80 miles of track. The famous Broadway cable line is now being re-equipped for electric cars in place of the cable.

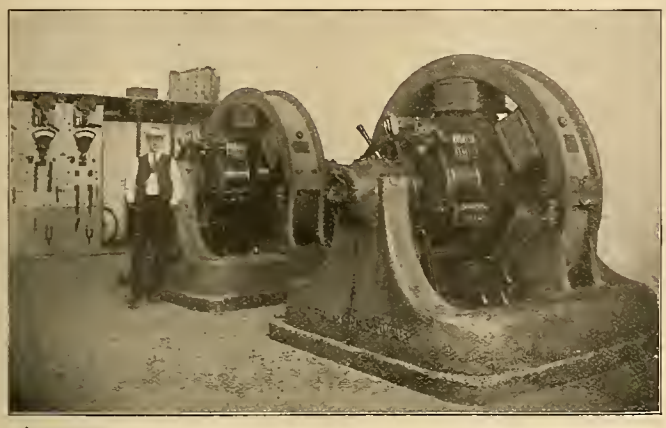


Fig. 15. Rotaries at Cold Springs Sub-station in Buffalo.

Fig. 16. Transformers and Rotaries at Railway Sub-station in Buffalo.

ROTARY CONVERTERS AND MOTOR-GENERATORS.

As an example of this system using waterpower as the prime mover, it will be well to consider the system of the International Traction company of western New York. This company is a consolidation of the various street railroads in and around the city of Buffalo and a number of smaller towns in the vicinity. In the past, current was supplied by a number of direct-current generating stations located at various points, but on completion of the large power house at Niagara Falls it was decided to utilize this power for operating the entire system. The Niagara street steam station, one of the best in the country, is now held only as a reserve and for assistance in carrying the peaks of the loads, the lower cost of waterpower making its operation relatively more expensive. This company at the present time receives all its power from the main power house at Niagara Falls and distributes it to its different lines through five sub-stations. These sub-stations, located in the city of Buffalo, supply current to the cars used in the ordinary city traffic. Fifteen 400-kilowatt, General Electric, 550-volt, rotary converters, operating at a speed of 500 revolutions a minute, are installed in the sub-stations.

In Fig. 15 is a view of two rotaries at the Cold Springs sub-station. Suitable air-blast transformers reduce the line potential, which at the present time is 11,000 volts, to a suitable voltage for supplying current to the alternating-current side of the rotary converters. Another view of one of the sub-stations of the Buffalo railway system, given in Fig. 16, shows some of these air-blast transformers and three rotaries. The switchboard is located at the end of each sub-station and is divided so that all of the high-tension apparatus is located on a gallery and connected to handles on the floor below. The operators thus remain on the lower floor and are able to handle the various devices on the switchboard with no danger, due to high potentials on the incoming alternating-current feeders. Oil circuit-breakers are used throughout for switching the alternating currents, each circuit-breaker being mounted in its separate brick compartment.

The Buffalo and Lockport branch of the International Traction company is a representative high-speed interurban electric road and is supplied from two sub-stations, one being located at Lockport and one at Tonawanda. Freight trains are handled by electric locomotives. The Lockport sub-station contains two 400-kilowatt, General Electric, rotary converters, with accompanying air-blast, step-down transformers and switchboard. This road uses four-motor GE-57 equipments, with electric brakes, and a maximum speed of over 50 miles an hour is reached on parts of the line. At Tonawanda, which is 10 miles from Buffalo and 14 miles from Niagara Falls, the Tonawanda Power company has installed a power station and supplies current to the International company for the feeders between Lockport, Buffalo and the Falls. The three-phase, 11,000-volt, Niagara current is reduced by static transformers and is used to operate two Westinghouse, 25-cycle, alternating-direct, rotary converters, which supply a direct current at a potential of 550 volts. A view of this station at North Tonawanda is given in Fig. 17. The Westinghouse rotary converters are started by Tesla induction motors and are equipped with magnetic oscillators, similar to those used with the General Electric rotaries. These attachments are arranged to oscillate the shafts axially to prevent the brushes from wearing grooves in the commutator and collector rings.

[*The end.*]

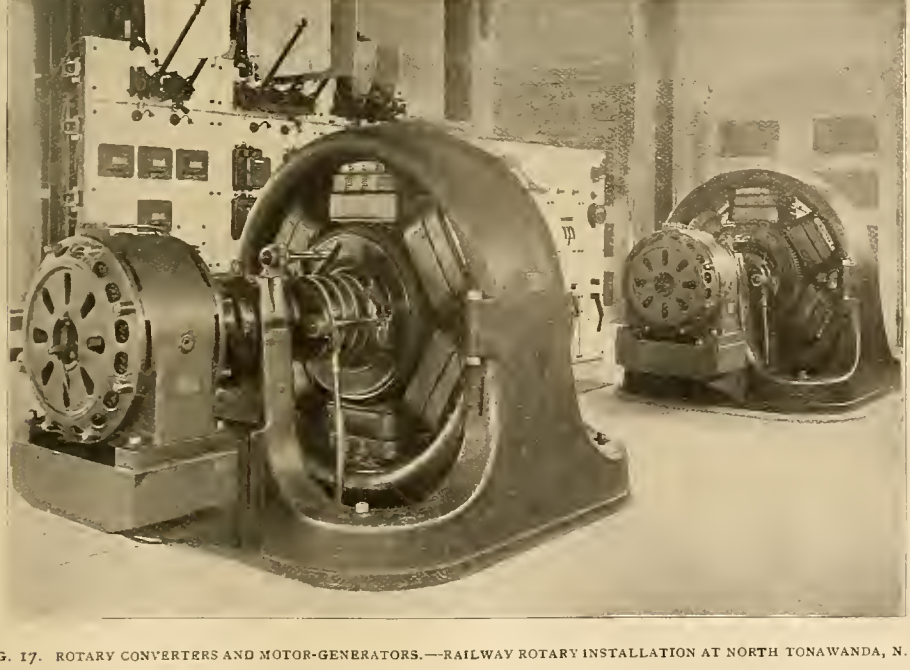


FIG. 17. ROTARY CONVERTERS AND MOTOR-GENERATORS.—RAILWAY ROTARY INSTALLATION AT NORTH TONAWANDA, N. Y.

An Important Telegraph Decision.

The suit of the Great Northern Railroad company for possession of the telegraph lines built by the Northwestern Telegraph company and leased to the Western Union Telegraph company was recently decided in favor of the Western Union company. The Great Northern company held that there was no provision in the contract with the Northwestern company authorizing a transfer of the telegraph lines either by lease or otherwise. The Western Union company claimed to own the Northwestern company, both by lease and ownership of stock. The importance of the suit was not alone in the amount of money involved, for it was the general understanding that should the railway company have won, all the great railway systems of the country would, at the expiration of their contracts with the telegraph companies, have claimed ownership of the telegraph lines along their rights-of-way and either have operated them independently, or have formed a consolidation which would have been a strong competitor in the telegraphic field.

The Galveston City Railway company of Galveston, Texas, has been incorporated, with $800,000 capital stock, to construct, acquire, maintain and operate street railways within and near that city. The incorporators are W. G. Oakman, G. R. Turnbull and E. Cornell.

Western Electrician.

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The interesting controversy between the authorities of the Kew magnetic observatory of London and a number of electric-railway men who have planned to build a trolley road in the neighborhood is still undecided. The scientists at, or interested in, the observatory contend, and of course with perfect truth, that the ordinary earth return of the railway system will interfere with their delicate measurements of terrestrial magnetism. They say that either the proposed road should not be built or else that it should be constructed with such insulated return conductors that no leakage to earth could result. It is unfilial, they assert, for the electric railway to destroy the usefulness of its scientific parent. On the other hand, some of the railway men have the temerity to insist that "the future continuity of magnetometer records is hardly a matter of vital consequence either to the nation or to science. Such value as the records might possess in the future is not sufficient to warrant any extensive restriction of the means of locomotion rendered necessary by our rapidly growing urban population, and it cannot be denied that the protective measures put forward would, if adopted, constitute a severe tax upon electric tramways, and, indirectly, upon those who use them." The railway company would like to have the observatory shifted, and the physicists suggest that the company spend about $250,000 in insulated return cables. The Board of Trade is the arbiter in this "magnetic storm," as Dr. Oliver Lodge terms it, and it appears not to have made a final decision.

In a recent lecture on the propagation of electric waves through space Professor J. A. Fleming touched briefly on some of the great problems with which the twentieth century will have to deal. He noted that it was not until 1864, when Clerk Maxwell read his most interesting paper on the dynamic theory of the electromagnetic field, that any reliable explanation of what takes place in transmitting electrical waves was available. The paper in question had been classed by an able contemporary of Clerk Maxwell as the greatest production of the human mind. Professor Fleming, in closing, gave a résumé of the various ether theories which have been in vogue during the century. These could be classed under three heads. By the first it was assumed that ether was a rare gas, but this had to be abandoned, as had also the theory that it was an elementary solid. The theory developed by Dr. Lamor, known as the rotating-ether theory, was, the lecturer thought, at present most favorable. He commended Dr. Lamor on the subject to those present in order that they might learn that scientist's view on the great ether question and on electrons, which he considered to be strains in the ether. One deduction from the theory was that electricity was atomic in character and that matter generally was a solid form of electricity. There was much to be gained by the study of these various theories, Professor Fleming said, even if they should be discarded in favor of others in the course of a few years. Theories helped us to search for new facts which would not be discovered but for theoretical predictions. At the same time, they helped us to rearrange the facts already ascertained, and in this way forwarded general knowledge.

Two annual stockholders' meetings held in London this month possess more than ordinary interest to the electrical fraternity. One was of the Marconi Wireless Telegraph company and the other of the Nernst Electric Light, both organized to exploit inventions that may exert a wider influence in the twentieth century than in the nineteenth.

The Marconi directors reported that the International Marine Communication company had commenced work. The first installations have been erected on the Belgian coast at La Panne and on one of the Belgian government steamers. These have been quite successful and have attracted a great deal of public attention. The International company has given orders for the erection of several stations on the coasts of the United Kingdom and is engaged in negotiations with several continental governments. The chief business event has been the obtaining of a contract with the British Admiralty for the supply and equipment of 32 sets of apparatus on payment of an annual royalty on each set. This is in addition to the five sets of apparatus which were transferred by the War Office to the naval authorities in South Africa. The captain of H. M. S. Vernon, under whom the work has been carried out, has expressed himself as satisfied therewith and with the rapidity with which it was completed. It was stated that Mr. Marconi has made great advances recently, some of which are of undoubted value. The works at Chelmsford have been improved and the plant and machinery increased, so that the company can now turn out all the apparatus required, or likely to be required, during the next 12 months.

Turning to the Nernst light, it is interesting to note the statement that the lamp will shortly make its appearance in the English market. Since the formation of the company the directors have been engaged in further developing the automatic Nernst lamp so as to render it more capable of being manufactured and sold in quantities on a profitable commercial scale, and with a uniform degree of quality and efficiency for the various sizes. While every discovery involving radical changes from existing methods must necessarily take time before the result can safely be placed on the market, the Nernst company's directors have found that the practical difficulties to be overcome in the wholesale reproduction of the Nernst lamp to the best advantage have been greater than they anticipated. The variations which occurred in endeavoring to repeat on a more extensive scale results already obtained have involved long experiments and chemical research in directions where no precedent was available. But it is now confidently hoped that the main causes of such variations have been traced to their origin and means devised for their elimination. The lamps at present prepared consist of 16 candlepower, 32 candlepower and 50 candlepower for either 100 or 200-volt pressure; also a lamp of 150 candlepower for street and factory lighting. These lamps are made to light automatically in all sizes. The principal difficulty in connection with the lamp is the initial heating of the rod automatically. At present the company is using wire-wound heaters, the best solution yet developed, but the company has also obtained the exclusive rights for the Vogt resistance heater in all its territories as well as in England.

It will thus be seen that the most distinctive electrical inventions of the closing years of the century are making their way but slowly. Whether one or both shall measure up to the possibilities they seem to possess, time alone can tell.

The street-railway commission of the city of Chicago has made an exhaustive report to the City Council and submitted a draft of a bill to be presented to the Legislature to cover the whole subject of public street-railway service in the state of Illinois. The proposed law provides that franchises must not be granted for periods longer than 20 years; that the city councils shall have the power to regulate the operation of street railways; that more-than-one-half frontage petitions shall be required for new lines unless the proposed new location is authorized by vote of all the citizens of the town; that no competition with existing systems shall be permitted, unless by popular vote; that hereafter it shall be lawful to provide in a street-railway grant that at its expiration the property may become the property of the city in consideration of the grant; that every city shall have the power to "own, construct, acquire, purchase, lease, maintain and operate street railways" when the proposition is approved by four-sevenths of the qualified voters of the city voting on the proposition; that municipal street-railway plants may be mortgaged to secure bond issues; that municipally owned street-railway plants may be leased for private operation for terms not exceeding 20 years; that every private street-railway company and every city doing a street-railway business shall make an unreserved annual report to the state auditor; that all accounts of street-railway companies shall be kept in a uniform manner; that no company shall issue bonds and stocks equaling in par value more than 25 per cent. in excess of the actual cost of constructing and equipping the road; that consolidation of street-railway companies must be approved by the public authorities.

Such are the main features of the proposed general street-railway law. The commission explains that it does not look with favor on the proposition to have the city of Chicago operate its street railways in the immediate future; but the city should acquire ownership of the trackage as soon as possible, it thinks. All labor disputes should be submitted to arbitration; the overhead trolley should not be permitted in the business district; Chicago should have a system of downtown subways—these are some of the recommendations of the commission.

The street-railway commission has evidently given careful consideration to its task and is no doubt actuated by worthy motives. But the existing companies, the experts of the situation, have the right to be heard, and they will no doubt find many features of the proposed law to criticize, particularly the 20-year limit and the municipal-ownership provision.

The Fire Departments of Our Cities.[1]

By F. C. Mason

In dealing with the subject it is my intention to confine myself almost entirely to the "nerve center," or, rather, what is known as the telegraph system of the department. In 1851 the city of Boston took up the matter of fire protection and voted $10,000 for the experiment. So with Dr. Channing, resourceful in ideas, and Mr. Moses G. Farmer, recognized as the most expert electrical mechanic of that day, the fire-alarm telegraph system as we now have it was developed and made practical. Then came Gamewell, indomitable, persistent, a born organizer, to whose able management is due the fact that 90 per cent. of all municipal fire-alarm business of the United States is done by his company. The names of Channing, Farmer and Gamewell stand high on the roll of municipal fire-protection fame.

A manual auxiliary fire alarm that would reliably give the desired results was found, and gave rise to what is known as the Gamewell auxiliary fire-alarm return-call system. This, operated in connection with the street fire-alarm boxes, greatly extended and perfected the area of municipal fire protection. Automatic devices there were, but none possessing that element of continuous reliability so necessary to the proper advisement of actual danger or fire. It was Chief Croker of New York who said: "Given advisement of a fire in the first five minutes, I will put it out in the next five," and now all this is possible, and to-day as a human being is equipped with a nerve center and nerves radiating therefrom, wherein every part of the body is sensitive to touch, so any building can be equipped with a similar nerve center and radiating nerves so sensitive to dangerous heat or flame as to be able to signal a warning to a common center without delay, so that the first minute will not have elapsed before the warning is given both locally and centrally.

Even the smallest of our cities are putting on the municipal airs of the largest, and to keep up with the times, especially in electrical work, is of the highest importance, a work which 95 per cent. of the people are thoroughly ignorant of. The ones who stand between this vast ignorance of these things on the part of the people and the municipalities are the municipal electricians. They must, in the future, more than ever, represent the safety valve of electrical protection. It has been too much the case that a superintendent of fire alarm or superintendent of police telegraph would each sit supinely by and let electric-light matters and the march of improvement, in inspection matters, hurry past him in their course, while he, in the same old way, runs his one branch without reference to the rest.

There are three very important branches of public service whose systems require the distribution of electrical energy in order to fulfill their obligations to that portion of the public which they serve. These are the automatic fire-alarm, electric protective and district messenger companies.

The automatic fire-alarm system keeps watch over some of the largest mercantile and manufacturing establishments. Its system detects and gives immediate warning of the presence of incipient fires to fire-department companies in the immediate vicinity, who are thus enabled to attack the fire long before it has attained dangerous proportions, thereby preventing not only extensive conflagrations, but excessive damage by fire and water to the contents of the building in which it occurs. The silent watchmen (thermostats and the multiphase cable) attached to this system are brought into action by the element (fire) whose presence they are supposed to announce. They never leave their post, and fire and smoke do not drive them therefrom.

The time has come when municipalities must undertake the supervision of all classes of electrical construction; many are already doing so. The superintendents of fire and police-signal systems, particularly in medium and smaller cities, should be qualified to undertake such supervision, as in most cases they will be called on to do so. For them to accept such a position through false pride, or an increase in salary, knowing themselves to be incompetent to supervise the work of what ought to be the most intelligent class of electrical workmen, and others not overscrupulous, would, in my opinion, be a crime, and to appoint them under such conditions would be one, only in a less degree.

For this reason it behooves all superintendents of fire and police telegraphs to become familiar with all known methods of generation and distribution of electrical energy, both of high and low-tension currents. The police officer, in order to perform the duties imposed upon him, must have a signal system on which he can place implicit reliance.

Can anyone for a moment contend that these two important systems should not be constructed in the best possible manner and maintained in the highest state of efficiency? Should any but the most competent persons be placed in charge thereof? And should they not be given the very best and most competent men assistants? These are questions that can be answered only in the affirmative by any public official or private citizen, if they will only familiarize themselves with the workings of both of these systems.

Without at this time attempting to combat the belief that exists in the minds of the active politician that "to the victor belong the spoils," I do contend that the position of superintendent of fire and police telegraphs should not be counted among the assets of the spoilsmen. While it is perfectly proper that these officials should be selected from among those of the same political creed as the appointing power, they should be qualified in every way to perform the duties, and should be obliged to prove their ability before some authorized person or board competent to decide impartially, and who possess the respect and confidence of all classes in the highest degree, and whose certificate or license should be of value to the holder.

The practice in many cities of carrying high and low-potential currents on the same poles is detrimental to good work by our fire departments, and is a source of great danger to our citizens; it should be discouraged in every possible manner, despite all practical safeguards.

The future needs of an up-to-date fire department, electrically speaking, can be summarized as follows: Instantaneous alarm notifying the department of the exact location of a fire; the "danger lines" in all buildings to be protected by automatic fire-alarm service. The day of the old-style fire-signal box, requiring a key to open in order to send in an alarm, is passed. The keyless box has come to stay and is a great saver of time. Add to these a good, practical electrician, and the electrical needs of a fire department are well covered.

1. Abstract of paper read before the League of American Municipalities at Charleston, S. C., December, 1900. Mr. Mason is superintendent of police telegraphs at Brooklyn, N. Y.

E. J. Nally, General Superintendent Postal Telegraph Company.

One of the most capable and most popular men in the telegraph business in this country, Edward J. Nally, will have especial occasion to remember the old century's end, for he has just been promoted to the general superintendency of the Postal Telegraph-cable company, succeeding Leander D.

EDWARD J. NALLY.

Parker. Mr. Nally is still a young man, but he has spent a quarter of a century in the telegraph service and owes his advancement to his own intelligence, industry and affability. He was born in Philadelphia on April 11, 1860. Moving with his parents to St. Louis in 1868, he took a position as messenger boy with the Western Union Telegraph company on September 1, 1875. Since that time Mr. Nally has worked without interruption for the Western Union and Postal companies and has not lost one day's time. In 1878 he was promoted to the position of junior clerk in the office of the assistant general superintendent, a position then held by Colonel R. C. Clowry, now vice-president and general superintendent of the Western Union. Young Nally advanced rapidly to important clerical positions in this office and left in March, 1881, to go to Minneapolis, to take a place in the office of I. McMichael, superintendent of the eighth district of the Western Union, who had been his old chief in St. Louis. He was appointed chief clerk to Superintendent McMichael in 1886 and resigned in October, 1890, to accept a position as assistant to General Superintendent L. D. Parker of the Postal Telegraph-cable company, Chicago. A short time later Mr. Nally was made assistant general superintendent for the western division of the Postal company, and he has held that position up to his present promotion to the general superintendency.

Mr. Nally has seen the telegraph business grow from a comparatively small volume to its present extent, and has especially been in touch with its extension and great growth in the South and West through his connections with both companies. He was the only all-night messenger boy in St. Louis in his time, and while there were enough messages to keep him occupied at night, there was no great rush. Newspapers, which are now supplied with direct wires leading to all principal news centers, at that time depended upon the delivery by messenger of the press dispatches, sheet by sheet.

Borsig Electric Plow.

The A. Borsig company of Berlin, one of Germany's large manufacturing concerns of steam and electrical machinery, has introduced an electrical plowing system which seems to have met with favor, especially among the large-estate owners of Germany and the beet-sugar producers. Germany, as is well known, is the greatest beet-root sugar producing country in the world. Most of the great sugar-mill proprietors own at the same time extensive estates on which they cultivate their own beet roots, and the Borsig company is especially pushing its trade in electric plows among the sugar mills in Germany, Austria-Hungary and Russia. Agencies have been established in all the principal sugar-producing centers of these countries.

The cost of such an electrical plowing outfit for an average sugar-mill estate is given by the Borsig company as $44,250. A steam engine of 250 horsepower is needed to operate five electric plows. This engine may be worked condensing before and after the season, but during the season the exhaust steam may well be used in the evaporating apparatus. The estimated items of cost are as follows:

Engine	$ 7,500
Electric generating station	5,000
Line construction and transformers	10,000
Five electric plows and sundries	21,250
Miscellaneous	500
Total	$44 250

At this cost the capital to be invested amounts to about $8,850 per plow, thus being about 40 per cent. less than that required for the two-machine steam plow. With such a plant, the Borsig company further states, 2,500 hectares, or about 7,200 acres, can be plowed over at a depth of 14 inches, or an area twice as large as that which could be worked by the two-machine steam plow.

The electric plow works by means of two wire cables, which run in a parallel direction over the field, about three feet from each other. At one end an anchor carriage is used, which is so constructed that the carriage body itself is never influenced by the working plow, as the anchoring device is fixed to a kind of portable crane attached to the frame of the carriage. Thus the carriage frame itself can never get out of its original direction. As soon as the plow returns to the motor the anchor is lifted out of the soil by means of the motion of the idle plow cable, and this exactly for the distance which is required for the anchor setting in again.

In most cases, where the electric plow is used at present, the current is derived from a central station, from which it is transmitted to the field by means of overhead wires. From this overhead wire a flexible, isolated cable is, at a given point, connected to the motor car. The latter is placed on one end of the field to be plowed, and the anchor carriage at the opposite end of the field. The plow then travels between the motor car and the anchor carriage. As soon as one furrow is completed, motor and anchor cars advance exactly one furrow's space, when the work starts again.

The Borsig company asserts that the anchor carriages with disk wheels leave very much to be desired as to their practical use. The Borsigs therefore adopted for their system a multiple strong earth anchor, which, by the tractive power of the plow cable, fastens itself in the earth by self-action. A short chain connects the anchor with a rope pulley, the latter serving as a guiding device for the plow. Two horses are required for the transportation of the anchor carriage from field to field.

With regard to the use of the electric plows in sugar-mill estates, the company states that a special advantage lies in the fact that already existing stationary steam powers can be used for the generation of electricity, and that at the same time a number of individual plants may be supplied from such a central station. This is of the greatest importance, as in sugar factories the whole machinery lies idle during nine months of the year.

Improvements at Hamilton.

The Cataract Power company of Hamilton, Ont., has been making extensive alterations to its power-house distributing lines and transformer station. Having found it necessary to increase its plant, the company has just installed two new 3,000-horse-power turbines, manufactured in Milan, Italy, two 2,000-kilowatt, S. K. C. generators, 10 400-kilowatt, step-up transformers, three 300-kilowatt, rotary converters, and a Chloride storage-battery equipment. It has also built a second transmission line. A new building is nearing completion, which will contain the rotary transformers, arc-light apparatus, new battery equipment and the switchboards. It is the intention of the company to close down the power houses of the Hamilton Electric Light company, the Hamilton Street Railway company and the Hamilton Radial Railway company, and to distribute altogether from the step-down station in the city, the incandescent, arc, power and railway services being supplied from the one building.

The electric-light plant at New Sharon, Iowa, is to be improved and a heating system installed.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Toll Lines.

By W. P. Beardsley.

New telephone companies are to-day springing up like mushrooms in a hotbed, and the one all-absorbing topic which seems to take precedence of all others in importance is the toll line. Is not the toll line an absolute necessity to the success of every exchange? Take a majority of the cities of our country to-day, and what were they before we had railroads? Isolated from one another, of little importance, merely boroughs striving to get along, but to-day these same towns, connected as they are with each other and the outside world by rail, have developed into large and growing cities. So it is with the telephone exchange isolated from intercommunication with other exchanges. To thrive and grow we must interconnect with each other as an absolute necessity to success. It will not only foster the growth of present exchanges, but encourage the building of new ones, and eventually develop, like the railroad, into giving us connection with every state in the Union.

To accomplish this end, there must be co-operation and consolidation of business interests, which is essential in bringing together diversified and scattered operations. Not more than a year ago the toll line was classed as the "baby of the telephone family, but the strongest and most robust of them all." The almost miraculous development of this child in the last year is beyond our fondest expectations, and to-day I think we have sufficient evidence of the most gratifying character to state correctly that long-distance service by the Independent telephone companies is not a mere fancified dream, but an accomplished fact. There probably has been no other line of industry that has ever made as rapid progress or secured as substantial a footing in so short a period as in the building of toll lines.

We all know that properly constructed telephone toll lines are expensive to build and costly to maintain, and as it is a hard matter for one to be able to fix an equitable relation between outlay and income, the Independent telephone companies, as individuals, have been slow in pushing forward this line of work. In most cases, however, it may principally be attributable to lack of capital, and as this is the most essential thing necessary in the telephone business, as in all others, to whom have we to look for the realization of that on which our ultimate growth depends?

Is it not to the long-distance telephone companies throughout our several states, who, by their untiring efforts and zeal, inaugurated the movement and accomplished the work, which would indicate that at last the Bell company had at least met a competitor whose objects and purposes it cannot hope to defeat? When we gave to the people an equitable telephone rate consistent with the expense of operation and maintenance, the Bell people ridiculed, scoffed and even threatened us, but we fought them with never-ceasing vigor, until to-day—well, you know the rest; we are still in business with no retardation to our progress. With the Interstate Telephone and Telegraph company of Pennsylvania and the United States Telephone company of Ohio, we are gradually, but surely, outflanking the Bell interests in these states. These companies are bringing about the highest character of efficiency in toll-line service, and the work which they have accomplished in the development of the Independent toll-line system within the last year is remarkable.

The United States Telephone company of Ohio has at its head a man who needs no introduction to the telephone man, whose name is a synonym of success to any industry, Judge James M. Thomas of Cleveland, Ohio. In the last two years this company has constructed two thousand miles of pole lines, necessitating the setting of nearly 90,000 poles, with a total of about 10,000 miles of wire, operating, as it does, nearly 300 toll stations of its own, besides the toll-board equipment at the various telephone exchanges with which it is consolidated.

The Interstate Telephone and Telegraph company of Pennsylvania, though the younger of the two, having only been organized since December, 1899, has over 200 miles of pole lines and over 1,000 miles of copper wire in service, furnishing long-distance service to upward of 16,000 telephones in the states of Pennsylvania and New Jersey. The executive officers of the company are men whose names are a guarantee of success in any undertaking and the work which they have accomplished and are pushing forward with untiring efforts is but a forerunner of the realization of that dream for which the Independent companies have been waiting, that of long-distance service.

These, with other similar companies, are the ones to which we must look for the accomplishment of this need, and to succeed there must be organization, consolidation and co-operation of all telephone interests, the rapid consummation of which will give to the public the many advantages obtained from such a policy. There have been so many able articles written on the countless advantages of the toll line that it would be useless for me to go into detail, but it must be said that it is an absolute necessity to our success, and the progress made will depend upon the co-operation of all interested.

Chicago Telephone Situation.

President Willard T. Block of the United Telegraph, Telephone and Electric company and V. H. Surghnor, also representing the company, appeared before the Chicago City Council committee on gas, oil and electric lights last week to urge the passage of the ordinance enlarging the territory of the company from Hyde Park to the entire city. The representatives of the company stated that it is their intention to enter into a bona fide competition with the Chicago Telephone company, that the United company is backed by New York capital to enable it to carry out these plans if the ordinance is passed, and that they have agreed to a provision in the ordinance that the company shall not sell its franchise.

It was stated positively to the committee that the report that the United company had business connections with the Illinois Telephone and Telegraph company was untrue.

The United company promises a sweeping reduction of rates. The ordinance provides for a maximum charge of $50 a year for residence service, $85 for business telephones and $125 a year for public instruments. Mr. Surghnor stated that if permitted to spread, it would be possible for the new company to cut the present rates in half and still make money. In return for the 25-year franchise asked the company agrees to give the city of its gross receipts three per cent. for the first five years, five per cent. for the next 10 years and seven per cent. for the remaining 10. It was declared that if the Chicago Telephone company made compensation on this basis it would be paying to the city $500,000 a year.

It is provided that the wires and cables shall be laid in approved conduits, excepting in the outlying districts. The territory which will have conduit systems is bounded by Lake Michigan and by a line running from the lake west in Fullerton avenue to Western avenue, south to Twenty-second street, east to Halsted street, south to Thirty-ninth street and east to Lake Michigan.

The question of whether the council could secure authority to compel the co-operation of the two companies for the convenience of citizens was one which entered into the consideration of the subject. The matter of the 25-year franchise was referred to a sub-committee and a report is promised for next week.

Personnel of the Bell Company.

Charles P. Bowditch has been elected as a director in the American Telephone and Telegraph company. It was supposed that the vacancy in the board caused by the death of President Hudson would remain unfilled until such time as a successor for that office could be decided upon, who would also be given a place on the board. Unless the number is increased, by a change in the by-laws, the presidency will continue to be occupied by someone now a member, in all probability, and indications for the present are that Acting-president Cochrane will remain at the head of the company.

Recently a rumor was current to the effect that Governor Crane of Massachusetts, who is the largest stockholder in the company, was to be chosen president of the telephone concern on the expiration of his term as governor a year hence. Mr. Crane was in Washington when the rumor first came to light in public print, and was interviewed on the subject by the Washington correspondents of some of the Boston papers. He gave an emphatic denial to the report.

Northern Pacific Starts Its Telephone System.

The Northern Pacific Railway company has taken its first step in the substitution of the telephone for telegraph at Fargo, N. D., by connecting with the long-distance lines of the Northwestern Telephone Exchange company. It is understood the connections will be made between Fargo and Jamestown and Fargo and Lisbon and between Sanborn and Cooperstown. Beyond these points the company will use its telegraph lines, as it is believed the same wires can be used at the same time for both telephoning and telegraphing.

Meeting of Interstate Telephone Association.

The Interstate Telephone association will hold its next meeting at the Hotel Baltimore, Kansas City, Mo., on Tuesday, January 15th next. The meeting promises to be the largest gathering of Independent telephone people held in the West, and all owners or representatives of telephone exchanges or toll lines are urged to be present. Fred Bason is president of the association and George R. Armstrong, Pierce City, Mo., is secretary.

Bell Company Wins Against Western Union.

In the United States Circuit Court in Boston on December 21st Judge Colt gave a decision in favor of the American Bell Telephone company in the long-continued case relating to the question of royalties, on suit of the Western Union Telegraph company, a large sum being claimed by the latter company under a contract between the two corporations bearing date of November 10, 1879.

Under the contract, the defendant, then known as the National Bell Telephone company, agreed to pay the plaintiff, the Western Union Telegraph company, 20 per cent. of all rentals or royalties received from licenses for telephones in the United States. The Bell company issued licenses to sundry corporations and received, in addition to the annual rental for telephones, 35 per cent. of the capital stock of these corporations.

The plaintiff asserted that this stock was "rentals or royalties" within the meaning of the contract, and that it was entitled to 20 per cent. of the stock and the dividends declared thereon. The defendant maintained that the "rentals or royalties" mentioned in the contract were the standard annual rentals (less commissions), and nothing more; that it had the exclusive right under the contract to carry on the exchange business and to receive the profits, or to license another corporation to carry it on, receiving from such licensee a share of the profits; that this stock, in other words, merely represented the outcome of the mode adopted for realizing its share of the profits of the exchange business. The case was referred to a master, who found in favor of the defendant. The present hearing was had on the plaintiff's exceptions to the master's report. Judge Colt overruled the exceptions taken by the plaintiff and sustained the master's report.

GENERAL TELEPHONE NEWS.

The directors of the American Telephone and Telegraph company have declared a regular quarterly dividend of 1½ per cent. and an extra dividend of three-fourths per cent., payable January 15th to stock of record December 31st.

A committee headed by Dr. S. N. Quillin, acting for the People's Free Telephone company, has made arrangements to open an exchange in the city of Spencer, Ind. Both day and night service will be given. There are now about 600 telephones on the line.

W. H. O. Buttler, manager and principal stockholder of the Citizens' Telephone company of Columbus, Ind., has sold his stock to S. P. Sheerin of Indianapolis, and will move to some point in Illinois. Mr. Sheerin has installed Max Hosea, chief lineman, as manager.

Mr. James Kelsey, who has made several successful tests of his wireless system of telephony near Minneapolis,, recently succeeded in telephoning a distance of 1,000 feet across the Mississippi River without conducting wires. The parallel wires on the two shores were No. 14 B. & S. copper.

A telephone girl in the exchange at Shelbyville, Ind., was able to interrupt a bank robbery there recently. Hearing an explosion at about three o'clock in the morning, she went to the window and saw the men at work in the bank opposite. Hurrying back, she aroused the villagers, but the robbers escaped.

The telephone service recently established at New Bedford, Mass., by the Automatic Telephone company is said to be working well and to be giving satisfaction. An automatic switchboard has been installed. It is said to have an ultimate capacity of 10,000 subscribers. The number actually receiving service is not stated, however.

Discussion has been started by several physicians in New York concerning the effect upon the ear of the click often heard in the receiver when connection is being made at the central exchange using a "relay" or "common-battery" system. The injurious effects of the click may be avoided by holding the receiver some distance from the ear.

The Rochester Telephone company (Independent) of Rochester, N. Y., has just issued its third directory. It is a neat and attractive publication and contains, besides the list of subscribers, information of interest to the company's patrons. This company now has 3,000 subscribers connected to its switchboard and is rendering good service at reasonable rates. It has toll-line connection with 14 towns in the vicinity of Rochester. The following-named gentlemen are officers of the company: President, Frederick Cook; vice-president, Eugene H. Satterlee; secretary, George R. Fuller; treasurer, V. Moreau Smith; general manager, C. E. Stinson; superintendent of construction, C. O. Harris; contracting agent, M. F. Babcock.

Telephone News from the Northwest.

The new police telephone system in St. Paul is promised to be in and ready for operation by February 1st.

The Dakota Central Telephone company of Aberdeen, S. D., proposes to extend its toll lines to Mitchell in the spring.

The rural telephone line of Carbon City, Iowa, is being extended to connect with Fort Dodge, Boone and other points.

The council of Creston, Iowa, will soon discontinue the use of the Iowa Telephone company's service. The new mutual company there has its system about completed, and will furnish the city free service.

A new telephone company, the Mitchell County Telephone company, has been formed at Osage, Iowa, largely through the efforts of M. O. Tuttle. The company will connect with Waterloo.

The Iowa Telephone company of Des Moines, Iowa, plans to place its wires underground in the business section there, if the courts find that it is entitled to the use of the streets without a franchise.

George C. Hunt has applied to the council of Seattle, Wash., for a local telephone franchise. He claims to have ample capital to push the enterprise to a successful conclusion.

Further experiments in Minneapolis with wireless telephony reveal the fact that there is a great deal of vagrant current at large. In one instance the ticking of a telegraph instrument could be heard distinctly, although there were no wires in the vicinity. Professor George D. Shepardson of the University of Minnesota took a number of tests. It is regarded as certain that a conversation can be carried on over a distance of 10 miles.

The new line of the Wood County Telephone company from Grand Rapids, Wis., to Marshfield has been completed and put in operation.

Milaca, Minn,. will soon have toll-line connection with Princeton, Minn.

A new switchboard, to accommodate 200 connections, has been installed for the exchange at Phillips, Wis.

The Whitten (Iowa) Mutual Telephone company has set poles to connect with the Mutual company at Felix.

The new local exchange at Lamberton, Minn., has been completed and put in operation.

The Wisconsin Telephone company is taking new bids from contractors for the erection of its exchange building in La Crosse, Wis., and expects to have work started in the spring.

The Edgar Local Telephone Exchange company of Edgar, Wis., has been formed and a local system will be installed at once.

The Steele County Telephone company has been formed at Blooming Prairie, Minn., and has been granted a franchise for a local system. Later on toll lines will be built to Corning and to Ellendale.

Arrangements are being made to secure connection by the local exchange at St. Thomas, N. D., with the toll system of the Northwestern Telephone Exchange company.

The Douglas County Telephone company has added a new switchboard for its exchange at the East End, Superior, Wis. The People's Telephone company of Superior now has over 700 connections, and will soon have to add sections to the switchboards at West End and also at East End.

The Oakland (Iowa) Telephone company has completed a line to Carson, on the way to Council Bluffs, Iowa.

Telephone connection has been completed with Whitehall, Mont.

The Fox River Valley Telephone company has completed a toll line from Kankauna, Wis., to Dale, where it will connect with the Little Wolf River telephone system. Poles are set from Dale to Appleton, and it is expected to have the line wired very soon.

A farmers' mutual line is constructed from Adair, Iowa, to Carley and Linwood.

The city of Minneapolis has won its case against the Northwestern Telephone Exchange company on a demurrer. The telephone company resisted the payment of a tax on its realty, claiming that the gross-earnings tax covered all property. The city demurred on the ground that the company had no right to a demurrer, as it had adequate remedy at law if the tax were illegal. The court refrains from entering into the merits of the case. R.

Ohio Telephone Notes.

Judge James M. Thomas, manager of the United States Telephone company, confirms the statement made in this correspondence a few days ago that a contract has been closed between his company and the Pittsburg and Allegheny Telephone company which will give all Ohio points entrance to Pittsburg, and on the other hand, will give Pittsburg and points connected by the Pittsburg company access to all points in Ohio which are reached by the United States Telephone company. The line to Pittsburg to form this connection is now well under way and its construction will be completed early in the year. This is one of the very important connections that will be made by the United States company toward giving its patrons an outlet to the East.

The London Telephone company has made arrangements to connect with a farmers' line in the northern part of Madison County and the southern part of Champaign County, which will give access to nearly all the smaller towns in that section.

At a meeting held at the office of the Columbiana County Telephone company at Salem a few days ago, the Independent Telephone Association of Columbiana County was organized, for the purpose of mutual aid among the Independent companies of the county, promotion of business and for improving the service to its subscribers. Lewis Walker of the Eastern Ohio Telephone company was chosen president, and W. F. Crossley of the Columbiana County Telephone company was made secretary. An executive committee, consisting of the following-named persons, was chosen: W. F. Crossley, Columbiana County Telephone company; B. T. Shreve, Eastern Ohio Telephone company, Bayard; Joseph E. Walton, Winona Telephone company, Winona; E. E. Walker, Damascus Telephone company, Damascus. Regular quarterly meetings will be held, but special meetings may be called by the president at any time.

Captain George N. Stone, president of the Independent telephone company at Cincinnati, has offered to place telephones in the principal school buildings in that city, to be used until further notice, free of cost, and the offer has been accepted.

A movement is on foot to organize an Independent telephone company at Springfield. There has been some dissatisfaction there concerning the rates charged and the service rendered by the old company. As a result, several local men proposed to enter into a plan to form a new company. J. J. Dunn of Columbus spent some time in that city last week looking the matter up, and David F. Snyder, city engineer of Springfield, is also interested. They are ready to make no announcements as yet.

Kora F. Briggs and other persons, citizens of Tiffin, have made arrangements to build and operate a telephone plant at Pemberville. It is a small place, but the people are enthusiastic over the prospects of having an Independent service.

On retiring from the service of the Warren and Niles Telephone company, a few days ago, Manager E. J. Clapp tendered the officers, directors and employes a banquet at the Elliott Hotel at Warren. Mr. Clapp was the recipient of several handsome presents. E. G. Miller succeeds him as manager. O. M. C.

EXTENSIONS AND IMPROVEMENTS.

The Carlinville Telephone company, located at Carlinville, Ill., has certified to an increase in capital stock from $5,000 to $30,000.

The Roanoke and Botetourt Telephone company will make extensions to its system now in operation and is in the market for telephone supplies. L. A. Noel, Fincastle, Va., is the president of the company.

The telephone line between Grand Junction and Delta, Colo., has been completed and the first messages were spoken over it recently. Within a few weeks Grand Junction will be connected with Denver by telephone.

The Telephone Toll Line company of Grand Rapids, Wis., has just completed a line from that city to Marshfield, Wis., a distance of 40 miles. The line will connect with the Marathon County lines, and will form an important part of the Wisconsin Valley system. The company has recently passed into the control of C. M. Dougherty, general manager of the Wood County Telephone company.

TELEPHONE MEN.

J. E. Epperson has been made manager of the Carroll (Iowa) office of the Iowa Telephone company.

J. H. Corcoran has accepted a position as chief inspector for the Central Union Telephone company at Rockford, Ill.

R. W. McHenry manager of the Hawkeye Telephone company at Iowa Falls, Iowa, has resigned his position and returned to his home at Rochelle, Ill. He is succeeded by A. Middledorf of Gladbrook, Iowa.

W. I. Thraikill has been transferred from the managership of the Iowa Telephone company's office at Red Oak, Iowa, to the office at Boise City, Idaho. He is succeeded at Red Oak by C. R. Potter of Creston, Iowa.

MANUFACTURERS AND DEALERS.

The Haynes & Noyes company of Chicago has been incorporated, with a capital stock of $10,000, to manufacture telephones and electrical appliances. The incorporators are Frank J. Smith, Austin J. Doyle, Jr., and Herbert Pope.

During the last eight months the Western Telephone Construction company of Chicago has, under its new organization and management, done a most successful business. In this short time it has secured many contracts for large exchange multiple equipments. The cities to be equipped by the company are Pottsville and Williamsport, Pa., Corsicana, Texas, Greensboro, N. C., and Binghamton, N. Y. The company has also recently shipped a 200-line Western express switchboard to Ashland, Pa., and has booked orders for 100-line switchboards for Columbia, Pa., Leesburg, Ohio, Zanesville, Ohio, Lancaster, Ky., and smaller orders for other points. Large orders for telephones have been recently filled for Leesburg and Eaton, Ohio; also an additional order for telephones from the Chicago and Alton Railroad company for its lines between Chicago and Bloomington.

Labor Conference Discusses Strikes and Arbitration.

The labor conference called by the National Civic Federation to consider the adjustment of labor troubles was held in Chicago on December 17th and 18th. The addresses presented were comprehensive and of deep interest, as was evidenced by the close attention given them and the frequent applause accorded the speakers. Chairman Franklin MacVeagh, in opening the conference, laid stress on the fact that the disagreements are not, as a rule, between laborers and capitalists, but between two sets of wage-earners—both sets properly coming under the classification of workingmen. As examples, he cited the great railway and coal-mine strikes, where the controversy is between different departments of the organization involved, while the real capitalists—the stockholders—take no active part in the strikes and are merely helpless sufferers.

During the conference several speakers laid emphasis on the self-evident proposition that compulsory arbitration is no arbitration at all, and is contrary to the spirit of the term.

The conference adopted resolutions recommending that the industries of the country should appoint boards of conciliation to which differences and disputes between employers and employes might be referred if they could not be otherwise settled. A committee was appointed to serve for one year "for the purpose of a general system of conciliation that will promote industrial peace."

The committee is composed of the following-named gentlemen: A. C. Bartlett, vice-president Hibbard, Spencer, Bartlett & Co., wholesale hardware; Henry W. Hoyt, president National Founders' association; Herman Justi, commissioner Illinois Coal Operators' association; G. Watson French, vice-president Republic Iron and Steel company; E. D. Kenna, vice-president Atchison, Topeka and Santa Fe railway system; Channcey H. Castle, president Stove Founders' National Defense association; Samuel Gompers, president American Federation of Labor; John Mitchell, president United Mine Workers of America; Martin Fox, president Iron Molders' Union of America; Frank P. Sargent, grand master Brotherhood Locomotive Firemen; Henry White, general secretary United Garment Workers of America and James M. Lynch, president International Typographical union.

The sense of the conference was distinctly against compulsory arbitration, and it is hoped that the committee may be able to establish a stable and efficient system for the amicable settlement of labor troubles throughout the country.

Chicago Electrical Association.

The annual meeting of the Chicago Electrical association was held at its rooms in the Monadnock block, Chicago, on the evening of December 21st. The paper of the evening had been prepared by J. M. Hollister, president of the association, and had as its subject "Electrical Features of the Paris Exposition." Owing to the fact that Mr. Hollister is still abroad, the paper was read by Van Renssaeller Lansingh. It was illustrated by about 25 stereopticon views of exhibits and scenes at the exposition and proved to be very interesting. In the discussion by the members the fact was brought out that practically all of the engine-driven units exhibited at Paris had engines of the single-expansion type. These engines were either run simple or condensing, and it seemed to be the practice in using the single expansion to sacrifice economy, so as to gain better regulation. There were compound and triple-expansion engines shown, but they were, as a rule, used solely for exhibition purposes.

Following the reading of the paper and its discussion, the annual election of officers for the ensuing year was held, resulting as follows: President, R. F. Schuchardt; vice-president, Harold Almert; treasurer, H. G. Dimick; secretary, W. J. Warder, Jr.; librarian, W. B. Hale; auditor, George M. Mayer; board of directors, L. G. Bassett, H. P Clausen and J. R. Cravath.

Owing to the inability of C. C. Mattison to be present and read a paper as schednled for the next meeting of the association, on January 4th, a substitution will be made by Albert Scheible, who will read a paper on "Popular Notions on Hindrances to Electrical Progress."

Zurich Electric-railway System.

Mr. Lieberknecht, United States consul at Zurich, sends some interesting notes on the Zurich tramways. The fare in Zurich is to-day 12.5 centimes (2.5 cents) when buying the tickets in block books, but will within the course of a few years be lowered to 10 centimes (two cents). Coal costs from 33 to 40 francs ($6.37 to $7.72) a ton delivered at the power station. The electric lines have all been constructed by Mr. J. Sigfrid Edström, a Swedish engineer, who received his technical education in the United States. The rail bonds used are from New York, and the cars are equipped with Peckham trucks. The motors and controllers are also of American manufacture. One line was built with cast-welded joints and no bonds.

The Empire City Gas and Electric company of Trenton, N. J., has been incorporated for $500,000, by G. W. Lynch, M. Caflesch and J. T. Underhill. The company is empowered to supply heat, light and power.

Steam Turbines.[1]

By Francis Hodgkinson.

The fundamental principle of the steam turbine, in contradistinction to the reciprocating steam engine, lies in the fact that the latter does work by reason of the static expansive force of the steam acting behind a piston, while in the former case the work is developed by the kinetic energy or particles of steam which are given a high velocity by reason of the steam expanding from one pressure to a lower.

Steam turbines may be divided into three clases:
First—Impact, of which Bianca's is an example.
Second—Reaction, of which Hero's is an example.
Third—A combination of both of these, of which Parsons' is an example.

It is proposed in this paper to deal only with the two forms which have attained some degree of

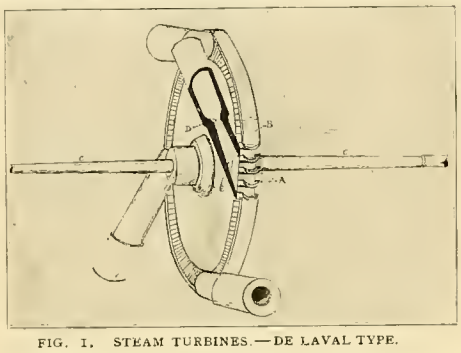


FIG. 1. STEAM TURBINES.—DE LAVAL TYPE.

commercial success, namely, the Parsons and the de Laval, particularly the former.

The general principles made use of in water turbines also apply to steam turbines. The buckets and guides must have as little skin friction as possible and be so arranged that the acting fluid may strike without sudden shock and have its direction of motion changed without sharp angular deflections. One difficulty, however, presents itself and is due to the tremendous velocity of steam, as compared with that of water under ordinary heads.

The laws governing the best velocity of buckets are the same as for waterwheels. In the impact turbine the ideal condition is when the peripheral velocity of the buckets is one-half that of the fluid comprising the jet. In the reaction turbine this velocity must be equal to that of the jet, in order to give us this ideal condition. Now, with high-pressure steam discharging into a vacuum, the velocities obtained are from 3,000 to 5,000 feet per second, as calculated by Zeuner's formula.

A turbine, therefore, built on the lines just enumerated would have peripheral velocities far beyond the limits of strength of material. As an example, a 10-inch Hero engine would revolve at 75,000 revolutions per minute.

The de Laval turbine, shown in Fig. 1, consists of a divergent nozzle, which directs the jet of steam upon suitably formed buckets (A), which are attached to the periphery of a revolving wheel. The outer edge of the buckets is shrouded by a steel ring (B), which prevents the centrifugal escape of the steam. The unique features of this turbine are the nozzle and the means by which the wheel is enabled to revolve upon its axis of gravity.

1. Abstract of paper read before the Engineers' Society of Western Pennsylvania at Pittsburg, Pa., on November 20, 1900.

With regard to this latter point, a difficulty always arises in attempting to revolve a body at a high rotative speed. It is essential, in the first place, that the body be accurately balanced, but in spite of all care this cannot be attained with absolute accuracy. The result is that, with ordinary shaft and bearings, tremendous vibrations would be set up that would probably result in eventual rupture of the shaft. De Laval overcomes this difficulty, however, by mounting his wheel near the center of a long, light shaft (C), capable of being considerably bent and returning to its original form. The shaft is mounted upon bearings of ordinary construction. This flexibility enables the forces set up by the revolving wheel to deflect the shaft and enables the former to revolve about its axis of gravity.

The nozzle is divergent. In it the whole expansion of the steam is carried out. The steam at the mouth of the nozzle has the same pressure as the exhaust. In other words, the steam has its energy completely transformed into mass and velocity by the time it comes in contact with the buckets. This brings up another feature of the turbine, which is, that with the exception of the nozzles and the throats of the nozzles, no parts are subjected to steam pressure.

The throat of the de Laval nozzle is at (D), having a well-rounded entrance, and from there on the nozzle diverges. The relation of the area of the outlet at (E) to the area of the throat at (D) should satisfy an equation which simply states that equal weights of steam pass at both the throat and the outlet in equal intervals of time. Practically, a nozzle must be made with the area at the exhaust end as small as possible, for the sake of getting the greatest velocity, but just so large that the pressure will not be higher than that of the exhaust pipe. The best length of nozzle is hard to determine. If too long, there will be considerable loss of velocity due to skin friction. At the same time, it must be long enough to admit of proper expansion of the steam. The best shape of the divergency has been the subject of investigation by various experimenters, in order to give the best expansion curve, regarded as a single particle. The writer's opinion is that the best results in this respect are obtained by a nozzle whose section is very near an ellipse.

In the de Laval turbine the nozzles are set at an angle of 20° with the plane of motion of the buckets, which is as acute an angle as is possible. These turbines, especially the larger sizes, are equipped with several nozzles, some of which are provided with independent stop cocks, such that

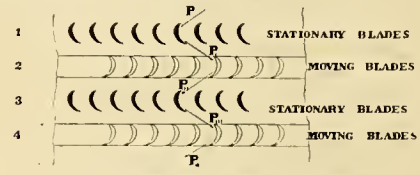


FIG. 3 STEAM TURBINES.—DIAGRAM ILLUSTRATING ACTION OF STEAM IN PARSONS TURBINE.

the number of nozzles in operation may be adjusted to suit the condition of running in order to obtain the most suitable steam pressure in the throats. They are essentially of very high speed. The smaller sizes run about 30,000 revolutions per minute and are geared down to about 3,000; the larger sizes, about 10,000 revolutions per minute. The peripheral speed of the wheel is usually from 600 to 1,200 feet per second. The reduction of speed is accomplished by means of a pair of helical spur gears with the angle of helix 45°. These gears form by far the biggest part of the whole outfit. The remaining portions of these turbines have no remarkable features. The regulation is effected by means of a fly-ball governor, which is on the slower running shaft and wire-draws the steam at the admission.

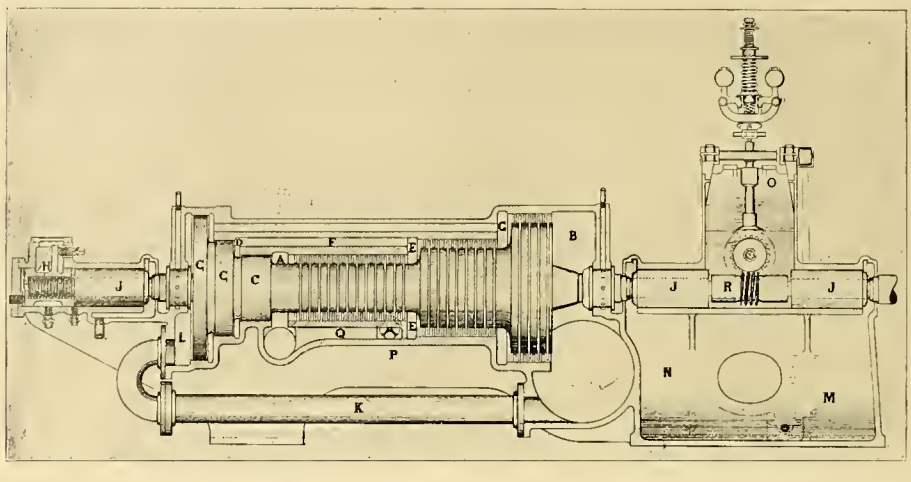


FIG. 2. STEAM TURBINES.—LONGITUDINAL SECTION OF WESTINGHOUSE PARSONS TURBINE.

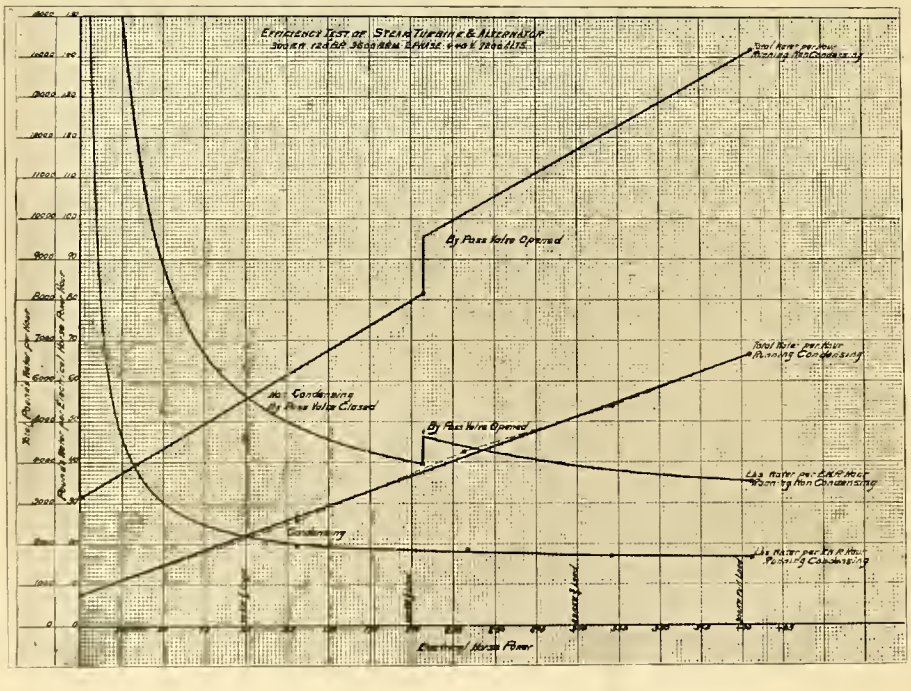


FIG. 4. STEAM TURBINES.—ECONOMY CURVES OF A 300 KILOWATT TURBINE.

Some tests of a 10-horsepower turbine were communicated to the American Society of Mechanical Engineers in 1895, in which the turbine described had four nozzles of 0.138 inch diameter and one of 0.157 inch diameter of throat. The nozzles were two inches long from throat to outlet. The speed of the turbine was 23,771 revolutions per minute, reduced by gearing to 2,400; the economy, full load, non-condensing, was 47.8 pounds per brake horsepower. This economy is by no means bad, when the small power of the outfit is considered. In December, 1899, some tests were made in France under the following conditions: One hundred and ninety-two pounds boiler pressure, with 69° F. of superheat; mean horsepower, 307.8; revolutions per minute, 772. The consumption of steam was 13.92 pounds per effective horsepower.

The first Parsons steam turbine and generator was built in 1884. It developed 10 horsepower at 18,000 revolutions per minute. It ran for several years in Gateshead-on-Tyne, England, supplying current for the manufacture of incandescent lamps. It is now in the South Kensington Museum. It consisted of two groups of 15 turbines each, the steam entering between them and passing in opposite directions through each group.

Fig. 2 is a general longitudinal section through a Westinghouse-Parsons steam turbine. The steam enters at the governor valve and arrives at the chamber (A), and passes out to the right through the turbine blades, eventually arriving at the exhaust chamber (B). The blades are shown in Fig. 3, the steam passing first a set of stationary blades and impinging on the moving blades, driving them around, and so on. The areas of the passages increase progressively in volume, corresponding with the expansion of the steam. On the left of the steam inlet (Fig. 2) are shown revolving balance pistons (C), (C) and (C), one corresponding to each of the cylinders in the turbine, which, according to size, may be one, two, three or four in number. The steam at (A) presses against the turbine and goes through doing work. It also presses in the reverse direction, but cannot pass the piston (C); but at the same time, the pressure, so far as the steam at (A) is concerned, is equal and opposite, so that the shaft is not subjected to any end thrust. The pressure at (D) is equal to that at (E), by reason of the balance port (F); so, similarly, as far as the steam pressure at (E) is concerned, there is no end thrust. This same fact also applies to (G).

The area of the balance pistons is so arranged that no matter what the load may be, or what the steam pressure or exhaust pressure may be, the correct balance is preserved and the shaft has no end thrust whatsoever. At (H) is shown a thrust bearing, which, however, has no thrust to take care of, but serves to maintain the correct adjustment of the balance pistons. The thrust bearing is in two halves, the lower half capable of adjustment in one direction, the upper one in the reverse.

The balance pistons never come in mechanical contact with the cylinder, and consequently there is no friction. The thrust bearing has ample surface, and, besides, is subjected to forced lubrication and does not wear. The adjustments once made always remain good. There is obviously some leakage past the pistons, but it is found to be very small. Centrifugal force seems to have something to do with keeping down this leakage. The particles endeavoring to escape have to pass radially inward in going through the small clearance. It is supposed, then, that the rapidly revolving pistons have the effect of throwing outward the particles with which they come in contact by reason of skin friction, so that the particles being slung outward tend to oppose the escape of the particles inward. This theory, however, is somewhat imaginary, but in view of the economy obtained, the leakage cannot be very great.

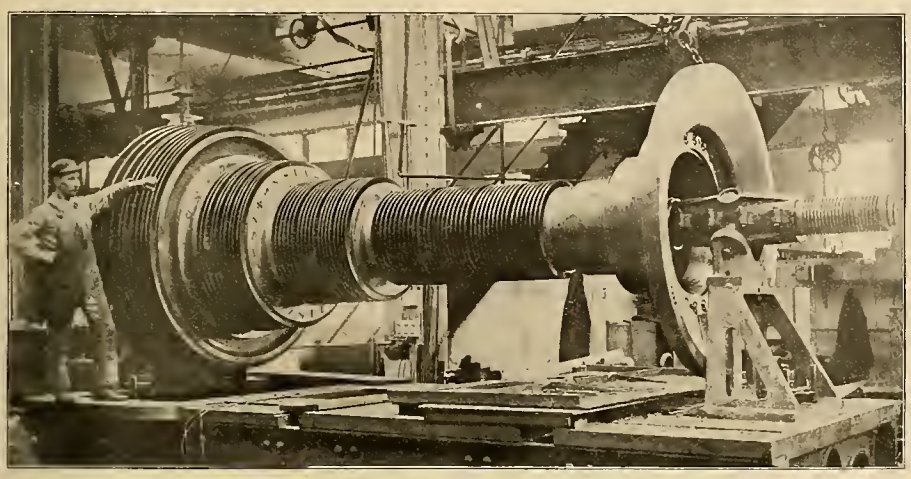


FIG. 5. STEAM TURBINES.—REVOLVING PART OF 3000-HORSEPOWER TURBINE.

At (K) is a pipe connecting the back of the balance pistons at (L) with the exhaust chamber, to insure the pressure at this point being exactly the same as that of the exhaust.

At (J) are shown the bearings, which are unique in construction. They have ample surface, are continuously lubricated under pressure, and it has been found in practice that they do not wear.

At (R) is shown a flexible coupling, by means of which the power of the turbine is transmitted. In small sizes the two shafts have a square cut on the ends, the coupling itself somewhat loosely fitting over these. In larger sizes it is generally a modification of this arrangement. The governor gear and oil pumps generally receive their motion by means of a worm wheel, gearing into a worm cut on the outside of the coupling.

At (N) is an oil reservoir, into which drains all the oil from the bearings. From there it runs into the pump (M), to be pumped up to the chamber (O), where it forms a static head, which gives a continuous pressure of oil to the bearings. The pump is single-acting, of the simplest possible construction, that will not become deranged. The oil runs in by gravity, so that it is unlikely to fail to continue pumping.

A by-pass valve is provided, shown at (P), which admits high-pressure steam by means of port (Q) to the steam space (E). By opening this valve as much as 60 per cent. overload may be obtained, and in the case of turbines operating condensing full load may be obtained should the condenser be at any time inoperative, due to any cause, and the turbine allowed to exhaust into the atmosphere. Naturally the effect of opening the by-pass valve is to reduce the economy to an extent that will be seen later when discussing economy.

The glands consist of packing rings set in grooves cut in the shaft. The rings press outward and remain stationary. Any form of frictionless packing necessarily leaks a little. In the case of the turbine exhausting into a vacuum a little live steam is admitted between the rings by means of a small reducing valve, so that the leakage consists of a negligible quantity of live steam, instead of air, which would impair the vacuum.

In case of the turbine exhausting against anything above atmospheric pressure, a small ejector is provided, which drains the leakage steam from between the packing rings and allows it to drain through a suitable drain pipe, instead of escaping into the engine room.

In all engines the governor is an important consideration. A fly-ball type of governor is made use of, and it has several features conducive to good regulation. The ball levers are swung on knife edges in lieu of pins. The governor works both ways; that is to say, the mid-position of the levers is admitting a full head of steam to the turbine. A movement from this in either direction is tending to cut off the supply. This serves a useful purpose in the event of a very excessive load coming on the turbine, such as a short circuit, which has the effect of bringing down the speed more than the percentage variation permitted by the adjustment of the spring, when the steam immediately becomes shut off. Again, in such an event as some of the governor-driving mechanism becoming broken, and the governor balls slowing up independently of the turbine, the steam is shut off before any damage could take place.

The speed of the turbine may be varied within all the limits of the governor spring while the turbine is running. This is particularly useful in bringing alternators into synchronism and adjusting their differences of load when in multiple.

The function of the governor is to vary the plane of oscillation of the relay valve, which causes the admission valve to remain open for a longer or shorter period, according to the position of the governor. The steam, therefore, is admitted to the turbine in puffs, which occur at constant intervals of time. The puffs are either of long or short duration, according to the load. At full load the puffs merge into an almost continuous blast. The advantages of this intermittence are threefold. The turbine is at all times using boiler-pressure steam, no matter what the load may be. The admission valve is continuously in motion, and consequently gets no opportunity to get stuck.

There is absolutely no variation of angular velocity in the turbine, which is necessarily present in reciprocating engines, hence the value of turbines for running alternators in multiple. This can be realized when we know a 500-horsepower turbine will run 20 minutes after the throttle has been closed. This, of course, speaks well for the low friction, but is principally due to the tremendous flywheel effect of the shaft. All the power is transmitted rotatively; there are substantially no reciprocating parts and no vibrations, hence no costly foundations and no holding-down bolts are necessary.

The essential parts of the turbine are, of course, the blades and buckets. They are made of hard-drawn material. They vary in size from one-half inch to seven inches, according to where they may be used. Every row of these blades has passages of increased area, corresponding with the volume of the steam. This increase of volume is obtained by increasing the heights of the blades, and when these have reached the desired limit the diameter of the turbine is increased and the steam permitted a higher velocity that enables the blades to recommence another progression.

Considering one barrel of the turbine, the fall of pressure, or, to be more exact, the coefficients of expansion, are the same for every row. Referring again to Fig. 3, the steam at pressure (P) in expanding through row (1) to pressure (P_1) converts its energy into velocity and impinges upon the moving blades in row (2). The steam then performs a second expansion in expanding through row (2), again converting its energy into velocity, but this time the energy of the efflux is to react upon the blades from which the steam issues. The same cycle is repeated in (3) and (4), and so on, until exhaust pressure is reached. The moving blades therefore receive motion from two causes, the one due to the impact of steam striking them, the other due to the reaction of the steam leaving them, and in this respect is this turbine a combination of Bianca's wheel and Hero's engine.

Turbines are constructed to utilize the energy of the steam down to the utmost limits. A condensing steam turbine, when in operation, affords a striking example of the conversion of heat into energy. The temperature of the walls of the cylinder at the high-pressure end, about 365° F., falls in the distance of three or four feet to a temperature of about 126° at the low-pressure end.

Fig. 4 shows some economy curves developed from tests made on one of the 300-kilowatt turbines now in operation at the Westinghouse Air Brake company's works. The results may be summarized as follows:

Full load, 16.4 pounds steam per electrical horsepower-hour.
Three-fourths load, 17 pounds steam per electrical horsepower-hour.
One-half load, 18.2 pounds steam per electrical horsepower-hour.
One-fourth load, 22 pounds steam per electrical horsepower-hour.
Running light, 750 pounds per hour.
Vacuum, 26 inches to 27 inches.
Boiler pressure, 125 pounds per square inch.
Revolutions per minute, 3,600.

The consumption of 16.4 pounds at full load is in itself remarkable, but such results as at the light loads have never been approached before. It may be said that the consumption at one-half load is only 10 to 12 per cent. greater than at full load.

It must not be lost sight of that these results are per electrical horsepower. To make a comparison with a reciprocating engine and assume the efficiency of transmission from the steam cylinders to the switchboard to be 85 per cent., which is about the very highest attainable, would bring the full-load water rate on the turbine just described to 14 pounds per indicated horsepower. The tests were made under ordinary conditions, so far as dryness of steam is concerned, the boilers being some distance away and no allowance made for wetness of steam.

On the curves are shown a set of lines showing the efficiency when running non-condensing. These results are somewhat inferior, by reason of this particular turbine being designed essentially for condensing. Nevertheless, the results are not so bad as to preclude it being operated under these conditions, should at any time the condenser be out of order. A turbine designed for running non-condensing gives proportionately as good results as the condensing curves shown on the diagram.

By this set of curves may be observed the function of the by-pass valve, how, when running non-condensing, the by-pass valve remained closed until about half load was reached. Upon being opened the efficiency fell off, as shown, and continued to improve from there on as the load increased. The overload capacity of the engine is obviously more flexible than that of most engines.

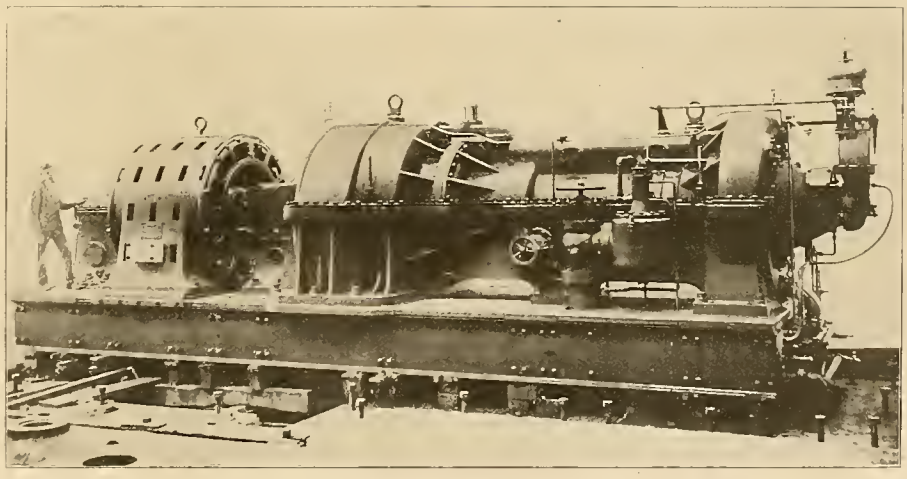


FIG. 6. STEAM TURBINES —3000-HORSEPOWER WESTINGHOUSE-PARSONS TURBINE.

The practical efficiency of a turbine power plant may be gathered by some tests made by the Westinghouse Air Brake company. After the plant had been installed some nine months the whole plant was shut down, and the steam engines, which had been previously doing the work, were connected up again, put in service and were kept running a week, during which time careful measurements were taken of fuel and water. After this the turbine plant was again put in operation and similar measurements made with the electrical transmission. The saving in coal averaged 35.7 per cent. during the day and 36.4

per cent. during the night in favor of the turbines. The saving in feed water averaged 29.8 per cent. during the day and 41.4 per cent. during the night. In round numbers, this means a saving of 40,000 pounds of coal in 24 hours. The gain is in a great measure due to the economy of the turbines, but also to some extent to the elimination of the condensation in long lengths of steam pipe and to the advantages of electrical transmission.

Lately, a 1,000-kilowatt outfit has been built by C. A. Parsons & Co. for the Elberfeld corporation in Germany. At 1,200 kilowatts, 130 pounds boiler pressure, 18° F. of superheat, the turbine driving its own air pump, etc., an electrical horsepower was produced for 14.025 pounds of steam. This is probably the highest economy ever attained in any steam engine.

Fig. 5 shows the complete revolving part of a 3,000-horsepower turbine. Its weight is 28,000 pounds; length over all, 19 feet eight inches; 12 feet three inches between bearings; the largest diameter, six feet. The turbine of which this forms a part is shown in Fig. 6, and is being set up in the power house of the Hartford Electric Light company. It is direct-connected to a 1,500-kilowatt generator, the total outfit having the following dimensions, viz., 33 feet three inches long, eight feet nine inches wide, 175,000 pounds' total weight, including generator. This is the largest steam turbine in one integral part ever built.

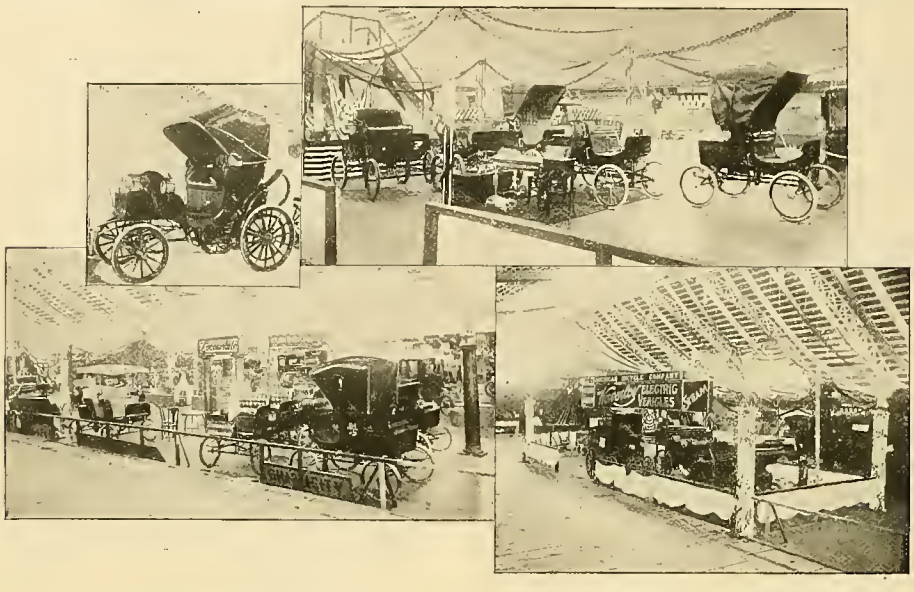
As there are no rubbing surfaces in the turbine, no internal lubrication is necessary. This enables surface condensers to be employed and the condensed water used for boiler feed without fear of getting grease into the boilers. The turbine is entirely automatic in all its functions, and requires remarkably little attention. The only real working part is the spindle revolving in its bearings. These bearings are found to wear but little, if at all, so the cost of renewals and repairs is very small. By reason of the turbine making use of the last available expansion of the steam, there is considerable advantage in employing the highest vacuum.

The applications of steam turbines are perhaps not so universal as ordinary steam engines. They are pre-eminently suitable for driving electrical machinery, particularly alternating-current dynamos. Some difficulties are, however, experienced with the commutation of continuous-current generators of fairly large powers. There is nothing remarkable in the design of generators for this purpose except that modification necessitated by the high speed. For this reason they are remarkable for their small weight and dimensions and the absence of crowded pole-pieces. Builders of electrical machinery have for some years been working in the direction of reducing speeds from the old belt-driven rigs to admit of direct-connection to slow-going, reciprocating engines. The condition for steam turbines is, however, a step in the reverse direction. Turbines have been used with good success in England for driving fans and blowers.

It is generally conceded by engineers that but little more may be anticipated in the development of the reciprocating engine. Any improvement that we can imagine would not very materially improve its efficiency as a heat engine. On the other hand, the turbine is capable of development in many ways, particularly in the use of superheated steam, to a degree hitherto prohibitive, so that the day may not be very far distant when the turbine will replace the reciprocating steam engine for most purposes. In conclusion, I must express my indebtedness to the Westinghouse Machine company for its permission to read this paper, and for the use of the various drawings, photographs, etc., that we have had before us.

Exhibits at Washington Automobile Show.

In the accompanying group illustration are shown some of the exhibits by automobile manufacturers at the automobile show held in Washington, D. C., during the week ended December 15th, of which mention was made in last week's Western Electrician. The exhibition was given in Convention Hall on Fifty-sixth street N. W., and was declared a decided success by the public, as well as the management and exhibitors. In the illustration the exhibits of the Locomobile company of America and the Mobile company of America, both manufacturers of steam vehicles, are shown complete. Part of the line of vehicles exhibited by the American Bicycle company, including several electric carriages, is shown in the picture, while the separate vehicle illustrates a new style of victoria that was exhibited by the Woods Motor Vehicle company of Chicago.



Victoria of Woods Motor Vehicle Company. Locomobile Company of America. Mobile Company of America. American Bicycle Company.

EXHIBITS AT WASHINGTON AUTOMOBILE SHOW.

CORRESPONDENCE.

London Letter.

London, December 11.—It is stated that a syndicate of American capitalists has been organized in New York to develop suburban electric railways about London. Mr. Frank W. Hawley, vice-president of the Erie Canal Electric Traction company, is a member of the syndicate. When interviewed recently he said: "For months past experts have been at work in the district surrounding London for 30 miles in every direction and are making elaborate reports upon the conditions of communication and the needs of the people. We propose, as far as possible, to join the towns about London to the metropolis by a system of electric railways giving quick service and low fares. Our intention is to have belt lines to encompass the city, with trunk lines running in to the termini of the underground tubes. We are prepared to spend from $5,000,000 to $20,000,000 in this work. Of course, we will have to secure franchises, and they will, in many cases, be difficult to obtain. Goods trains will be run, so that farmers can get their produce to the city in a hurry. We will not parallel existing railways. Not a penny of British capital is asked, as the men behind this design have the fullest information, gathered by experts, in their hands, and they have every confidence that the lines proposed will be a brilliant financial success."

The London United Tramway company has spent over $3,000,000 in linking up Chiswick and Kew with the new central London underground at Shepherd's Bush. Its lines are laid, the overhead wires are fixed, and the generating station is complete, yet horses still drag the cars. The scientists of the Kew Observatory are the stumbling block. They say that if the cars are run by electricity, it will render useless their instruments. The engineer of the London United Tramways said to me yesterday: "It is very hard upon us. Here is all our capital locked up and we are unable to realize a penny of it. We have been ready for the last three weeks to carry passengers, but have been stopped by the Board of Trade until a decision has been reached. The Board of Trade is empowered by an act of Parliament to prescribe means of preventing our electrical power from acting injuriously upon instruments in the government observatories. But the act specially notes that the board shall have regard to the expense involved and to the effect thereof upon the commercial prospects of the undertaking. Yet in spite of this they propose that we shall prevent our electricity from leaking, at an expenditure of $250,000. We have already spent $75,000 in experiments for the prevention of electrical leakage between Chiswick and Hounslow, and have come to the conclusion that even if we do spend the $250,000 proposed by the astronomer royal, the results cannot be guaranteed. It would seem that an alternative scheme has been proposed which involves the use of lesser electrical power. This, however, is harder than the former scheme, as the power mentioned would only permit the company to run one-tenth the number of cars wanted by the public." An assistant at the Kew Observatory pointed out that it was impossible to insulate their delicate instruments without destroying their utility.

A syndicate, which is said to number among its members some of the largest capitalists of America, is now getting concessions to furnish electric motive power for canals, and its representatives are going over the artificial inland waterways of Great Britain preparatory to asking for wholesale franchises. Mr. Frank Hawley is here in England to study the conditions of canal transportation. In the system which will be introduced power is supplied by a wire along the towpath. A motor, called a tractor, runs on the towpath and takes its power from the overhead wire by a trolley. The motor has three large wheels like those used on steam rollers, which smooth down the roadway and keep it in condition. An operator supplied by the company runs the tractor. All the boatman has to do is to throw out his line to the tractor, which will tow him at the rate of five miles an hour for a very small charge per ton. The company will guarantee to effect a saving in cost of motive power of not less than 40 per cent.

There is a movement on foot in the British West Indies to secure improved cable communication with Great Britain. W. H. B.

New York Notes.

New York, December 22.—The formal opening of the West End division of the Brooklyn Rapid Transit company's through-motor-train service from the bridge to Bath Beach has taken place with the running of a special train from the Manhattan end of the bridge, with Borough President Grout and 50 officers and guests who had been invited by General Manager J. C. Brackenridge to make the trip. Half-hourly trains will be run from 6 a. m. until midnight.

Announcement has been made of the signing of the recently reported contract between the Consolidated Railway, Electric Lighting and Equipment company of New York and Vickers' Sons & Maxim of London, whereby the former company's system for car lighting is to be introduced among the railways of Europe. Isaac L. Rice, president of the Consolidated company, has been abroad since last July, arranging to dispose of the company's foreign rights. He has now made a contract with Vickers' Sons & Maxim covering a period of 25 years, which will give the latter firm a monopoly of the business. The contract, it is said, is most advantageous to the Consolidated company.

In the seizure of fine telegraph and wire-tapping instruments worth $700 in a room at 357 West Forty-fourth street recently, the police think they just missed the capture of a part of a gang of wire-tappers who have also been narrowly missed by the Chicago, Omaha and St. Louis police. They found a letter which leads them to believe the men intended to tap the Chicago-New Orleans line, which runs along the elevated structure in Ninth avenue, just alongside the house.

The Manhattan Railway company reports a daily traffic this week of 650,000 passengers. The escalator at Twenty-third street and Sixth avenue is reported to have brought a large increase in traffic at that point.

Articles of incorporation of the Arecibo Electric Light and Water company have been filed at Newark, N. J. The corporation's principal office is to be in East Orange, and it will do business in Porto Rico by furnishing light and water to towns and contracting for building railroads, canals, ferries, telegraph and telephone lines, etc. The capital stock of the new company is fixed at $300,000.

Final arrangements have been perfected by the United Gas Improvement company of Philadelphia and New York for the purchase of the Fair Haven and Westville and the Winchester avenue street-railroad properties of New Haven. If purchased, the price will amount to more than $7,000,000.

It is announced that prominent directors of the Metropolitan Street Railway company have acquired holdings of Brooklyn Rapid Transit stock sufficient to control the property, with the co-operation of financiers already having large investments in the property. Messrs. Elkins and Widener and Thomas Dolan of Philadelphia, with William C. Whitney and Thomas F. Ryan of New York, have recently been buyers of Brooklyn Rapid Transit on a scale large enough to approximate a majority of the company's capital stock, and Mr. Ryan is believed now to be the largest stockholder of the Brooklyn company. M. L. G.

New England News.

Boston, December 22.—It was announced at the meeting of the Springfield (Mass.) Board of Trade last week that the Springfield City Council will be petitioned for a franchise for 20 miles of street-

railway tracks in that city and for a line to connect with Hampden. The capital will be about $600,000, and the promoters promise a three-cent fare within a radius of two miles from the city hall. They will compete with the existing street-railway system on parallel streets. Fred T. Ley & Co. of Springfield will finance the project and build the tracks if the scheme goes through. The firm has the contract for building the Palmer and Monson line.

Among the petitioners for new legislation at the coming session of the General Court of Massachusetts is the Boston Elevated Street Railway company, which asks for an extension of six months on its time limit for the construction of the overhead road in Boston. Authorization to build was given on July 26, 1898, and three years was named as the period within which the work must be done. Now the road seeks to have January 1, 1902, at the earliest, the time for its completion. The overhead structure at present under construction is completed, with the exception of two sections between South Union station and Harrison avenue.

The Boston Elevated and the Worcester and Boston street-railway companies have reached an agreement whereby the latter road obtains entrance into Boston. The announcement is somewhat in the nature of a surprise, inasmuch as the Worcester and Boston tried in vain to get an act of the Legislature at the last session permitting joint use of the elevated tracks in Boston. It appears that the elevated company imposes very decided restrictions upon the other road, such as the manning of the Worcester and Boston cars, after they enter upon the tracks of the elevated line, by employes of the latter road, and collection of a five-cent fare, which is to be retained by the Boston Elevated company. B.

Information from Indiana.

Indianapolis, December 22.—The Indianapolis and Greenwood Traction company has put men to work grading the road from Greenwood to Franklin. The line will be extended and in operation by June 1st.

Charles F. Smith, former president of the Indiana Bicycle company, is preparing to renew his attack on the Indianapolis Street Railway company's charter. He has asked the Supreme Court to advance his appeal on the calendar. Mr. Smith tendered a conductor three cents under the three-cent-fare law, and was put off of the car. The validity of this law is in question.

J. J. Burns has obtained a franchise for an electric line through the streets of Goshen, Ind. The road is to be built next year, to connect Goshen with Wawasee Lake, a distance of 17 miles. Mr. Burns projected the line connecting Goshen, Elkhart, Mishawaka and South Bend, and is the owner of large soap works in Goshen. Citizens of Wawasee are interested in the project.

The first of the heavy interurban cars purchased by the Union Traction company, for use between Muncie and Anderson, was stalled on the tracks in the paved streets at Muncie, the tread of the wheels being too wide for the narrow grooves of the rails. Under present conditions, the cars can run only to the edge of the paved streets. It is a great disappointment, as the remedy will be expensive.

The Indiana Railroad company, capital stock $100,000, has filed articles of incorporation with the secretary of state. The company will build two interurban lines, one from Greenfield to Knightstown, a distance of 14 miles, and the other from Greenfield to Pendleton, a distance of 16 miles. The work will begin on the roads early in the spring. The directors of the new company are F. G. Banker, N. C. Binford, C. M. Kirkpatrick, E. J. Binford, W. C. Dudding, L. E. McDonald and W. R. McCowan.

The dismantling of the famous Siemens & Halske electric plant of Chicago for removal to Fort Wayne, as a part of the Fort Wayne Electric company, formerly the McDonald plant, and now owned by the General Electric company, will largely increase the payroll of this concern, as the 200 men now employed will be increased to 1,000. Citizens are generally elated over the prosperity of the city in this direction.

Thomas McNamee, superintendent of the Wabash Electric Light company, on the first of January, will become superintendent of the Wabash Water company, vice W. S. Stitt, resigned. The two systems are owned by the First National Bank of New York, and hereafter they will be operated as one system.

The holiday street decorations at Indianapolis are completed, and the principal streets are ablaze at night with red and white electric lights spanning the streets at intervals. The thousands of lamps are supplemented by an unusually strong electrical illumination of store fronts. The scene and display is the most lavish and beautiful holiday decoration ever attempted before by the city.

Judge Houghton of the Daviess County (Ind.) Circuit Court made a recent decision which, if sustained by the Supreme Court, will give towns and cities some additional taxes. He held that franchises granted by municipalities are taxable. A lighting franchise at Washington was recently sold to that city by the owner, who had held it for seven years. He received $10,000 for it, and the assessor claimed taxes on its value for that period, and the decision is in his favor.

John A. Reed, while passing along the street of Union City, was instantly killed by coming in contact with one of the wire ropes used by the Union City Electric Light and Power company for the suspension of one of its electric lamps and for hoisting and lowering it. As the ground, the rope and Reed's clothing were all wet, he received a shock which instantly killed him. The defense set up was that Reed knew the lamp was out of order, and took hold of the rope to lower it to the ground, and was therefore guilty of such contributory negligence as defeated any right to recover anything in favor of his widow and children. The court, however, held the company liable, and rendered judgment for $2,800, which judgment has been affirmed by the Indiana Appellate Court. F.

Northwestern Notations.

Minneapolis, December 22.—The Postal Telegraph-cable company has begun work stretching wires from Sioux City, Iowa, to Sioux Falls, S. D.

All the telegraph instruments in every station between Davenport and Maquoketa, Iowa, on the Chicago, Milwaukee and St. Paul railway were recently burned out, but the cause has not been discovered.

The Railway and Power company of Tacoma, Wash., has made a settlement with all the victims of the Delin street disaster of Fourth of July last. The cases have all been settled out of court—many of them with the sufferers themselves and others with their attorneys. The company has been very liberal in the matter.

The Rapid Transit company of Waterloo, Iowa, has about completed the construction of an electric locomotive, to take the place of a small steam engine, which has been used to haul freight, and also for the large interurban trailers when there is a pressure of passenger business.

R. R. Macgregor has made a proposition to Yankton, S. D., to furnish street lighting all night.

Dan Cavanaugh of Bloomfield, Iowa, has bought the electric-light plant at Jefferson, Iowa.

The Story City (Iowa) Electric Light and Power company has filed articles of incorporation, with $10,000 capital stock.

The Street Railway and Power company of Tacoma, Wash., has given 15-minute service on its South End line.

The Albert Lea Electric company of Albert Lea, Minn., has changed its meter rate to 18 cents per kilowatt, instead of 12½ cents, as hitherto. But a discount of 30 per cent. is offered on all bills paid by the tenth of the month. The change is merely one to expedite collections, and means practically no change in the cost of lighting.

It is understood the county commissioners and the projectors of the electric road between Omaha and Fremont, Neb., have agreed upon a franchise.

The council of La Crosse, Wis., demands that the La Crosse Brush Electric Light company reduce its rate for lighting from $85 per light to $70. If the company agrees, the council will contract for light for 10 years. If it refuses, the council will contract for six months at $85 and will put in a municipal plant.

The Gas and Electric company of Council Bluffs, Iowa, has filed articles of incorporation, with $150,000 capital stock. The incorporators are all residents of Jersey City.

A stock company has been organized among the business men of Stella, Neb., to construct and operate an electric-light plant.

An electric-light plant is projected for Juneau, Wis. The estimated cost of a plant is $15,000.

The Sheboygan (Wis.) Street Railway company contemplates building an electric line to Schleisingerville, 42 miles. In the spring the electric line may be extended from Sheboygan Falls to Plymouth.

H. M. Thatcher of Astoria contemplates establishing an electric-light plant at Pomeroy, Wash.

The Western Union Telegraph company is constructing a new line along the Burlington railway right-of-way, between Huntley and Sheridan, Wyo.

H. H. Bartling, the president of the horse-car line in Nebraska City, Neb., has interested eastern capital and proposes to establish an electric-car line.

Marinette, Wis., will offer inducements to secure the extension of the projected electric railway to that city, if it is built through to Green Bay, Wis., as is projected.

The St. Francis Electric Railway company has been incorporated at St. Francis, Minn., with $50,000 capital stock. The company proposes to utilize the surplus power from the dam there, and will build a line five miles long to the Eastern Railway of Minnesota cut-off.

The Wisconsin Midland Electric Railway company has been incorporated, to build a line from New London to Berlin, Wis. Arrangements are about completed with a New Jersey construction company for the building of the line. The franchises and right-of-way have been about all secured. The charter permits hauling freight, which is an innovation for electric railways in Wisconsin.

The promoters of the electric railway between Rockford, Ill., and Beloit and Janesville, Wis., say that they have options on ties, rails, copper wire and cars for the entire line, and that the road will be put through with all speed next summer.

The Dyersville (Iowa) Electric Light and Water company has awarded contracts to the Allis company of Milwaukee to furnish the machinery for the new plant.

The International Electric company of Minneapolis has been sold to eastern parties. It is believed that the move is a step toward a consolidation with the General Electric company, although the officers of the latter strenuously deny that any such thing will occur. The two companies have been rivals in Minneapolis for seven years.

The Canadian Pacific railway contemplates using electric power to operate its trains on the steep grades between Rossland and Robson, B. C. The company will detach its steam locomotives at Rossland and attach the electric. Negotiations have been opened with the West Kootenay Power and Light company, with reference to furnishing power to the amount of 2,000 horsepower. It must be at a price which will be more economical than steam. R.

PERSONAL.

W. W. Geisse of Marshfield, Wis., who has represented the Central Electric company in his territory for the last 14 months, has accepted a position as manager of the Marshfield Water, Electric Light and Power company.

Carl J. Schlesinger, vice-president of the Alden Electric company of Chicago, recently met with an accident, resulting in a sprained ankle, which has confined him to the house for some time, but within the next week or so he expects to be out and around to see his friends again. Mr. Schlesinger travels for his company in Iowa and northern Illinois.

Mr. Francis E. Drake, late director of machinery and electricity for the American commission to the Paris Exposition, arrived in Chicago for a brief visit last week. He left the city on Christmas Day on his way to Berlin, Germany, where he expects to be engaged in electrical work for several months. Mr. Drake was particularly interested in the American machinery exhibit at Vincennes, and he reports that the building, with the power plant complete, has been sold to Mather & Platt, to be re-erected at Manchester, England.

ELECTRIC LIGHTING.

The town of Fairbury, Neb., is negotiating for an electric-lighting plant.

Oskaloosa, Iowa, has granted a franchise for an electric-light and heating plant.

The Merrill (Wis.) Railway and Lighting company contemplates improvements to the extent of $5,000.

The Merchants' Electric Light, Heat and Power company of York, Pa., has been incorporated, with $1,000 capital stock.

The lighting plant at Waterloo, Iowa, has been sold and the new company will expend about $50,000 on improvements.

E. S. Willey and E. Buck have purchased the electric-light plant at Ellsworth, Wis., and it will be improved extensively.

A $35,000 power house will be erected by the Kenosha (Wis.) Electric and Gas company. Work on the new building will be started at once.

The new Light, Heat and Power company of Salt Lake City, Utah, has been incorporated, with $24,000 capital stock, with M. H. Walker, president.

The Zanesville Electric Light company of Zanesville, Ohio, has increased its capital stock from $75,000 to $140,000. J. Hoge is president of the company.

The light committee of the village of New Freedom, Pa., wishes bids for electric lights for the town. W. C. Bailey and P. O. Klingfelter, commissioners, may be addressed.

At a meeting of the City Council of Norman Okla., in the near future, Hon. J. C. Walls and F Essex will make a proposition to put in an electric light plant in that city.

The Chattanooga Light and Power company of Chattanooga, Tenn., has applied for an amendment to its charter increasing the capital stock from $150,000 to $250,000, the additional funds to be used for improvement of the system.

J. E. Owen, owner of the electric-lighting plant at Onarga, Ill., has purchased the lighting plant at Gilman and will consolidate the two. He expects to have his central plant at Gilman and supply lighting services for the towns of Onarga and Danforth.

The University of Chicago expects to build a heating and lighting plant with a part of the donation of $1,500,000 recently made to the institution by John D. Rockefeller. It was suggested that $100,000 be set aside for this purpose. The plant will supply all the buildings on the campus.

The city lighting plant at Fourteenth street and Indiana avenue, Chicago, is to be abandoned as a regular station, and will be used hereafter only in case of emergency. The action is said to be taken partly on account of complaints from residents in the neighborhood, who have been much annoyed by smoke from the plant, and partly to enable the generating machinery for the municipal lighting service to be concentrated into a smaller number of stations. It is said that this change will result in a saving of about $7,500 a year.

Articles have been recently filed in New Jersey consolidating the Raritan Electric Light and Power company, the Bound Brook Electric Light, Heat and

Power company, the Dunellen Electric Light company, the Edison Electric Illuminating company of New Brunswick, the Railway Electric company and the Middlesex Electric company into the Central Electric company, and increasing the capital stock of the latter from $100,000 to $750,000. The officers of the consolidated company are: President, Phil N. Jackson; vice-president, Adrian Riker; secretary, L. B. Howard Gilmour; treasurer; Uzal H. McCarter, all of Newark.

ELECTRIC RAILWAYS.

L. B. Bradley, representing Chicago capitalists, has been granted a franchise for the immediate construction of an electric railroad to connect La Porte and Michigan City, Ind.

The Kansas City and St. Joseph Railway company has been incorporated for $1,500,000, by J. Dole of Erie, Pa., R. P. McGeehan, H. Reed and C. E. Gibson of Kansas City, Mo.

A dense fog was the cause of a collision between two trolley cars, which occurred in the middle of the city of Ashland, Ky., recently. Both motormen and a number of passengers were seriously hurt.

A franchise has been granted the Oskaloosa (Iowa) Street Railway and Land company, giving it the right to use the streets for a street railway. The company will invest about $250,000 within the next year.

The company proposing to build an electric line between Rockford and Belvidere, Ill., has asked the City Council of Rockford for permission to enter the city. It is thought the cars will be running on the line by next summer.

The Washington and Oregon Railway company has been incorporated, by A. C. Mason of Tacoma, E. Rice of Olympia and E. H. Guie of Seattle. The object of the concern is to construct a line of railway from Portland to Seattle. The capital stock is $50,000, and the principal place of business is at Olympia.

Tracklaying on the proposed electric railway between Rockford and Sterling, Ill., will be commenced in the spring. The line will pass through Rockford, Byron, Oregon, Grand Detour, Dixon, Sterling and Rock Falls, and will serve a total population of about 85,000. A funeral car, finished in black and gold, it is expected, will be operated on the road.

Consul-general Lay of Barcelona, Spain, sends reports of several roads in that vicinity which are to be electrically equipped, and which present opportunities for securing contracts for electrical machinery. A line is to be built from San Andres to Horta, and another is to be equipped from Barcelona to St. Andres, concerning which information may be obtained from the Société Anonyme d'Enterprise de Travaux, Liege, Belgium. G. H. Gillis of Barcelona is manager of a road from Barcelona to Badalona, which is to be electrically operated in the near future. The Compañia General de Tranvais has been purchased by German capitalists, whose technical representative in Barcelona is Mr. Fengercroff.

AUTOMOBILES.

An electric generating plant is being installed by the United States Signal Corps at Fort Myer, Va., for charging the storage batteries of the electric vehicles and for instruction and other purposes.

It is stated that an automobile club is about to be organized in Indianapolis. The racing heretofore has taken place on Capitol avenue, a prominent street of the city. Objections having been raised to this discrimination, the club will share the business men's driving park next summer for racing and speed purposes.

A movement is on foot to operate two automobiles daily from Columbus to Bloomington, Ind. Wealthy men of these cities are having two three-seated machines built, and they will be expected to make the trip from Columbus to Bloomington, or vice versa, in four hours, a distance of 40 miles, over the most hilly region in the state. Each machine will carry five passengers and baggage. The fare will be three cents a mile. If the automobile proves a success it will supplant other stage-coach lines in communities where there are no railway facilities.

PUBLICATIONS.

The Caro Journal of Caro, Mich., has published a special illustrated edition describing the institutions of the city. An interesting illustrated description of the Moore telephone system is given, together with a sketch of L. R. Peck, the electrician of the Caro Light and Power company.

The Falcon Electric Manufacturing company of New York city has issued an additional sheet to its bulletin No. 4, illustrating and giving prices on the company's panel boards. The supplement quotes prices and explains the various additions which the Falcon company furnishes with its panel boards.

The Jeffrey Manufacturing company of Columbus, Ohio, has recently issued a 96-page catalogue covering its chain belting, elevating and conveying machinery, etc., for the saw-mill, lumber and wood-working industries. A copy of the catalogue (No. 57) will be mailed by the company to persons applying for it.

The electric novelties and specialties manufactured and sold by the Brooklyn Electric Lamp and Novelty company of Brooklyn, N. Y., are illustrated and described to good advantage on a large sheet recently issued by the company. The novelties shown include lamps, dynamos, motors, batteries, toy cars and telephones.

The Emerson Electric and Manufacturing company of St. Louis, Mo., is sending to its friends a very useful token for the new year. It consists of a "Daily Reminder" desk calendar for 1901, containing a page for memoranda for each day in the year. At the head of each page is a word of advice relating to Emerson apparatus. The whole is mounted on a neat metal-work frame, making it convenient for desk use.

A handy and useful souvenir is being sent out to its friends by the Viaduct Manufacturing company of Baltimore, with the compliments of the season. It is a vest-pocket memorandum book, bound in a substantial celluloid cover. Most of the leaves are blank, but a few pages contain calendars for 1901 and 1902 and useful information in relation to postage, population, accidents, war taxes, the new United States possessions, etc.

The Industrial Water company, 15 Wall street, New York city, has published a catalogue describing the operation and advantages of its modern water-softening and purifying apparatus for softening water before it enters feed-water heater or boiler. The company has also issued, in pamphlet form, an article entitled "The Work of Railroad Men on the Problem of Pure Water for Steam Boilers," by C. Herschel Koyl, reprinted from the Railroad Gazette.

POWER TRANSMISSION.

Ramon Valdez has been granted power rights in the Rio Plata, 15 miles from San Juan, Porto Rico. It is understood that he will sell out his rights to the Rio Plata Electric company, in which Philadelphia capital is interested, and that $400,000 will be expended in developing power for lighting, manufacturing and railway use in the city of San Juan.

The Vanderbilts, through the agency of the Niagara, Lockport and Ontario Power company, says the Lockport (N. Y.) correspondent of the New York Sun, will build a great power plant, rivaling in extent the Niagara Falls plant, will construct a big water conduit from Lake Ontario to Lockport to supply that city with water, cut a wide power canal from Niagara River to Lockport, build a power-transmission line to Depew, and make of Lockport and Depew electric cities. The Lockport and Newfane Water Supply company holds the franchise for a power canal, and, contending that it has enlisted the support of the New York millionaires, has given the city of Lockport to understand that if it makes a water contract with it the company will build the great canal.

The Cornucopia Mines company, operating near Baker City, Ore., is adopting an electrical service. A power plant is being built in Pine Creek Canyon, near the mines, where 500 horsepower is to be developed by hydraulic means, a head of 300 feet being obtained. With the big generators and converters will come new 12-drill air compressors. Electricity will also be employed to operate a 50-horsepower hoist and the 20-stamp mill. Steam will be done away with entirely. The air compressors required for the drills will be electrically driven. First in the advantages to be gained by use of electricity instead of steam is the great saving in wood. At the present time the machinery of the mines consumes about 15 cords of wood daily, which is furnished by contractors at the rate of $5 a cord, and the supply in the neighborhood is rapidly being exhausted.

SPACE TELEGRAPHY.

Prof. Willis Moore, of the Weather Bureau, has been conducting experiments in space telegraphy on a secluded island not far from Washington. The work is being done privately, and the results will not be given to the public for several months. One of the ends sought for is the perfecting of a system whereby vessels in the coast trade may keep in constant touch with stations on shore, and thus be able to give notice of damages sustained by fire or accidents to machinery, and also may be warned of approaching storms.

It is announced from Toledo, Ohio, that the Ann Arbor railroad will experiment with the Marconi system of wireless telegraphy between Menominee, Sturgeon Bay and Frankfort, this winter. The experiments last winter were partially successful. This will afford a communication between these points and greatly facilitate the running of the car ferries. It is also learned that in case the wireless telegraphy does not prove satisfactory, the carrier-pigeon service may be tried. The Pere Marquette road has used this service effectively on its car ferries.

Mr. L. B. Miller of England has patented an invention for the purpose of decohering the coherer rapidly. The coherer is attached to the light armature of a small and quick-acting electromagnet. The latter is thrown into action by the relay, the sudden jerk forward of the armature serving to decohere the filings. The speed of decohering may be greatly increased if the movement of the armature away from the stop is also made to break the coherer circuit. When this is done, it is possible to adjust the relay more delicately, and then when the shunt circuit through the relay is opened the received wave can pass through the coherer only. The inventor states that the coherer filings should be of a metal or alloy that cannot be magnetized owing to the proximity of the electromagnet.

SOCIETIES AND SCHOOLS.

At the meeting of the Roentgen Society of the United States, held in New York, recently, the following-named officers were elected: President, Dr. Heber Robarts of St. Louis; first vice-president, Dr. G. P. Girdwood of Montreal; second vice-president, Dr. Bender; secretary, Dr. J. Rudis-Jicinsky of Cedar Rapids; assistant secretary, Dr. Price; treasurer, Dr. E. A. Florentine of Saginaw, Mich.

The electrical engineering department of the University of Minnesota is making rapid progress and already stands high in the matter of good work done. The department is very much cramped for space and will ask the Legislature to provide a separate building. It is the boast of the faculty that no working student has ever left the college and been unable to secure a position. In fact, there are now applications on hand for more men for central-station operators than the school is able to furnish. Professor Springer has recently made a new machine for testing the voltage and current consumed in starting street cars, elevators and other load machines. It makes 60 instantaneous records a second of the positions of the indicating pointers.

ELECTRICAL SECURITIES.

The Metropolitan Street Railway company of New York city has filed a certificate of increase of its capital from $45,000,000 to $52,000,000. The amount paid in is $44,959,000 and the debts and liabilities are $32,750,000.

The Massachusetts Electric Companies has disposed of about 3,000 shares of stock of the Nashua (N. H.) Street Railway company (leased to the Lowell, Lawrence and Haverhill), which it has held in its treasury, the object being to confine investments of the company to Massachusetts property.

MISCELLANEOUS.

There was on exhibition in London recently a collection of vacuum tubes charged respectively with samples of the various new gases which scientists have succeeded in obtaining from the atmosphere. When the electric spark is passed through the tubes some very beautiful color effects are obtained. Especially noticeable in effect is that obtained in passing the spark through the gas neon, when a magnificent crimson glow is yielded.

A remarkable mining project is afoot in Switzerland. Owing to the great difficulty in securing coal to work the beds of hematite ores in the Bernese Oberland, near Meiningen, an electrical aerial tramway is to be built for carrying the ores to the village of Innert Kirchen, in the valley below. Here the waterpower of the River Aar is available, and a 60,000-horsepower electric plant is to be erected. This current, besides being utilized for general power purposes, will be employed for refining the ore in a specially designed electric smelter.

TRADE NEWS.

The R. Louis Steiner Manufacturing company has been incorporated in New York, to manufacture gas and electrical fixtures. The capital stock is $15,000, and the incorporators are R. L. Steiner, A. Lenz and Matilda Steiner.

The General Pneumatic company of Chicago has been incorporated, with a capital stock of $25,000, for manufacturing power, electricity, vehicles, motors, etc. The incorporators are Peter F. Thede, Frederick Gehm and Thomas P. Kerrigan.

The General Electric company has awarded a contract for a large office building at Schenectady. It will cost $250,000 and the builders will be the Prescott & Buckley Construction company of Plattsburg, N. Y. The building will have a frontage of 150 feet and will be 210 feet deep and six stories high.

The San Francisco office of the Wagner Electric Manufacturing company, St. Louis, has been removed to 593 Mission street, where the company has much better facilities for accommodating its customers and more convenient show rooms. Mr. Clark, the company's representative, will take pleasure in attending to the wants of the customers.

In a circular letter issued by the Delaware, Lackawanna and Western Railroad company to its employes, the following reference is made to the International Correspondence Schools, Scranton, Pa.: "Having personal knowledge of the benefits to be derived by a course of study in any of the branches offered by this school, the good effects it is producing and the satisfaction it is giving to railroad men on other lines, and knowing also its high standing as an educational institution, we confi-

dently recommend it to all employes of this company who desire an improved education and a general knowledge of railroading, and urge them to avail themselves of this opportunity."

BUSINESS.

The Western Electric company, Chicago, is prepared to furnish arc-light carbons for direct and alternating-current lamps. The company would like to receive specifications from its customers.

A large order has just been closed with the Sprague Electric company of New York for 20-horsepower motors of the slow-speed, direct-connected type to operate the new plant of the Delaware Button company at Wilmington, Del.

The Electric Appliance company, Chicago, has found it necessary to issue a second edition of its little booklet called "Skepticism" which it published for the benefit of skeptics on the subject of wattmeters in general and the Gutmann wattmeter in particular.

The Colonial Electric company, Ravenna, Ohio, manufacturer of Orient incandescent lamps, reports the outlook for business in its line flattering. Since moving into the new factory its manufacturing facilities have been greatly increased, output tripled and business has come its way in due proportion. The Colonial company is at present enjoying the heaviest business of its career.

The American School of Correspondence, Boston, Mass., is sending out a special money card, to be used by engineers and others desiring to examine its instruction papers and textbooks. The card contains a place where a silver 25-cent piece may be inserted and securely sealed, and also a place for name and address and textbook wanted. It may be placed in an envelope and addressed to the school without further trouble. Anyone wishing to examine any of the instruction papers of this school should send for one of these cards in order to send the money safely.

The American Bridge company of New York city has a contract to furnish to the Compagnie des Chemins de Fer de Porto Rico two 133-foot spans for the Manati River bridge, Porto Rico. The same company has also secured the contract from Mr. Y. Watanabe, architect imperial of the Japanese navy, for the steel work for the foundry, forge shop and the gun and mounting shop for the Kure arsenal.

As is well known, the Chicago House Wrecking company makes a specialty of second-hand machinery and supplies. It has become known the world over by its daring purchases at international expositions and in other places. These purchases have given it possession of almost an endless supply of materials of all kinds. The company now has on hand a fine line of all kinds of electrical machinery and electrical supplies, which will be sold at a sacrifice. Intending purchasers will find it to their interest to send for the company's catalogue No. 156.

The Crocker-Wheeler company of Ampere, N. J., has opened an office in Pittsburg to handle the increasing demand for machinery in western Pennsylvania. Among the large orders for generating machinery recently received by this company may be mentioned two 600-kilowatt, 125-volt machines for the Government Printing Office, to be used for power and lighting, three generators of 200, 150 and 75 kilowatts, respectively, for power and lighting, at the United States mint in Philadelphia, a 300-kilowatt, 250-volt electrolytic generator for the Arlington Copper company, and two 100-kilowatt lighting generators for the Public Library at Newark, N. J. Besides these orders for direct-connected generators, the Crocker-Wheeler company has received orders for 66 motors for power work at the United States mint in Philadelphia, making a total of 300 horsepower, and for the Toledo Bridge company at Toledo, 35 motors, aggregating 400 horsepower.

Thomas Wrigley of 300-306 Dearborn street, Chicago, reports a growing demand for many of the well-known appliances which he manufactures. Among these may be mentioned Wrigley's patent local ticket-printing press, index cutter and printer, patent emery-wheel dresser, patent tile toggle bolts, electric point switches, blind outlet fixtures, girder clamp and foundation bolts. Mr. Wrigley also makes a specialty of repairing engines, printing presses and special machinery of all kinds. The amount of business done in this line indicates forcibly the satisfactory character of service rendered. All work is under the personal supervision of Mr. Wrigley, who is one of Chicago's oldest and best-known mechanicians.

The B. F. Sturtevant company of Boston, Mass., reports its business of the last year to have been the largest in its history. In the line of standard types of blowers, exhausters and hot-blast heating apparatus, its products have kept pace with the recent industrial movement. But in the installation of fans for the production of mechanical draft for steam boilers, the desirability of this method in preference to the chimney has been shown by a great increase. The volume of domestic and foreign orders for forges has been noticeable, while the output of the rapidly growing electrical department has been far in excess of the previous year. This electrical output has been principally in the specialties of this company, namely, electric fans of all types and small high-grade generating sets. New applications of fans are constantly presenting themselves, and the careful study which this company gives to the solution of such problems is one of the main factors in its growth. All departments have been taxed to the utmost, and the outlook is favorable for the continuation of this condition.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 18, 1900.

663,859. Receiver for Printing Telegraphs. John Burry, New York, N. Y. Application filed August 18, 1896.

A type wheel is mounted to turn and move longitudinally. A single magnet is provided for turning and another single magnet for shifting the type wheel. A local circuit contains a press magnet and is closed every time current is admitted to either or both of the two first-mentioned magnet circuits. A presser and paper-feed mechanism are operated by a magnet in the local circuit.

663,903. Telegraphic Instrument. Harry T. Johnson, Jersey City, N. J. Application filed February 26, 1900.

The subject of this invention is a swinging support for the armature lever of a telegraphic instrument and means for actuating the support to vary the distance between the armature and magnet.

663,926. Auxiliary Attachment for Signal Boxes. Bartholomew Oehmen, New York, N. Y., assignor to the Gamewell Fire-alarm Telegraph company, New York, N. Y. Application filed May 22, 1900.

An auxiliary magnet is located adjacent to a street box containing a clockwork mechanism and a trip lever for releasing it. A slide is normally locked in a retracted position by the armature of this magnet and an auxiliary trip lever is engaged by the slide, the auxiliary trip lever engaging the trip lever at or near its extreme end. An arm is carried by the auxiliary trip lever and a pin operated by the clockwork mechanism for engaging the arm to restore the same.

663,929. System for Heating Conductors of the Second Class. Carl D. Raab, Kaiserslantern, Germany. Application filed April 30, 1900.

In a system for heating conductors of the second class, a heater is placed in the secondary of a transformer having differential primary coils. Alternate coils have in circuit with them a first and a second-class conductor, respectively.

663,937. Primary Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor to the Waterbury Battery company, Waterbury, Conn. Application filed February 27, 1900.

A transparent jar contains a perforated cylinder provided with a series of corrugations to retain it at a uniform distance from the jar. An oxide of copper element is contained in the space formed between the jar and cylinder, and a contact wire leads from the cylinder. A zinc element is supported at the center of the cylinder and provided with a contact wire.

663,938. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor to the Waterbury Battery company, Waterbury, Conn. Application filed March 22, 1900.

A porous cup is provided with an opening through its bottom and a non-porous protective lining for its side walls, and contains copper oxide. A central terminal post is mounted in the cup and fitted with a protective casing for its sides. A perforated conducting disk attached to the bottom of the post constitutes the contact for the same.

663,951. System of Motor Control. Albert H. Armstrong, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed October 6, 1900.

In a train-control system employing induction motors, resistances on each of the cars are arranged to be included in circuit with the secondaries of the motors. Actuating means for the controllers are constructed and arranged to be operated from an alternating-current source, and a master controller, located at any desired point on the train, controls the connections between a source of alternating-current supply and the actuating means. (See cut on next page.)

663,981. Electric-lighting Appliance. Arthur Peters, Manitou, Colo. Application filed November 11, 1899.

In a system of electrical distribution, a relay electromagnet is in circuit with the conductors, and a main electromagnet in shunt circuit with the relay magnet and conductors, the shunt circuit excluding the translating devices and including a resistance of like value to that of the translating devices. A make-and-break is operated by the relay magnet and included in circuit with the main magnet, and a make-and-break, operable by the main magnet, is included in one of the conductors to the translating devices, whereby, upon an addition to the translating devices, the relay magnet will be actively energized by the consequent increased flow of the current and caused to cut in the main electromagnet, cut out the translating devices, and establish a continuous current through the shunt-circuit and conductors, excluding the translating devices.

663,995. Germ Destroyer for Telephone Mouthpieces. Lewis L. Lacey, Austin, Texas. Application filed April 20, 1900.

A cup-shaped bulb, the outer contour of which conforms to the inner contour of the mouthpiece of a telephone, contains a vacuum chamber between its walls. Filaments are mounted in the vacuum chamber, with electric connections to the filaments, the idea being the destruction of the germs by the heat radiated from the filaments.

664,004. Electrical Piano. Stephen K. Reynolds, New York, N. Y., assignor of one-half to Frank W. Chamberlin, New York, N. Y. Application filed June 10, 1899. Renewed May 17, 1900.

A series of solenoids are supported above the keyboard of a piano with their axes at right angles thereto, the cores of the solenoids being provided with striking heads resting freely upon the keys. The cores of the solenoids are held in their withdrawn position by the same force which holds the keys in their normal position.

664,006. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor to the Waterbury Battery company, Waterbury, Conn. Application filed March 22, 1900.

A negative pole for a battery is described comprising a tubular body, with perforated conducting disks to inclose the ends thereof, a binding rod forming a metallic connection with the two disks, a suitable insulation around the periphery of the rod between the disks, and an oxide of copper element within the tube.

664,007. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor to the Waterbury Battery company, Waterbury, Conn. Application filed June 12, 1900.

The positive element comprises zinc located opposite to the negative element, metal strips detachably secured to the cover of the battery and means for detachably connecting the zinc to the strips. The negative element comprises a glass tubular body, an oxide element therein and perforated metallic covers inclosing the ends of the tube. A bolt in the center of the cover and body carries stop nuts arranged on the inside of the covers and washers and jam-nuts upon the outside of the covers, by means of which the latter are secured in place.

664,008. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor to the Waterbury Battery company, Waterbury, Conn. Application filed August 21, 1900.

The negative element comprises a metallic receptacle having perforated sides and one or more transparent edges, the receptacle being broader across its top surface than the bottom to insure the consumption of the oxide of copper at the bottom earlier than at the top.

664,023. Electric Accumulator. Pascal Marino, Brussels, Belgium. Application filed June 23, 1899.

The process described consists in adding to an active material comprising lead oxide a liquor composed of distilled water, guncotton, caustic alkali and benzine for the purpose of obtaining adhesion to the electrodes, forming the electrodes so composed first, in a solution of bisulphate of lead and ammonia, then in a solution of sucroglycerate of an alkaline earth metal.

664,046. System of Non-interchangeable Contact Parts. Rudolf Hundhausen, Wilmersdorf, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed November 4, 1899.

A number of engaging elements in the form of sockets is combined with a second set of engaging elements in the form of plugs, laterally projecting pins of different sizes being provided upon one set of the engaging elements, and longitudinally disposed slots or recesses of different sizes provided upon the other elements, whereby circuit connections may be established and the improper insertion of connecting plugs prevented.

664,061. Electric Switch. Charles W. Scott, Lynchburg, Va. Application filed August 16, 1900.

A back piece has two channels, one containing a number of contact strips connected with the switchboard of a telephone-exchange system, the other containing contacts connected to a grounded conductor. A movable bar has a tapering edge adapted to fit within the channels, and a number of conductors secured to the bar, connected with the line wires of a telephone system, and adapted to engage respectively the contacts in the channels.

664,068. Automatic Stop Mechanism. Charles F. Van Dyke, Atchison, Kan., assignor of one-half to George Moss, Atchison, Kan. Application filed September 26, 1900.

This mechanism comprises a controlling cable having an operative connection with the cut-off of an engine or similar machine, an actuator for drawing the cable in one direction, holding means for normally retaining the actuator in an inactive position, an electrical releasing device for the holding means, and separate means set in action solely by the movement of the actuator for automatically slackening the controlling cable by relieving the same from the drag or pull of the actuator.

664,077. Operating Dynamo-electric Machines. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed June 29, 1900.

The alternators excited by synchronously driven exciters have series transformers in the leads of the alternators, leads extending from the secondaries of the transformers to the armatures of the exciters, and equalizing conductors connecting corresponding secondaries.

664,081. Electrical Heating Apparatus. Carl Gohlin, New York, N. Y. Application filed July 26, 1900.

The apparatus described is adapted for use in connection with a table, cot, bed or other support, and comprises two vertically adjustable oblong frames or casings segmental in cross-section and open at the bottom and one side, and provided with suitable end-closing devices, the frames being hollow. The body portion thereof is composed of inner and outer shells, the inner shell being a reflector, and being also provided on its inner side with electric lights or attachments for the same. Conducting wires extend into the space between the shells, in connection with which the lights are wired.

664,083. Clutch for Electric Arc Lamps. Charles E. Harthan, Lynn, Mass., assignor to the General Electric company of New York. Application filed March 10, 1899.

The frame piece is composed of a single piece of metal bent in the middle so that two substantially parallel sides are formed with one open and with one closed end. A shoe is pivotally mounted in the frame and has a single friction face, a second shoe being also mounted in the frame formed of a single piece of metal having two faces for engaging with the carbon rod or pencil.

664,086. Regulator for Electrically Actuated Air Compressors. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed November 7, 1898.

This invention deals with a motor controller operated by fluid pressure. The switch has two circuit-closing posi-

tions. Means are provided for causing the switch to assume one or the other position when the pressure reaches its superior and inferior limits, and for shunting the switch by a circuit of low resistance when in one position, and for opening the shunt when the switch reaches the second position.

664,087. Automatic Rheostat. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed November 7, 1898.

This starting box comprises a resistance with a switch for cutting sections out or in as may be desired, an electromagnet for holding the switch closed when the resistance is cut of circuit, and a switch controlled by the magnet for shunting its winding when the current exceeds a determined maximum. The same coil is employed to respond to both maximum and minimum current flow. (See cut.)

664,092. Electricity Meter. William M. Mordey and Guy C. Fricker, London, England. Application filed October 10, 1900.

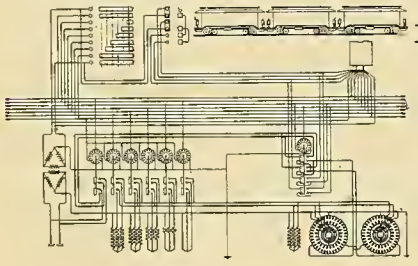
A spindle carries an armature and is formed near one end with a flattened surface. Means are provided for mechanically imparting a forward impulse to the spindle and armature as the latter approaches the mid-position of its stroke or throw in each direction. A meter coil is carried by and arranged opposite the supporting frame so as to surround a portion only of the armature. A pivoted arm is mounted in bearings carried by the frame and arranged to extend across the flattened portion of the spindle, and a movable contact is operated by the arm and connected to one end of the coil. A fixed contact, carried by but insulated from the frame, is connected to the other end of the coil, and the movable contact can bear against this only when the armature is in or near its mid-position.

664,096. Electric-railway System. William B. Potter, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed October 31, 1900.

In a train of two or more motor cars with motor controllers upon the cars, an independent source of varying potential is placed on each car, and an indicating device in circuit with the source and the switch arm of the controller and responsive to changes in potential.

664,106. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 30, 1900.

The armature winding of a dynamo-electric machine is connected to a commutator, and direct-current mains extend from the commutator as usual. A number of reactive coils having separate cores are connected to points in the winding. A direct-current main leads to a connection between the coils, and counter-magnetizing coils are in series with the main.



NO 663,951.

664,135. Electric Sweeper and Dust Gatherer. Corinne Dufour, Savannah, Ga. Application filed July 31, 1900.

The sweeper comprises a casing open at the top, sweeping mechanism therein, and a fan in the upper portion of the casing. A movable hood on top of the casing is open at the top, and contains a dust-absorbing body. A cap is movably connected with the hood at the top.

664,144. Electrical Connection. William Gerhardt, Hazleton, Pa. Application filed September 27, 1900.

There are two insulating sections, one being provided with a projection and the other with a cavity in which the projection is received. Oppositely disposed dogs are carried by the section having the cavity and work through the walls thereof to engage with the projection of the other section. Means are provided to hold the two sections together, and electrical conductors are carried in the sections and contact with each other when the sections are engaged.

664,163. Combined Automatic Gas-light Extinguisher and Electric Sparker. Gustav H. Lippmann, Milwaukee, Wis. Application filed March 20, 1900.

A valve with a flange carries a series of ratchet teeth on the under side of the flange. A pawl engages the teeth and a single spring normally closes the valve and acts to retain the pawl in engagement with the teeth on the flange of the valve. An operating rod is attached to the flange. A vertically movable electric contact rod is connected to the operating rod and moves in unison therewith, and makes circuit with a stationary electric contact in its path.

664,176. Electric Insulator. Emil Risler, Freiburg, Germany. Application filed July 25, 1900.

An insulating piece is adapted to fit over the reduced and screw-threaded end of a pin. An upper insulating piece comprises a part having a central bore, a screw-threaded metal lining inserted in the bore, and a cap cemented both to the upper insulating piece and to the lining, the upper insulating piece being adapted to screw on to the screw-threaded end of the pin and to clamp an electric wire between itself and the lower insulating piece.

664,189. Electrical Switch Cap. George B. Thomas, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing company, Hartford, Conn. Application filed August 27, 1900.

The metallic cap of an electrical switch or similar article has a lining disk and means for securing it to the top of the cap and a separate lining band for the walls of the cap, the lining band having a flange to engage behind the edge of the lining disk.

664,190. Alternating-current Electric Motor. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed August 19, 1897.

The claims describe an alternating-current induction motor of such design as to have a low starting torque and higher running torque, a clutch for coupling the rotating member of the induction motor to the shaft or body, and automatic means for bringing the clutch into action when the torque of the motor is high and for causing the clutch to be out of operation or disengaged when the torque of the motor is low. (See cut.)

664,191. Call-register or Service-meter Circuit for Switchboard Apparatus. George K. Thompson, Malden, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed October 8, 1900.

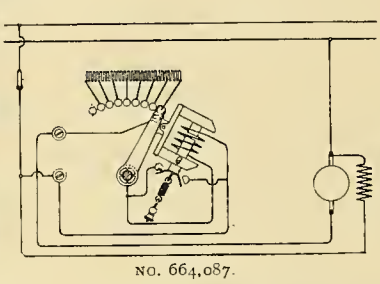
Two local circuits are associated respectively with a calling and a called-for telephone line, and contain each the cut-off relay of such line and a source of current appropriate for the operation of the relay. A service meter for the calling line is operated by an electromagnet in the local circuit of the calling line, but irresponsive to the normal current thereof. An auxiliary source is organized to develop in the calling-line local circuit a stronger current, adapted for the operation of the service meter. An electromagnetic, circuit-changing device comprises a switch lever in the calling-line local circuit controlling the connection of the circuit with both sources of current, and adapted when operated to change the circuit transiently from the normal to the auxiliary source. An operating magnet therefor has its actuating coil in the local circuit of the called-for line.

664,195. Controller Switch. Noble Vance, Chicago, Ill., assignor to the Hewitt-Lindstrom Motor company, Chicago, Ill. Application filed July 23, 1900.

A rotatable cylinder carries a series of contacts arranged in succession along its length. A series of contact shoes, one for and opposite each contact on the cylinder, are provided. Sliding bolts move radially relatively to the cylinder carrying the contact shoes. Springs press the contacts toward the cylinders. The binding posts are set beside the bolts and the electrical connections are made between the shoes and the posts.

664,198. Secondary Battery. Frank W. Wetherill, Philadelphia, Pa., assignor of three-fourths to William S. Kirk and W. Stokes Kirk, Philadelphia, Pa. Application filed February 4, 1899.

A series of negative and positive plates are suitably spaced, the space between the plates being filled with a layer of litharge in contact with each of the negative-pole plates and a layer of red lead on each side of the positive-pole plates. A layer of charcoal separates the red lead and the litharge, a partition plate saturated with a non-conductor extending beyond the negative-pole plates, with a non-conductor binding the several elements together and forming non-conducting ends for the battery.



NO. 664,087.

664,207. Railway Signaling Device. Reuben B. Benjamin, Chicago, Ill., assignor of one-half to Rodney B. Swift, Chicago, Ill. Application filed February 5, 1900.

An electric generator having a movable part adapted to be reciprocated relatively to the stationary part is so mounted in connection with a railway track as to provide means operated by the passage of a car for moving the movable element of the generator in one direction. A spring or equivalent device has energy stored in it by the movement, and a catch or lock holds the movable part in the position to which it is thus moved. A trip device at another portion of the track is operated by the passage of the car for releasing the lock to permit the spring to return the movable part of the generator, and a signaling device is adapted to be actuated by the current from the generator.

664,209. Electric Arc Lamp. James A. Brennan, Worcester, Mass. Application filed September 11, 1897.

A locking plate is adjustably attached to the rod tubes of the lamp, whereby it is held in a position parallel with the hanger board, and yielding cushions are interposed between the locking plate and the hanger board. Means are provided for supporting the lamp from the hanger board to prevent it from swaying.

664,222. Cover or Shade for Incandescent Lamps. William R. Krumwiede, Providence, R. I. Application filed March 1, 1900.

A series of annular metal settings are perforated to receive rings. Lenses are secured in the metal settings. The rings connect the settings together to form the shade. Hooks are secured to the settings, and a spring band is provided whereby a flexible, readily attachable and removable shade is secured by which the illuminating effect of the incandescent light may be changed.

664,247. Dynamo-electric Machine. Justus B. Entz, Philadelphia, Pa., assignor of one-half to Guy F. Greenwood, Allegheny, Pa. Application filed November 27, 1897.

The machine has the magnetic material of its magnetic circuit which is constituted by the field and armature, magnetically subdivided as to one at least of its parts by an interposed medium, such as an air gap of relatively high magnetic resistance, the subdivisions so constituted extending in the direction of the desired magnetic circuit, and adapted thereby to direct and equalize the intensity of the field of force.

664,265. Electric Meter. Edward S. Halsey, Chicago, Ill. Application filed July 5, 1900.

A simple flat disk of copper is submerged in mercury and rotated in a magnetic field by a direct current conducted by the disk through the field. The controlling device is an electrical generator automatically developing within the disk restraining Foucault current in proper amount with the propelling current to determine to the shaft of the meter a speed of rotation varying practically in proportion with the measured current passing through the meter. A stationary conductor also constitutes a part of the controlling device. (See cut.)

664,301. Insulator. Richard H. Sterling, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing company, Pittsfield, Mass. Application filed March 14, 1900.

The insulator has an upper surface in the form of a flattened cone and a substantially vertical flange about its edge forming a gutter for collecting and discharging the water from the surface.

664,308. Electrotherapeutic Spectacles. Thomas B. Zeller, Pittsburg, Pa., assignor of one-half to Franklin P. Saylor, Pittsburg, Pa. Application filed October 29, 1900.

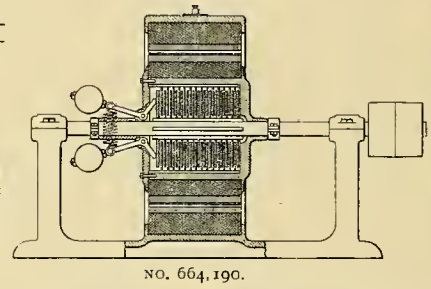
The invention consists of electrotherapeutic spectacles having a bridge with an electric negative element therein and temples with terminal bows formed of an electrical positive element, the elements being fully within the confines of the parts set forth and without increasing the dimensions of the same.

664,333. Electric Furnace. John M. Morehead, Chicago, Ill., assignor to the Union Carbide company, Chicago, Ill. Application filed December 12, 1899.

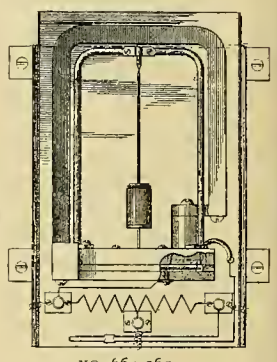
This furnace is provided with a hood having gas-tight sides and top and having an opening in the bottom for the removal of the product. Conductors of opposite polarity project through the hood. Means are provided for embedding the skirt of the hood in packing material and thereby establishing and maintaining a seal for preventing ingress of air to the hood and for directing and confining gas in the hood, and for removing gas from the hood.

664,334. Manufacture of Carbide of Calcium. John M. Morehead, Chicago, Ill., assignor to the Union Carbide company, Chicago, Ill. Application filed December 12, 1899.

This patent covers the improvement which consists in passing a current of electricity and thereby establishing a region of reduction, under a gas-tight hood, feeding raw material under the hood into the region of reduction, removing the product downward from under the hood, and embedding the skirt of the hood in the raw material and thereby creating and maintaining a seal between the skirt of the hood and the product for excluding air from the hood and for permitting of the downward movement of the product and for directing and confining gas in the hood, and withdrawing the gas through the hood.



NO. 664,190.



NO. 664,265.

664,346. Telephone-call Register. William H. Barker, Hartford, Conn., assignor to the Gray Telephone Pay Station company, Hartford, Conn. Application filed August 10, 1898.

A reciprocating plunger is adapted to operate a register and sound an alarm, and key-operated means are provided for moving the plunger, also means adapted to prevent an improper movement of the operating parts.

664,348. Electric Clock. Ulysses L. Collins, St. Louis, Mo. Application filed November 20, 1899.

The clock embodies a combination of a spring, mechanism for winding the spring, a shaft, a gear wheel loosely mounted upon the shaft, and a rim integral with the gear wheel in which rim is formed a series of internal ratchet teeth. An armature is fixed upon the shaft, and a gravity pawl carried by the armature, the point of which pawl engages the internal ratchet teeth. A magnet is provided, between the cores of which the armature operates, and a circuit runs from the magnet to a suitable source of electrical energy, which circuit is normally open. Means are provided whereby the circuit is established whenever the spring is unwound.

664,362. Galvanic Battery. Eason L. Slocum, Pawtucket, R. I. Application filed March 7, 1896.

The negative electrode is provided with a central opening adapted to receive an apertured insulator for a positive electrode, and with a perforated flange adapted to receive a number of apertured insulators for positive electrodes. The insulators and the positive electrodes are held in the central and outer insulators, and the jar is provided integrally with separate wells for containing the quicksilver to amalgamate the positive electrodes.

664,366. Fire-alarm Telegraph Box. Leonidas G. Woolley, Kenton, Ohio, assignor to the National Magneto Electric Telegraph company, Springfield, Ohio. Application filed December 28, 1899.

A magneto-electric machine, with a yoke for manipulating the same, and a motor for revolving the armature, are installed in connection with a second motor having an escapement and operating a wheel provided with projections upon its periphery. The wheel operates a lever which is connected with the yoke.

664,367. Electric-circuit Indicator. Leonidas G. Woolley, Kenton, Ohio, assignor to the National Magneto Electric Telegraph company, Springfield, Ohio. Application filed December 28, 1899.

In a magneto-electric telegraph or signal system, a movable armature for a permanent magnet is provided with a coil, and the armature and coil are mounted upon a pivoted rod. Suitable wires are provided for connecting the coil with the closed external circuit. Means are described for operating the movable armature, the closed external circuit, and an alarm which is operated by the increased movement of the armature when the circuit is broken or left open.

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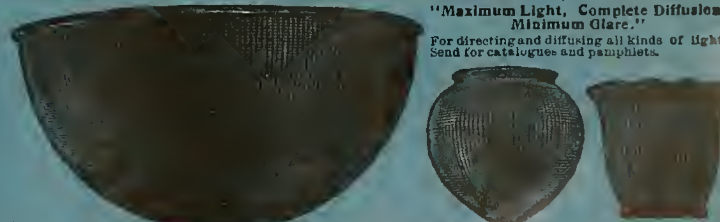

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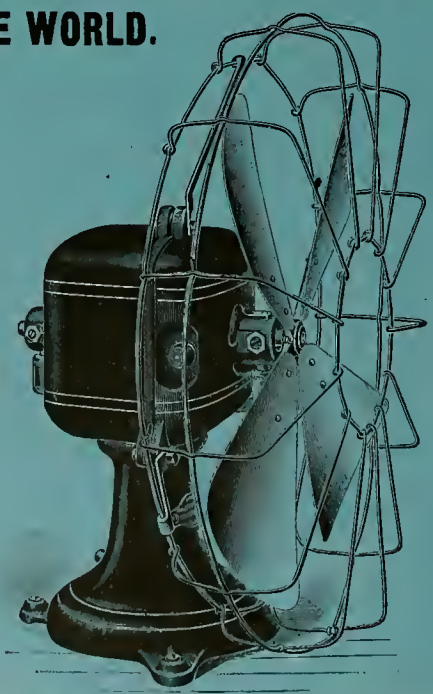

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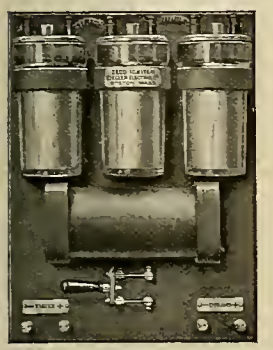

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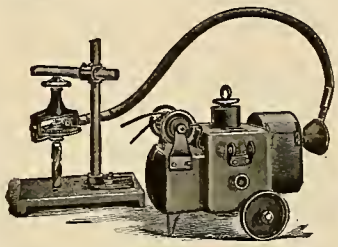

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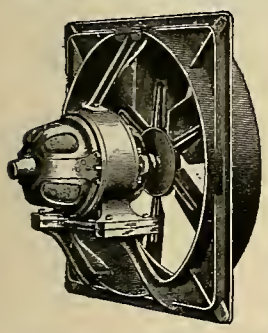

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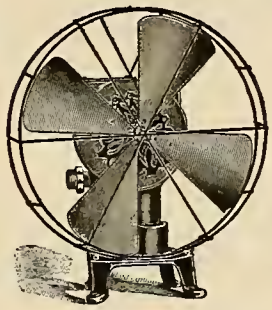

THE JUNIOR WATER BLOW FAN

Is the only successful Water Desk Fan. Is operated by water pressure of 30 pounds and upward.

ATTRACTIVE.
DURABLE.
EFFICIENT.

No plumber is required to install this Fan, as garden hose can be used for supply and waste.

Weight, Boxed, 15 lbs.
List Price, $7.50.

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PARAGON

CHICAGO EDISON **FAN MOTORS**

COMPANY, 139 ADAMS ST., CHICAGO.

Cross-Arms, Pins, Brackets.

Our factory is near Indianapolis, therefore we can give you the advantage of best freight rates and prompt shipments.

INDIANA'S LARGEST SUPPLY HOUSE.

Robert L. McOuat,

The "Junior" Member of the Old Firm of Varney & McOuat,

MANUFACTURERS AND JOBBERS OF

TELEPHONE AND ELECTRICAL SUPPLIES,

125 S. MERIDIAN ST., INDIANAPOLIS, IND.

MICA—India and Amber, all Sizes and Patterns.

MICABOND—Plates, Segments, Rings, Tubes, Slots, Cloth, Paper and Flexible.

CHAMPION CLOTH—Bond, Ropes and Express Paper.

CRYSTAL TRADE MARK

VARNISH.

VERY ELASTIC. HARD FINISH.

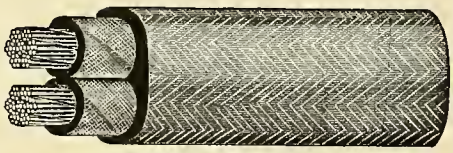
CHAMPION INSULATING PAINTS (Blacks), Four Kinds. Also Other Insulating Materials.

Our Careful and Persistent Growth ie Proof of the Quality of our Insulations. Prices and Quality Guaranteed. Write Us.

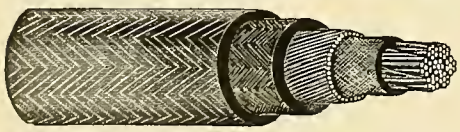
CHICAGO MICA CO.,

Main Office and Factory, VALPARAISO, IND.

INSULATED RUBBER WIRES AND CABLES.



JOHN A. ROEBLING'S SONS CO.

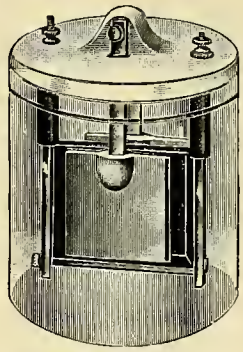


WORKS AT

TRENTON, N. J.

EDISON LALANDE BATTERIES.

FOR GAS ENGINES, SLOT MACHINES, AUTOMOBILES, RAILROAD SIGNALS, CROSSING BELLS, SMALL MOTORS, ETC.



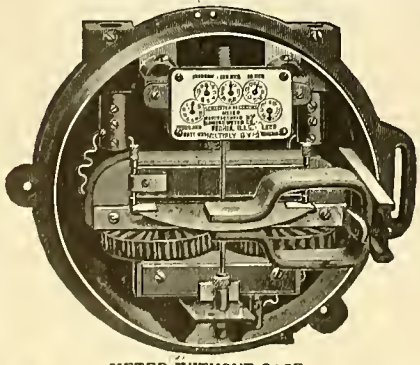
CONSTANT CURRENT, NO LOCAL ACTION, WILL NOT FREEZE, LIQUID TIGHT CELLS FOR PORTABLE WORK.

FULL DESCRIPTION IN BOOKLET NO. 4.

EDISON MANUFACTURING COMPANY,

135 FIFTH AVENUE, NEW YORK.

SCHEEFFER RECORDING WATT-METERS.



METER WITHOUT CASE.

Accurate on All Loads.
Will Start and Register Correctly on 5 Watts.
Shunt loss LESS than one Watt on 60 Cycles.
Dust Proof.
Correct on All Inductive Loads.

DIAMOND METER CO.,

PEORIA, ILL., U. S. A.

METER WITH CASE.

85% YOU LOSE 85%

WHY

Throw away 85% of your coal when you can sell it for three times its cost by putting in our system of UNDERGROUND EXHAUST STEAM HEATING MAINS.

It is common for electric companies who are now operating EXHAUST STEAM HEATING PLANTS to pay their entire coal and labor bills for the year and 6% on investment for steam mains from sale of exhaust steam. Why cant you do the same? Write for our pamphlet. Mention Western Electrician.

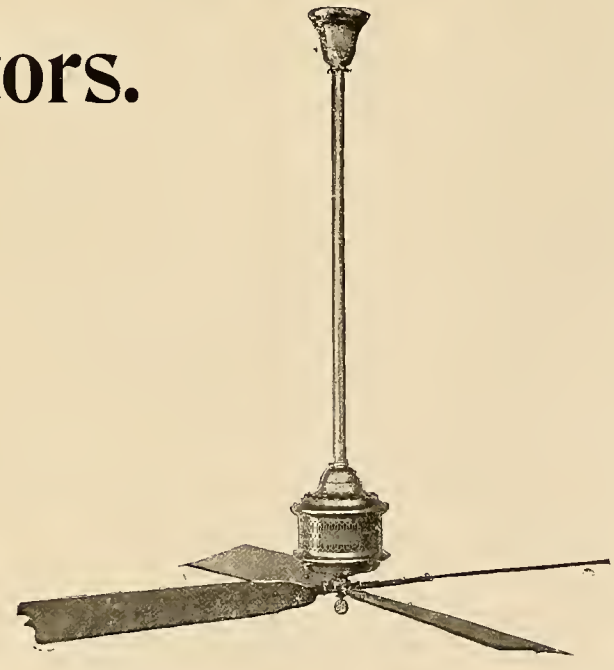
AMERICAN DISTRICT STEAM CO. LOCKPORT N.Y.

THE GENERAL ELECTRIC COMPANY'S

Ceiling Fan Motors.

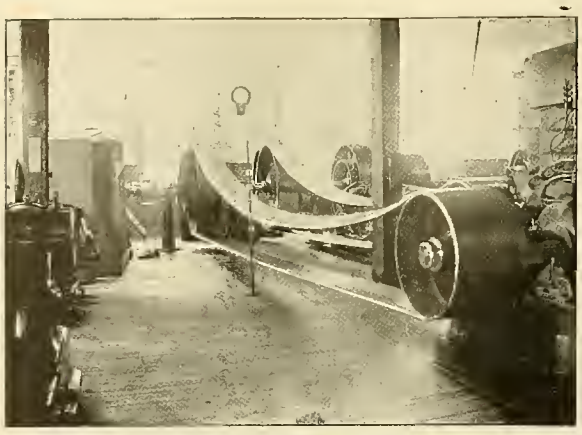
For direct current circuits
115 and 230 volts.
Slow and high speeds.
Two, four and six blades.

WRITE FOR PAMPHLET.



GENERAL OFFICE: SCHENECTADY, N. Y.

CHICAGO OFFICE: MONADNOCK BLDG. SALES OFFICES IN ALL LARGE CITIES.



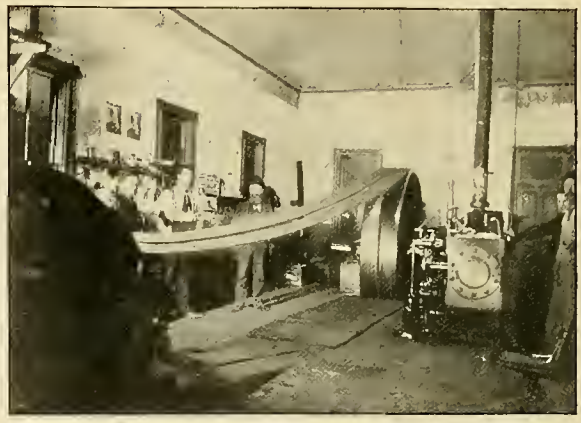
CLING-SURFACE.

We guarantee these results from Cling-Surface:
Slipping stopped.
Belts made pliable and elastic.
Power increased at least 15%.
Belts will run easy or slack.

ASK US FOR THE ONLY BOOKLET OF SLACK BELTS YOU EVER SAW.

CLING-SURFACE MFG. CO.,
177-182 Virginia St., BUFFALO, N. Y.

Chicago, St. Louis, New York, Boston, New Orleans.



ROCKLAND, ME., February 22, 1900.
Cling-Surface Mfg. Co., New England Branch, Boston.
GENTLEMEN:—These two 16-in. belts have been treated with Cling-Surface for some time. They run this way all the time. The load sometimes jumps from zero to full load, yet there is no slip.
ROCKLAND, THOMASTON & CAMDEN ST. RY. CO.

MOUND CITY, Mo., March 5, 1900.
Cling-Surface Mfg. Co.
GENTLEMEN:—Have used Cling-Surface four months. It has stopped all slipping. Belts 10 in., 30-ft. centers, run with 22-in. sag, yet carry full load, are pliable and in fine condition. Used to run very tight. We highly recommend Cling-Surface.
MOUND CITY ELEC. LT. & TELEPHONE CO.

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Western Elec. Supply Co.

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Gregory Electric Co.
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Gr. Western Sm. and Ref'g. Co.

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Gilchrist Jar Co.
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Western Elect. Supply Co.

Bells, Buzzers, Etc.
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Huebel & Manger.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Belt Dressing.
Cling-Surface Mfg. Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Belting.
Chicago House Wrecking Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Blowers.
Fuller Co., The
Sturtevant Co., B. F

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Electrician Publishing Co.

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American Bridge Co.

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Becker Bros.
Central Electric Co.
General Electrical Repair Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.

Burglar Alarms.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Elect. Supply Co.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
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American Steel & Wire Co.
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General Electric Co.
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Western Elect. Supply Co.

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Link Belt Machinery Co.

Circuit Breakers.
Cutler Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jaffrey Mfg. Co.
Link Belt Machinery Co.

Coating for Pulleys.
Little, O. C., Pulley Coat'g Co.

Coils and Magnets.
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Varley Duplex Magnet Co.

Compound.
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Western Electric Co.

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Crocker-Wheeler Company.
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General Electric Co.
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Roth Bros. & Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
National India Rubber Co.
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.

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Int. Correspond. Schools.

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Central Mfg. Co.
Indpls. Arm, Brack. & Pin Co.
Kans. City & So. Lum. Co.
Leavitt, R. H.
Tennent Insulator Pin Co.
Texas Arm & Pin Co.
Valentine-Clark Co., The.
Western Elect. Supply Co.

Cut-Outs and Switches.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
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Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Cuts.
Franklin Eng. & Electro Co.

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Iron Clad Resistance Co.

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Central Electric Co.
Chicago Motor and Dyn. Co.
Chicago House Wrecking Co.
Crocker-Wheeler Company.
Diehl Manufacturing Co.
Ft. Wayne Elec. Wks., Inc.
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General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Matthews & Bro., W. N.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
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Sturtevant Co., B. F.
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Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Elec. Heating Devices.
Simplex Electrical Co.

Electric Railways.
Arnold El. Power Station Co.
Crocker-Wheeler Company.
General Electric Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Westinghouse El. & Mfg. Co.

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Crocker-Wheeler Company.
Hodge-Walsh Elec. Eng. Co.
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Sargent & Lundy.

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Electric Appliance Co.
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General Electric Co.
General Inc. Arc Light Co.
Manhattan Elec. Supply Co.
Queen & Co.
Siemens & Halske Electric Co. of America.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
Crocker-Wheeler Company.
General Electric Co.

Elevators-Conveyors.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

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Camp Engineering Co.
Chicago House Wrecking Co.
Sturtevant Co., B. F.

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American District Steam Co.

Fan Outfits.
Central Electric Co.
Crocker-Wheeler Company.
Diehl Manufacturing Co.
Edison Mfg. Co.
Emerson El. Mfg. Co.
Fuller Co., The.
General Electric Co.
General Inc. Arc Light Co.
Holtzer-Cabot Elec. Co.
Paragon Fan Motor Co.
Roth Bros. & Co.
Siemens & Halske Electric Co. of America.
Specialty Mfg. Co.
Sprague Electric Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Flexible Shafts.
Stow Mfg. Co.

Forges.
Sturtevant Co., B. F.

Fuses.
American Elec. Fuse Co.
McIntire Co., The C.

Fuse Wire.
American Elec. Fuse Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
Electric Appliance Co.
McIntire Co., The C.
Western Elect. Supply Co.

Gas Lighting, Electric.
Western Electric Co.

Gears.
Besly & Co., Chas. H.

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Bunnell & Co., J. H.
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Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Manhattan Elec. Supply Co.
McGuat, Robert L.
Mianus Electric Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Holophane Glass Co.
Phœnix Glass Co.
Western Elect. Supply Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heaters (Feed Water).
Kelley & Son, Benj. F.

Heating and Ventilating Apparatus.
Sturtevant Co., B. F.

Holders, Inc. Lamp.
Faries Manufacturing Co.
Vought, M. I.

Igniters.
Ziegler Electric Co.

Insulators and Insulating Materials.
Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Central Electric Co.
Chicago Edison Co.
Chicago Mica Co.
Eagle Paint & Varnish Wks.
Electric Appliance Co.
General Inc. Arc Light Co.
Illinois Insulated Wire Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
McGuat, Robert L.
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Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Elec. Fuse Co.
American Electrical Works.
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Northwestern Elec. Mfg. Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
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Bossert Elect. Const. Co.
General Inc. Arc Light Co.

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Shelby Electric Co.
Warren Elec. & Specialty Co.
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Butler-Taylor Co.
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Electric Appliance Co.
Eureka Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
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Linemen's Climbers.
Klein & Son, Mathias.

Magnet Wires.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
Fort Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.
Siemens & Halske Electric Co. of America.

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Chicago Mica Co.
Munsell & Co., Eugene.

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Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Siemens & Halske Electric Co. of America.
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Motors — See Dynamos and Motors.

Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Bamlin, Geo. R.
Johnston, Thomas J.
Page & Durand.

Phosphor Bronze.
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Phosphor Bronze Sm. Co., Ltd.

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Goldsmith Bros.
Gt. West. Sm. and Refining Co.

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Fowler, John H.
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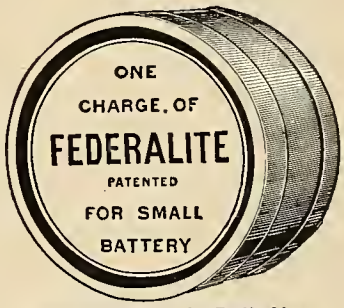

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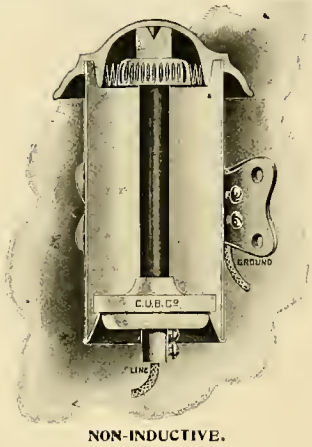

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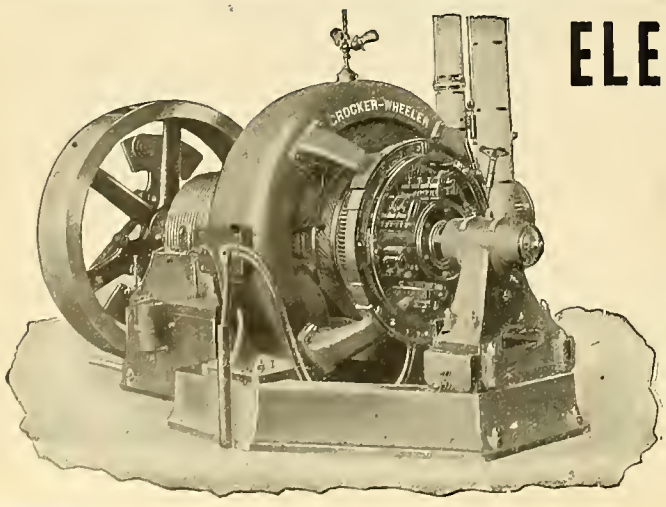

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5 " 18 "	1,048	8 " 30 "	120	7 " 55 "	124
6 " 18 "	398	6 " 35 "	1,000	8 " 55 "	1
4 " 20 "	4,481	8 " 35 "	147	6 " 60 "	13
5 " 20 "	3,474	6 " 40 "	300	7 " 60 "	36
6 " 20 "	1,234	7 " 40 "	1,000	8 " 60 "	1
7 " 20 "	127	8 " 40 "	44	6 " 65 "	3
4 " 25 "	7,050	6 " 45 "	343	7 " 65 "	5
5 " 25 "	6,000	7 " 50 "	200	7 " 70 "	1
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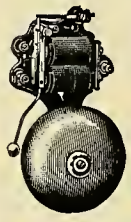

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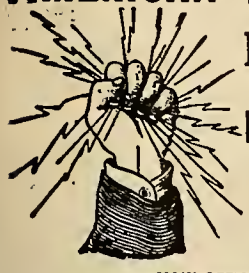

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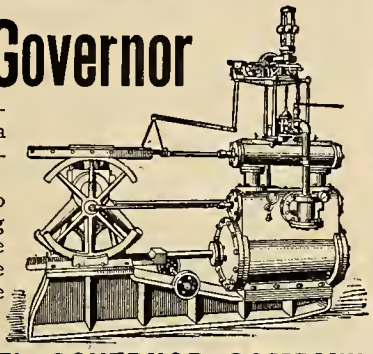

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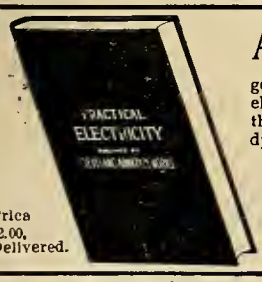

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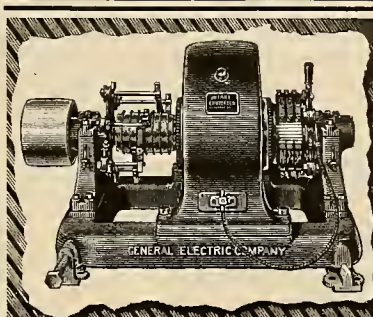

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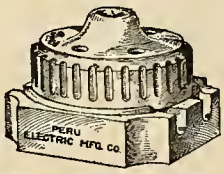

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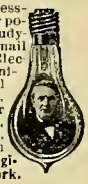

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1 3 H. P. Card, self-oiler.
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1 12 H. P. Rockford.
1 18 H. P. National, self-oiler.
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1 18 H. P. Siemens & Halske, M. P., self-oiler.
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1 24 H. P. Eddy, self-oiler.
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1 1 H. P. Edison, ¾ K. W., self-oiler.
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1 1¼ H. P. Lundell, slow speed, self-oiler.
1 3 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 3 H. P. General Electric, type I. B., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 6 H. P. Akron, self-oiler.

220 Volt Motors.—Continued.

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1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
2 7½ H. P. Eddy, self-oilers.
1 7½ H. P. Edison, self-oiler.
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1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 2½ H. P. Wood, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Thomson-Houston.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 5 H. P. D. & D.
1 6 H. P. T.-H., 6 K. W.
1 7½ H. P. Jones, self-oiler.
1 7½ H. P. Thomson-Houston.
1 10 H. P. Eddy, self-oiler, M. P.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow speed.
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2 18 H. P. C. & C., self-oilers.
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
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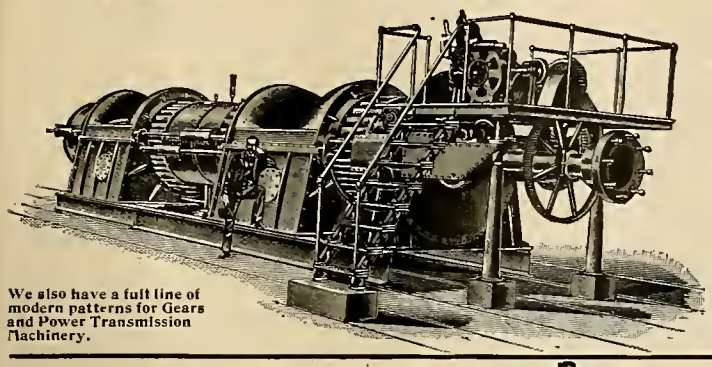

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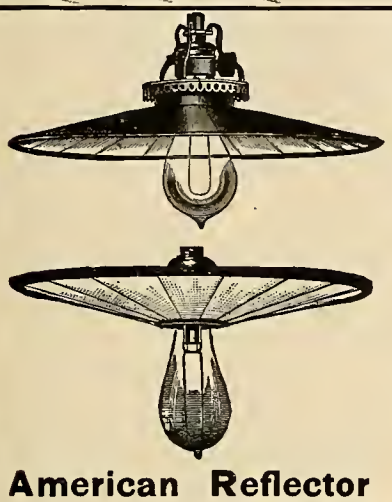

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Two 54x14 horizontal tubular boilers.
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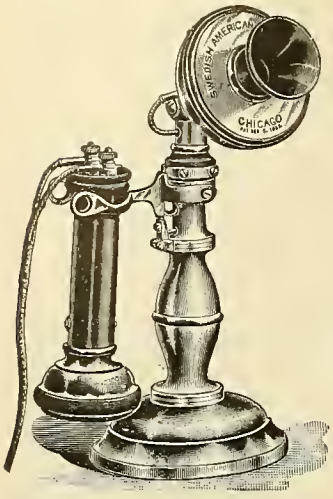

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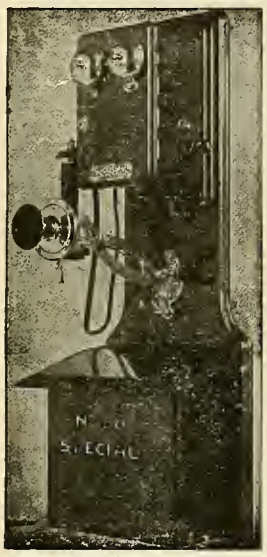

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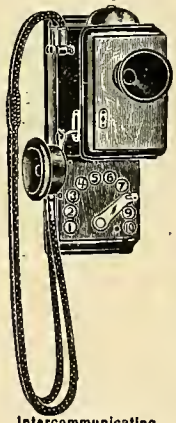

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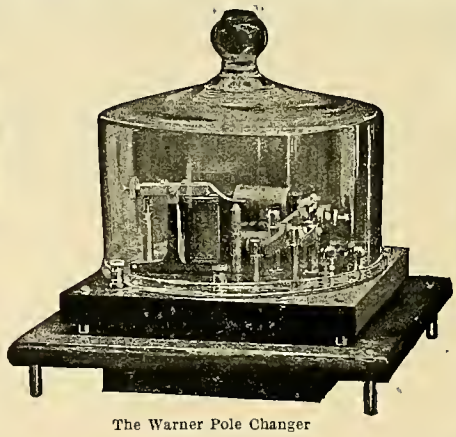

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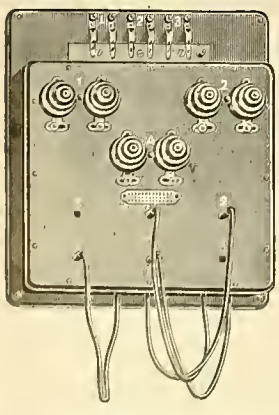

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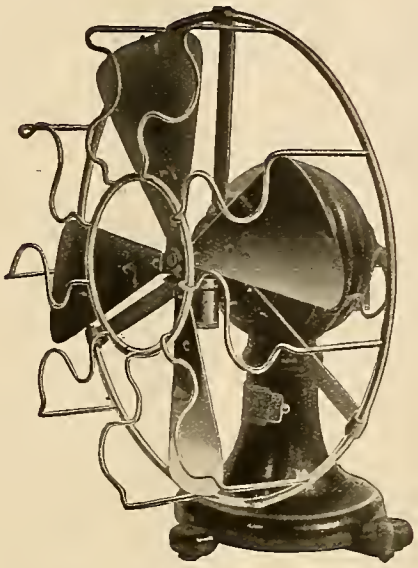

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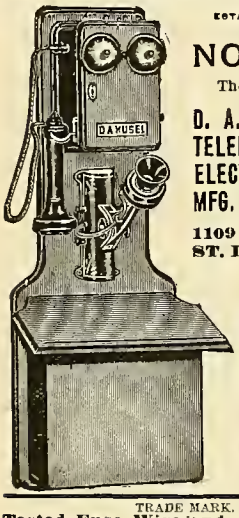

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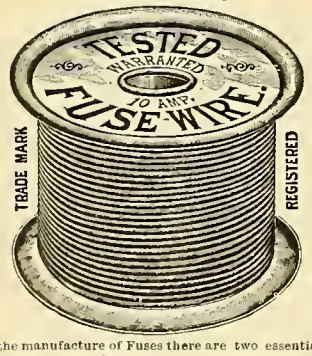

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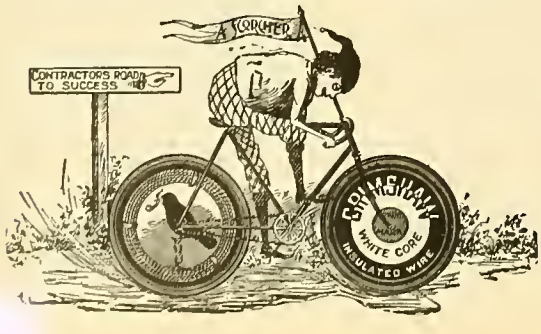

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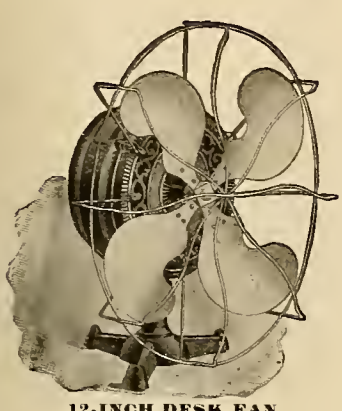

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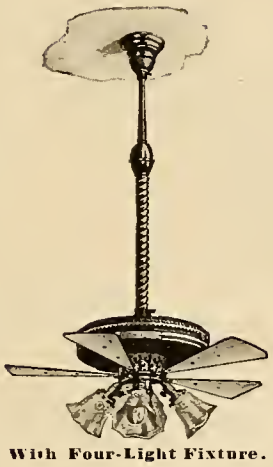

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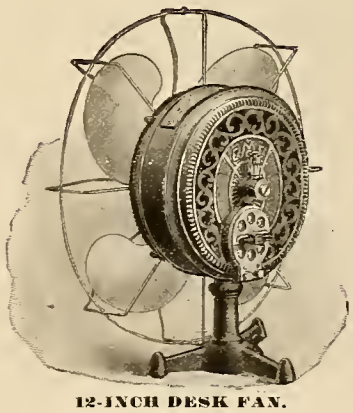

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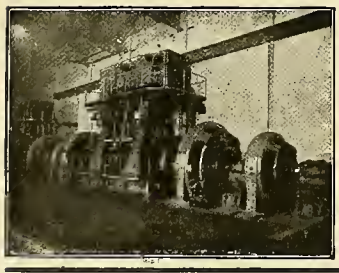

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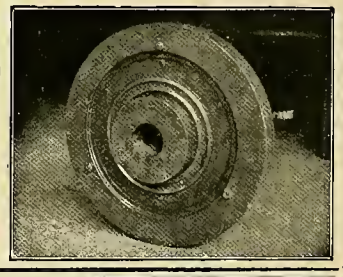

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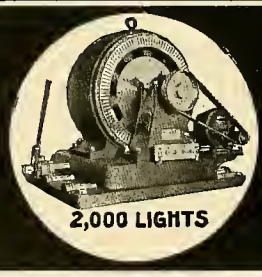

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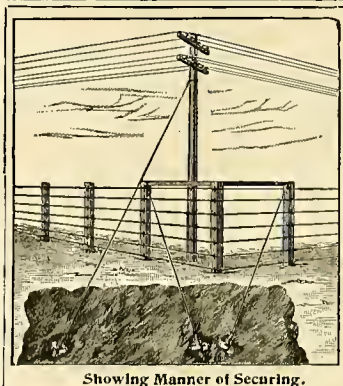

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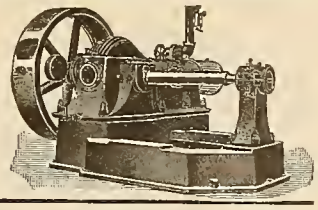

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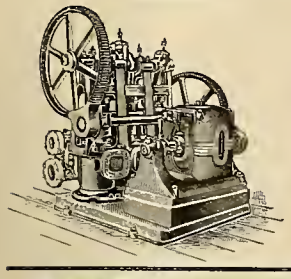

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PUMPING MACHINERY FOR EVERY POSSIBLE DUTY.

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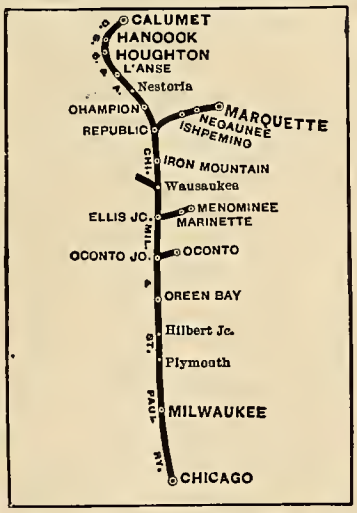

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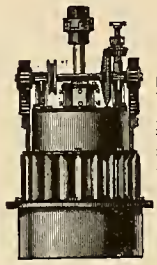

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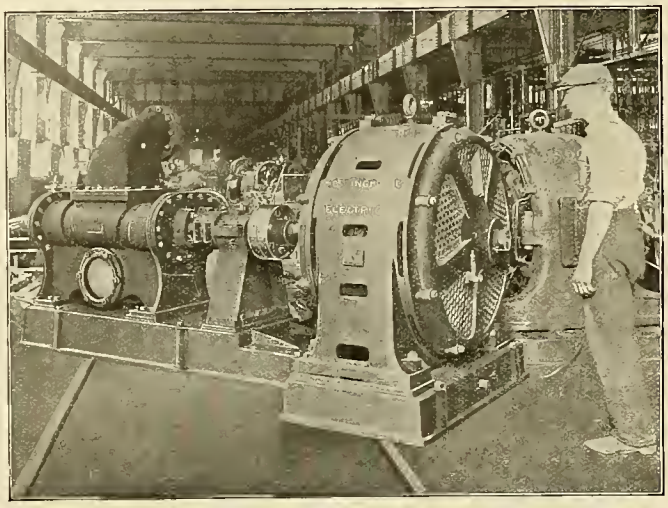

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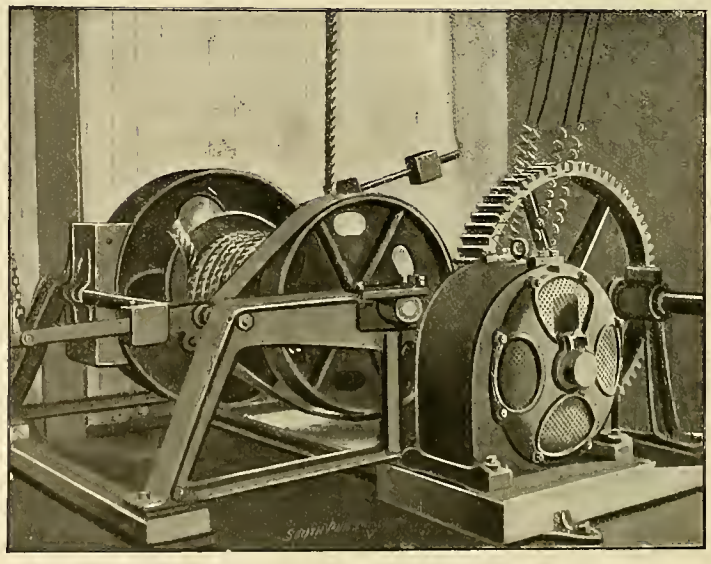

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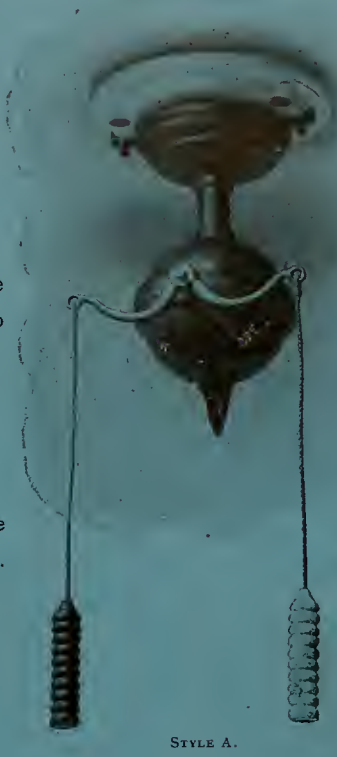

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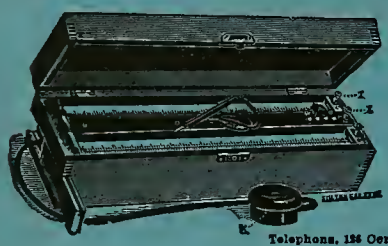

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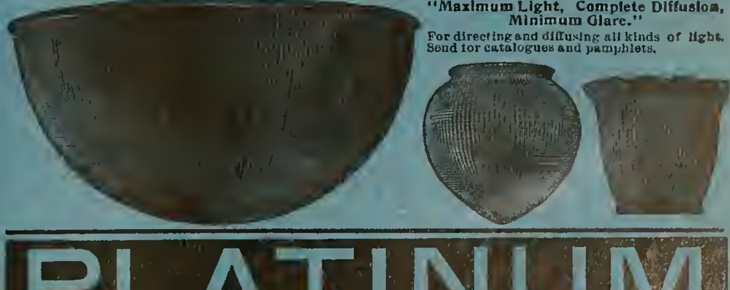

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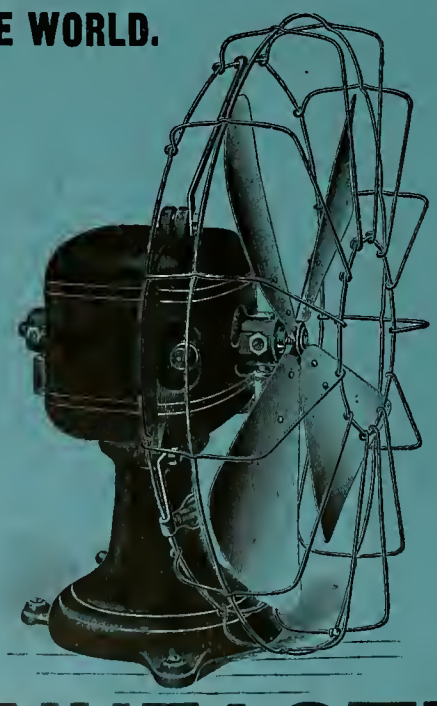

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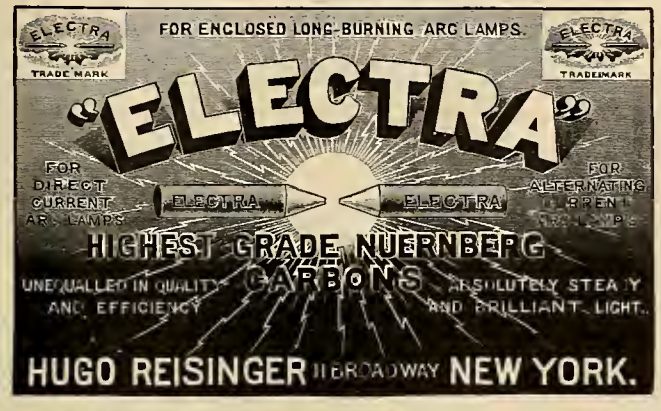

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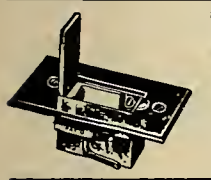

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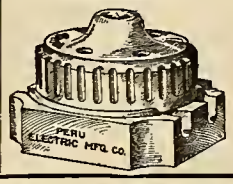

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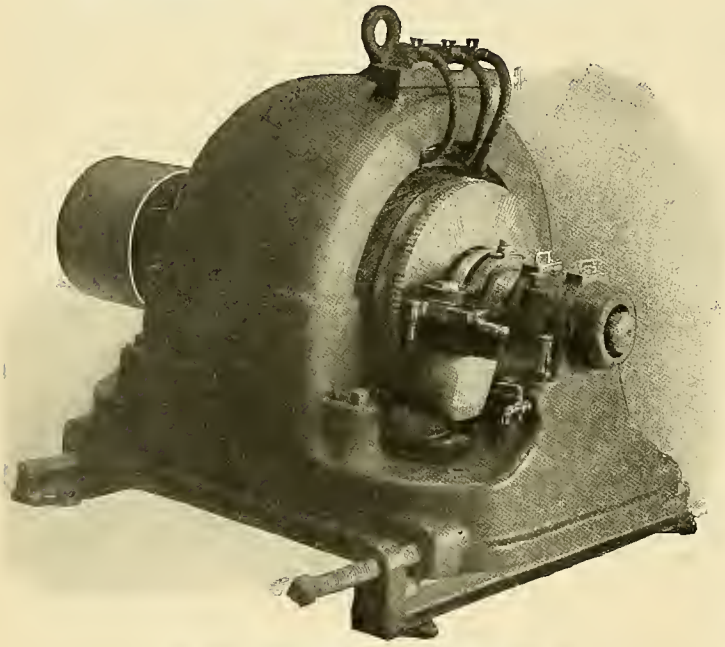
PARAGON

CHICAGO EDISON COMPANY, **FAN MOTORS**

139 ADAMS ST., CHICAGO.

Wagner Electric Mfg. Co.'s

SELF-STARTING, SINGLE-PHASE A. C. MOTORS....



10-horsepower single-phase motor, one-twelfth actual size.

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General Offices and Factory, St. Louis, Mo., U.S.A.

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CHICAGO, 1519 Marquette Bldg. BALTIMORE, 204 East Lexington St.
ATLANTA, GA., 1002 ENGLISH-AMERICAN BUILDING—R. J. RUSSELL.
SAN FRANCISCO, 120 Sutter St. YOKOHAMA, JAPAN. LONDON, ENGLAND. CITY OF MEXICO.
FOREIGN DEPARTMENT, Havemeyer Bldg., New York City.

MICA—India and Amber, all Sizes and Patterns.

MICABOND—Plates, Segments, Rings, Tubes, Slots, Cloth, Paper and Flexible.

CHAMPION CLOTH—Bond, Ropes and Express Paper.

CRYSTAL TRADE MARK CRYSTAL **VARNISH.**

VERY ELASTIC. HARD FINISH.

CHAMPION INSULATING PAINTS (Blacks), Four Kinds. Also Other Insulating Materials.

Our Careful and Persistent Growth is Proof of the Quality of our Insulations. Prices and Quality Guaranteed. Write Us.

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Our factory is near Indianapolis, therefore we can give you the advantage of best freight rates and prompt shipments.

INDIANA'S LARGEST SUPPLY HOUSE.

Robert L. McOuat,

The "Junior" Member of the Old Firm of Varney & McOuat,

MANUFACTURERS AND JOBBERS OF

TELEPHONE AND ELECTRICAL SUPPLIES,

125 S. MERIDIAN ST., INDIANAPOLIS, IND.

FRED H. ALDEN, Pres. **J. GEISEROWICH, Secy. and Treas.**

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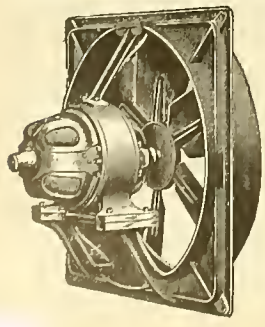
ILLINOIS INSULATED WIRE CO.,

MANUFACTURERS OF

High-Grade Weatherproof Wire,

NO TRUST PRICES. **SYCAMORE, ILL.** **ALL SAMPLES FREE.**

WEATHER-PROOF INDEX BRAND WIRE WE SHOW THE WAY



TRIUMPH EXHAUST FAN,

Direct Connected with Detachable Motor.

Sizes, 30-in., 36-in., 42-in. and 48-in. For all standard voltages of direct current.

Moves more air, steam, dust, etc., than any other Fan.

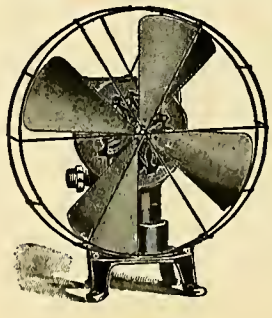
Correct electrical and mechanical construction. Motor amply protected. Convenient for inspection. Has self-oiling boxes. Carbon brushes with automatic feed. Rheostat with automatic release. Motor may be detached and utilized for other purposes. Motor and Fan frame being shipped separately renders installation easy and simple.

Triumph Exhaust Fan for belted service, Sizes, 18-in to 96-in.

SPECIALTY MFG. CO.,

FAN MANUFACTURERS,

INDIANAPOLIS, IND., U. S. A.



THE JUNIOR WATER BLOW FAN

Is the only successful Water Desk Fan. Is operated by water pressure of 30 pounds and upward.

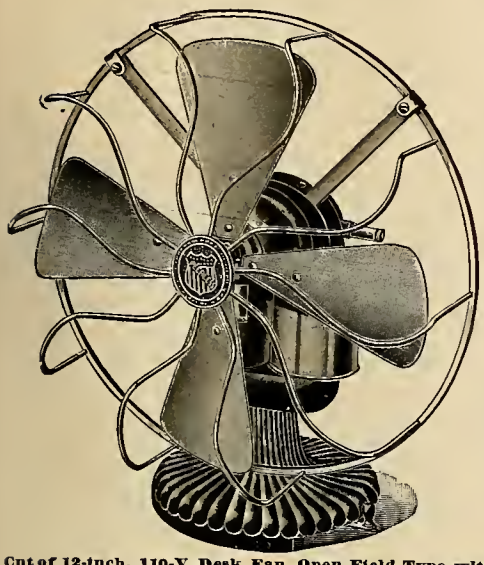
ATTRACTIVE.
DURABLE.
EFFICIENT.

No plumber is required to install the Fan, as garden hose can be used for supply and waste.

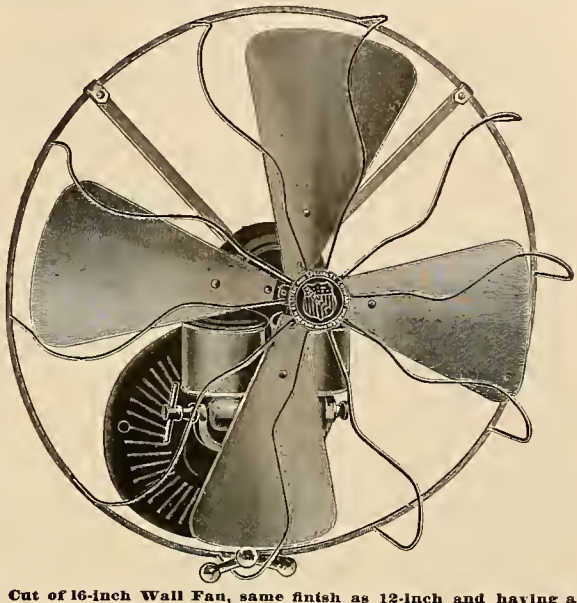
Weight, Boxed, 15 lbs.
List Price, $7.50.

PEERLESS

DIRECT-CURRENT DESK AND CEILING FANS.



Cut of 12-inch, 110-V. Desk Fan, Open Field Type with polished brass hoods and field coverings, the handsomest and most efficient Fan on the market.



Cut of 16-inch Wall Fan, same finish as 12-inch and having a swivel joint. By simply turning a handle this Fan can be adjusted to blow air up, down or on either side.

THE FOLLOWING SUPPLY HOUSES ARE AGENTS FOR PEERLESS FANS:

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4. Valiee Bros. & Co., 625 Arch St., Philadelphia, Pa.
5. Frank H. Stewart & Co., 35 North 7th St., Philadelphia, Pa.
6. Electric Supply & Mfg. Co., 62 Public Square, Cleveland, Ohio.
7. The Devere Electric Co., 430 Plum St., Cincinnati, O.
8. Doubleday-Hill Electric Co., 535 Wood St., Pittsburg, Pa.
9. Julius Andrae & Sons Co., 225 W. Water St., Milwaukee, Wis.
10. H. S. Sands El. & Mfg. Co., 1153 Market Street, Wheeling, W. Va.
11. Electric Supply & Const. Co., 80 E. Gay St., Columbus, O.
12. Robert L. McOnat, 125 S. Meridian St., Indianapolis, Ind.
13. W. G. Nagel & Co., 510 Adams St., Toledo, O.
14. Central Electric Co., 124 So. Jefferson St., Peoria, Ill.
15. Elect. Sup. & Eng. Co., 211 Jefferson Ave., Detroit, Mich.
16. Stuart-Howland Co., No. 283-285 Devonshire St., Boston, Mass.

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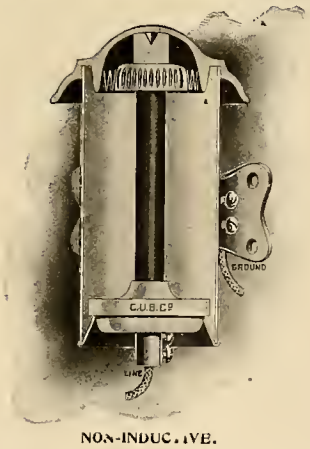
OKONITE IT NEVER DISAPPOINTS

Insulate your Electrical Machinery with Electric Varnish and protect your line with the Wood Lightning Arrester. Then you are safe.

OKONITE IT NEVER DISAPPOINTS

THE WOOD LIGHTNING ARRESTER—Section View.



NON-INDUCTIVE.

Short Gap= Isn't It?

THAT'S WHAT DOES THE WORK.

Patented April 19, 1892.

HAPPENED IN '92.
PROVED TO BE A

Good Thing=Is Yet.

Made in one style. Two finishes, though. POLISHED BRASS for switchboard. PLAIN FINISH for pole use.

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GENERAL SELLING AGENTS,

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GREENFIELD FLEXIBLE STEEL ARMORED CONDUITS.

These products represent the latest and most radical advance in the art of

ELECTRICAL WIRING.

Their use reduces the installation of electric conduits to an absolute simplicity.

NO ELBOWS REQUIRED. ENTIRE FLEXIBILITY.

We offer to electrical contractors the greatest variety of conduits and appliances in the world.

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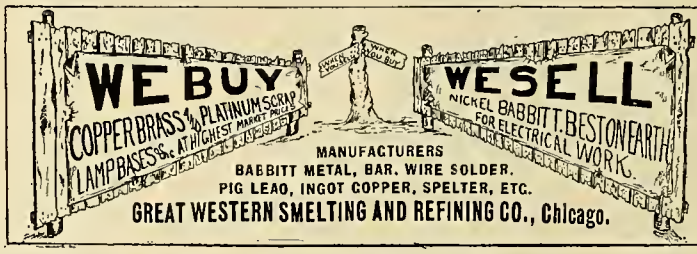
Electro Galvanized Conduits
AND FITTINGS.
Endorsed by Board of Fire Underwriters.
ALL SIZES IN STOCK. WRITE FOR PRICES.
Richmondt Conduit Co.,
MILWAUKEE, WIS., U. S. A.



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Anchors (Tel. & Tel. Pole).
Smith, Philip.

Annunciators.
Central Electric Co.
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Western Electric Co.
Western Elec. Supply Co.

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General Electric Co.
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Siemens & Halske Electric Co. of America.
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Shultz Belting Co.

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Western Elect. Supply Co.

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Sprague Electric Co.
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Sprague Electric Co.
Wagner Elec. Mfg. Co.
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Leavitt, R. H.
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Palsie Co., H. T.
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Northern Elec. Mfg. Co.
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Sprague Electric Co.
Star Dynamo Works.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Electric Supply Co.
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Simplex Electrical Co.

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General Electric Co.
Siemens & Halske Electric Co. of America.
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Bain, Forea.
Crocker-Wheeler Company.
Hodge-Walsh Elec. Eng. Co.
Humphrey, Henry H.
Northern Elec. Mfg. Co.
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Ball Engine Co.
Camp Engineering Co.
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Sturtevant Co., B. F.

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Emerson El. Mfg. Co.
Fuller Co., The.
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Paragon Fan Motor Co.
Roth Bros. & Co.
Siemens & Halske Electric Co. of America.
Specialty Mfg. Co.
Sprague Electric Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elect. Supply Co.
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Kartavert Mfg. Co.
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Barnett Co., G. & H.

Flexible Shafts.
Stow Mfg. Co.

Forges.
Sturtevant Co., B. F.

Fuses.
American Elec. Fuse Co.
McIntire Co., The C.

Fuse Wire.
American Elec. Fuse Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
Electric Appliance Co.
McIntire Co., The C.
Western Elect. Supply Co.

Gas Lighting, Electric.
Western Electric Co.

Gears.
Besly & Co., Chas. B.

General Elec. Supplies.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Manhattan Elec. Supply Co.
McOuat, Robert L.
Mianus Electric Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Holophane Glass Co.
Phœnix Glass Co.
Western Elect. Supply Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. B.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heaters (Feed Water).
Kelley & Son, Benj. F.

Heating and Ventilating Apparatus.
Sturtevant Co., B. F.

Holders, Inc. Lamp.
Faries Manufacturing Co.
Vought, M. I.

Insulators and Insulating Materials.
Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Central Electric Co.
Chicago Edison Co.
Chicago Mica Co.
Eagle Paint & Varnish Wks.
Electric Appliance Co.
General Inc. Arc Light Co.
Illinois Insulated Wire Co.
Indiana Rub. & Ins. Wire Co.
Kanavert Mfg. Co.
Manhattan Elec Supply Co.
McOuat, Robert L.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Palste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Elec Fuse Co.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Illinois Insulated Wire Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
McDermid Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Northwestern Elec. Mfg. Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lamps, Incandescent.
Central Electric Co.
Chicago Edison Co.
Colorado Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
Kentucky Electrical Co.
Manhattan Elec. Supply Co.
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Shelby Electric Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lightning Arresters.
American Elec. Fuse Co.
Butler-Taylor Co.
Central Electric Co.
Electric Appliance Co.
Eureka Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Klein & Son, Mathias.

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Mechanical Machinery.
Besly & Co., Chas. B.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
Fort Wayne Elec. Wrks., Inc.
General Inc. Arc Light Co
Siemens & Halske Electric Co. of America.

Mica.
Chicago Mica Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Siemens & Halske Electric Co. of America.
Westinghouse El. & Mfg. Co.

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Robertson & Sons, Jas. L.

Patent Attorneys.
Bamlin, Geo. R.
Johnston, Thomas J.
Page & Durand.

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Phosphor Bronze Sm. Co., Ltd.

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Goldsmith Bros.
Gt. West. Sm. and Refining Co.

Poles.
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Fowler, John H.
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Amer. Reflector & Ltg. Co.

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Noblett, E. J.

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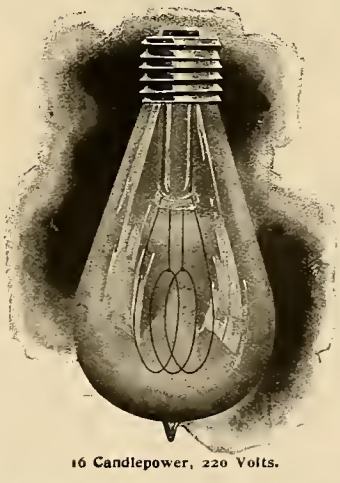

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4 inches, 18 feet	200	5 inches, 30 feet	1,534	6 inches, 55 feet	32
5 " 18 "	1,048	8 " 30 "	120	7 " 55 "	124
6 " 18 "	398	6 " 35 "	1,000	8 " 55 "	1
4 " 20 "	4,481	8 " 35 "	147	6 " 60 "	13
5 " 20 "	3,474	6 " 40 "	300	7 " 60 "	36
6 " 20 "	1,234	7 " 40 "	1,000	8 " 60 "	1
7 " 20 "	127	8 " 40 "	44	6 " 65 "	3
4 " 25 "	7,050	6 " 45 "	343	7 " 65 "	5
5 " 25 "	6,000	7 " 50 "	200	7 " 70 "	1
6 " 25 "	3,000	8 " 50 "	8		

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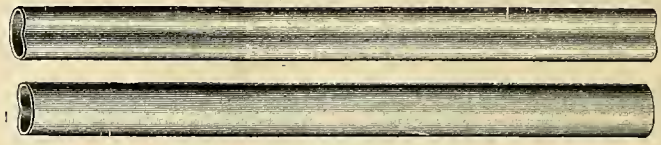

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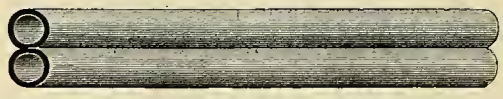

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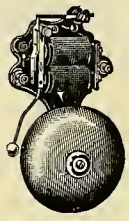

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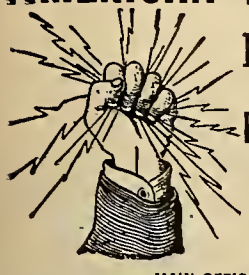

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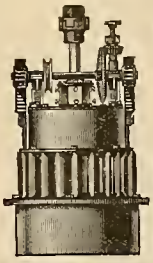

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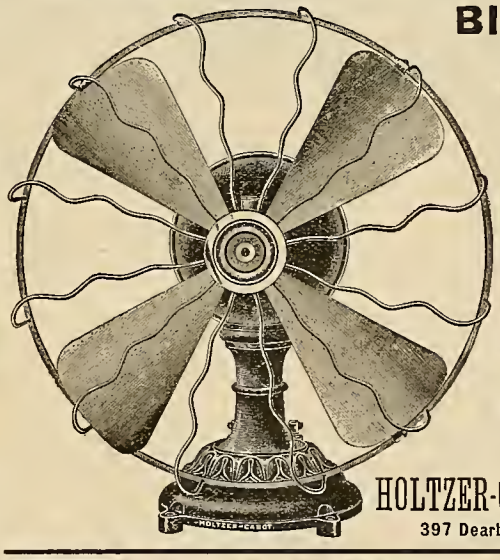

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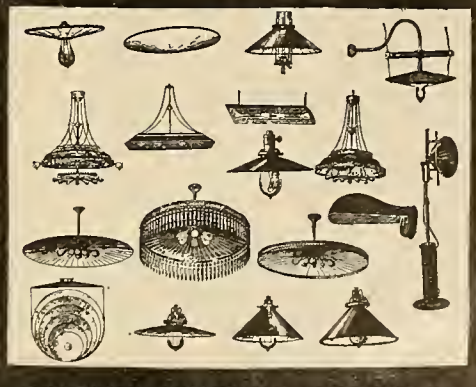

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We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

CAMP ENGINEERING CO.,
18 South Canal Street, Chicago, Ill.

FOR SALE.

Motor generator, 500 volt—110 volt for charging storage batteries. Old material of all kinds purchased. WALSH'S SONS & CO., 260 Washington Street, Newark, N. J.

FOR SALE.

50,000 1¼ oak pins, painted.
10,000 cross-arm braces. Great bargain.

STAFFORD & EVANS, LTD.,
Steinway Hall, Chicago.

WANTED.

For immediate delivery, one or more 125-light Brush Multicircuit Arc Dynamos, 2,000 c.-p., new or in good second-hand condition. Address, giving full particulars,

The ROYAL ELECTRIC CO.,
Montreal, Canada.

WANTED.

Telephone working foreman wanted in England, well up in cable laying party wire, bridging, series and automatic systems. State age, wages and where employed. "ENGLAND," care Western Electrician, 510 Marquette building, Chicago.

WANTED.

Position by a man capable of taking charge of a police and fire alarm or an electric-light system. Address "A. M.," care of Western Electrician, 510 Marquette Building, Chicago.

WABASH MIDNIGHT FLYER TO ST. LOUIS.

Spend the evening at home or at the theater—leave Chicago at 11:30 p. m. and be in St. Louis before 8 o'clock the next morning. Try this popular train.

FOR SALE CHEAP.

Dr. J. S. Romine of Chadron, Neb., will sell $10,000 stock of Chadron Electric Light and Power Co. for $3,000 cash; balance stock, $4,000, held by J. D. Bacon of Chadron, a retired banker, he will sell on account of my selling, for $2,000 cash or on time, or keep his stock. Plant cost over $16,000; no bonds, mortgages or debts; no other light plant; city contract. Coal, $2.95 per ton. Pure city spring water. City of 3,000, healthy, good school, academy, six churches. Business can be greatly increased. Reason for selling, age and business keep me away all the time.

Sealed bids to light the city of Lebanon, Ky., will be received until Saturday, Sept. 1st, 1900—3 o'clock p. m., with thirty-two 1,200 candle power arc lights. The contract to take effect January 1st, 1901, and continue in force until December 31st, 1904. The city reserves the right to reject any or all bids. Address all bids to

JOHN BARR, Mayor,
Lebanon, Ky.

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Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
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NOTICE.

Sealed bids will be received for the installation of an electric-lighting plant for the village of Dalton, Ill. Bids will be opened on Saturday, July 28, at 12 o'clock noon.

Plans and specifications are on file at the office of the village clerk.

The Board of Trustees reserve the right to reject any or all bids.

Address all bids to

VILLAGE CLERK,
DALTON, ILL.

The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,
111 to 117 East 131st St., N. Y.

REPAIRS EVERYTHING ELECTRICAL WRITE US ROBT. L. McQUAT, INDIANAPOLIS, IND. REPAIRS

110-Volt Incandescent Dynamos.

1 12-light Edison, ¾ M. P.
1 25-light C. & C., self-oiler.
1 25-light Duplex, 75, self-oiler.
1 35-light Westinghouse, self-oiler.
1 36-light Bernard, self-oiler.
1 50-light Hawkeye, self-oiler.
1 50-light Bain, self-oiler.
1 50-light Card, self-oiler.
2 90-light Westinghouse.
1 160-light Rockford.
1 200-light Howard.
1 250-light Commercial, comp., self-oiler.
1 260-light National, comp., self-oiler.
1 270-light T.-H., comp., self-oiler.
1 300-light Eickmeyer.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp. wound.
1 350-light National, self-oiler, compound.
1 350-light Edison, 20 K. W., self-oiler.
1 360-light Rockford, self-oiler, compound.
1 450-light Edison, 25 K. W., self-oiler.
1 400-light Wood, M. P., self-oiler.
1 450-light Rockford, self-oiler.
1 540-light Edison, 30 K. W., oil cup.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 540-light Westinghouse, 8-pole, slow-speed, 30 K. W., self-oiler, new.
1 600-light E. & C., slow speed, M. P., self-oiler, compound.
1 600-light Eickmeyer.
2 700-light Siemens & Halske, 40 K. W., M. P., slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
1 800-light Rockford, self-oiler, new arm't.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., for direct connection.

BOOSTER SET.

1 Siemens & Halske, multipolar ironclad type booster set, for raising 275 amperes, 26 volts or less; motor, 90 amperes, 110 volts; generator, 275 amperes, 26 volts.

500-Volt Generators.

1 45 K. W. Edison, compound, self-oiler.
1 150 K. W. Detroit, M. P., compound, self-oiler.

DIRECT-CONNECTED RAILWAY GENERATORS.

1 100 H. P., 500-volt Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x21x14, all complete, fine.

GREGORY ELECTRIC CO.

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--FOR SALE--

Alternating Generators.

1 350-light Thomson-Houston, A. 18.
1 600-light Bain, 30 K. W., self-oiler, new toothed armature.
1 600-light Thomson-Houston, A. 6, 30 K. W.
1 600-light Thomson-Houston, 30 K. W., two-phase, 1100 volts.
2 650-light Thomson-Houston, A. 35, s. o.
2 750-light Westinghouse, 37½ K. W.
1 900-light 60-cycle Westinghouse, 45 K. W., self-oiler, toothed armature, compound wound.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed armature.
1 1400-light Westinghouse, 70 K. W.
2 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oilers, outboard bearings.
1 6000-light Westinghouse, 300 K. W., 2200 volts, toothed armature, composite wound, self-oiler, outboard bearings.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 25-light 2000 C. P. T.-H.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, self-oilers.
4 45-light 1200 C. P. T.-H., M. 12.
4 45-light 1200 C. P. Brush, No. 7.
1 60-light 2000 C. P. Excelsior, latest type.
2 60-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. Western Electric, self-oiler.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. Western Electric, self-oilers.
1 60-light 2000 C. P. Westinghouse.
3 60-light 2000 C. P. Wood, No. 8.

Arc Dynamos.—Continued.

3 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Standard.
1 75-light 2000 C. P. Westinghouse.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

110-Volt Motors.

2 1 H. P. Roth, self-oilers.
1 2 H. P. Duplex, self-oiler.
1 2 H. P. Westinghouse, self-oiler.
1 3 H. P. Jenney, self-oiler.
1 3 H. P. Card, self-oiler.
2 7½ H. P. Westinghouse.
1 12 H. P. Rockford.
1 18 H. P. National, self-oiler.
1 18 H. P. Commercial, self-oiler.
1 18 H. P. T.-H., self-oiler.
1 18 H. P. Siemens & Halske, M. P., self-oiler.
1 20 H. P. Eickmeyer.
1 24 H. P. Eddy, self-oiler.
1 25 H. P. Rockford.
2 30 H. P. Edison, 25 K. W., self-oilers.
1 25 H. P. National, self-oiler.
4 25 H. P. Edison, 20 K. W., self-oilers.
1 30 H. P. Rockford.
7 35 H. P. Edison, self-oilers.
1 35 H. P. Westinghouse, 8-pole, slow speed, 30 K. W., self-oiler, new.

220-Volt Motors.

2 1 H. P. Eddy, self-oilers.
1 1 H. P. Edison, ¾ K. W., self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 1¼ H. P. Lundell, slow speed, self-oiler.
1 3 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 3 H. P. General Electric, type I. B., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 5 H. P. Akron, self-oiler.

220-Volt Motors.—Continued.

1 5 H. P. Eddy, plug type, M. P.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
2 7½ H. P. Eddy, self-oilers.
1 7½ H. P. Edison, self-oiler.
1 12 H. P. T.-H., self-oiler.
1 16 H. P. Crocker-Wheeler elevator motor, with controller.
1 50 H. P. Northern, M. P., self-oiler.
1 60 H. P. Edison, self-oiler, 45 K. W.

500-Volt Motors.

2 1 H. P. Jenney, self-oilers.
3 1 H. P. Crocker-Wheeler, self-oilers, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 2½ H. P. Wood, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Thomson-Houston.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 5 H. P. D. & D.
1 6 H. P. T.-H., 5 K. W.
1 7½ H. P. Jones, self-oiler.
1 7½ H. P. Thomson-Houston.
1 10 H. P. Eddy, self-oiler, M. P.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow speed.
1 18 H. P. T.-H.
2 18 H. P. C. & C., self-oilers.
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 25 H. P. Edison, new armature.
1 30 H. P. Commercial, self-oiler.
1 30 H. P. T.-H., self-oiler.
1 30 H. P. Edison, 25 K. W., self-oiler.

Alternating-Current Motors.

SINGLE PHASE.

1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125-cycle, self-oilers, single-phase.
2 5 H. P. Wagner, single-phase, 60-cycle, 200 volts.

Alternating-Current Motors.

MULTIPHASE.

2 1 H. P. Westinghouse, self-oilers, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 3-phase, type 8-10-900, Form A, 60-cycle, 110 volts.

Arc Motors.

1 ½ H. P. Excelsior, 9.6 amp.
1 1 H. P. Excelsior, 9.6 amp.
1 2 H. P. Excelsior, 9.6 amp.

Special Bargain: One 75 K. W., 500 V., direct-connected Westinghouse Kodak Set.

LARGE STOCK OF TRANSFORMERS, METERS AND ARC LAMPS.

NOTICE.—All machines are actually in stock ready for prompt delivery. All machines are guaranteed. Write for particulars and send for MONTHLY BARGAIN SHEET with net cash price.

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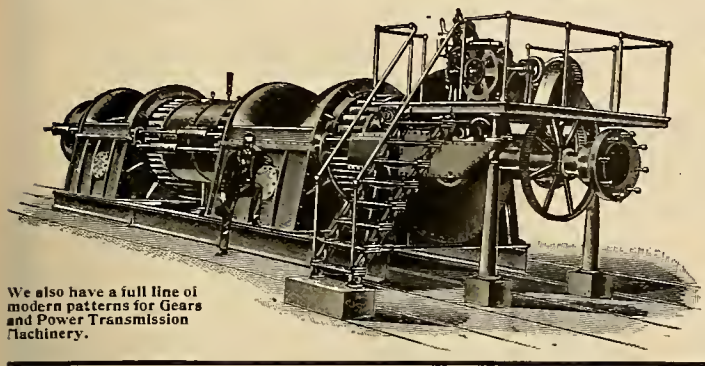

We also have a full line of modern patterns for Gears and Power Transmission Machinery.

That there are more Victor Turbines in use supplying power for electric generators than any other is due to the many points of superiority possessed by this Turbine.

FEATURES WORTH REMEMBERING:

High Speed, Close Regulation,
Great Capacity, High Efficiency,
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3—M. P. 100 G. E. 500-Volt Railway Generators.
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1—300-Amp. U. S. Dynamo, 125 Volts.
1—400-Lt. National Bipolar Dynamo, 125 Volts.
2—50-Lt. Excelsior Arc Dynamos.
2—100-Lt. Excelsior Arc Dynamos.
1—100-Lt. Western Electric Arc Dynamo.
600—Ft. Wayne Wood, Western Electric, Excelsior, Helios and A-B Arc Lamps.
1—16x27x16 Westinghouse Compound Engine, 300 h. p.
1—13½x12 Westinghouse Standard Engine, 125h.p.
1—8½x8 Westinghouse Standard Engine, 40 h. p.
1—16x16 Ideal Simple Engine, 175 h. p.
2—66x18 Tubular Boilers, with Hawley Down Draft.
1—200-h. p. Hoppes Exhaust Heater.
1—5½x3x5 Worthington Duplex Pump.
2—10-h. p. 220-Volt Eddy Bipolar Motors, good as new.

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This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Cut-Outs
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A new Wabash morning train for Detroit now leaves Chicago at 9:25 a. m. and arrives Detroit 6:30 p. m. Through cars. Other trains for Detroit via the Wabash leave Chicago at 12:40 noon, 3:15 p. m. and 11:00 p. m.

Machinery and Supplies at Bargain Prices.

We have the largest establishment of its kind on earth. Our plant and yards cover over a million feet of space. We are constantly buying factories and buildings. **We purchased the Omaha Exposition, the World's Fair, the Chicago Postoffice Buildings, etc., etc.** Our facilities for rebuilding machinery are unsurpassed. We furnish a binding guarantee with all goods purchased. Our stock is constantly being added to. Get our prices on the following:

One 25-light, 2,000 c. p Westinghouse low-tension arc dynamo.
Two 50-light Standard arc dynamos.
One 20-light Sperry arc dynamo.
One 500-light, 100-volt Edison dynamo.
One 1,000-light 1000-volt Wood Ft. Wayne alternating dynamo, complete with switchboard and exciter.
One 1,000-light, 1,000-volt Westinghouse dynamo, complete with switchboard and exciter.
One 1,200-light Slattery alternating dynamo.
One portable Weston ammeter, reading from 0 to 150.
Two Thompson alternating ammeters, reading from 0 to 100.
Fifty 10, 20, 40 and 80 ampere Westinghouse house meters.
200 series arc lamps, different makes.
Rubber-covered, weatherproof and bare copper wire.
5,000 assorted sizes clear and opal arc globes

OUR CATALOG NO. 156 IS AN EDUCATOR. ASK FOR IT SURE. Write to-day.

One 18x42 Frick Corliss engine.
One 20x32 Watertown automatic engine.
One 18x28 Watertown automatic engine.
One 12x20x14 Ball compound engine.
One 9½x16x14 Payne compound engine.
One Armington & Sims cross-compound condensing engine, 30x20x15.
One 15x14 Ideal automatic engine.
One 14½x13 Armington & Sims automatic engine.
One 12x21 Buckeye automatic engine.
One 12x12 Armington & Sims automatic engine.
One 12x12 Ideal automatic engine.
One 250 h. p. Baragwanath feed-water heater.
One Stilwell-Bierce live steam heater and purifier.
One 150 h. p. Berryman heater.
One 125 h. p. Baragwanath heater.
One 500 h. p. Hanover independent condenser.
Two 72x16 horizontal tubular boilers.
One 60x18 horizontal tubular boiler.
Two 60x16 horizontal tubular boilers.
Five 54x16 horizontal tubular boilers.
Two 54x14 horizontal tubular boilers.
Two 48x16 horizontal tubular boilers.
Two 48x14 horizontal tubular boilers.
Ten Hill friction-clutch pulleys, 52x22x6 in. bore, double arm, double crown, double belt.

3 Thompson recording wattmeters, 10 ampere.
2 Thompson recording wattmeters, 15 ampere.
2 Thompson recording wattmeters, 25 ampere.
1 12x24 engine made by Zeahm Bros.
1 20x22 Corliss engine.
1 9x12 center crank engine.
1 12x12 center crank engine.
1 7x10 slide valve center crank.
1 3x5 upright engine.
1 80 H.-P. A. B. Farquahar Co. engine.
1 horizontal pattern Lansing engine, 12-in. stroke.
1 10x18 stationary engine.
1 12x20 Sinker & Davis engine.
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1 25 H.-P. Portable engine and boiler.
1 Atlas automatic engine, 9x14.
1 New York safety engine, 9x10.
1 30 H.-P. stationary engine.
1 40 H.-P. steel tubular boiler, 44x14.
1 9x14 Atlas automatic engine.

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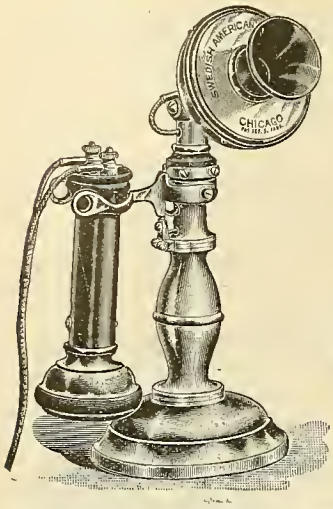

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Adjustable Head, Platinum Contacts, Auxiliary Springs in Receiver and Transmitter, Silk Cords.

Material Used, Workmanship, Fine Finish and Results Considered make it the Cheapest and the Best.

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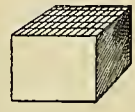
WOUND BY MACHINERY.

HERE'S THE OBJECT LESSON— A PLAIN FACT



These 28 spools containing 91 lbs. of No. 36 single silk-covered wire will cost you $243 net at 50, 10, 10, 5 off list; and there is sufficient wire on these 28 spools to wind 1,000 500-ohm bridging-bell magnets. Your winding labor will cost you at least 85 additional, making a total cost of your own 1,000 magnets finished at factory, $328.

The above box contains 1,000 "Duplex" magnet windings. Each winding is made up of No. 36 wire, 500 ohms per winding, and each winding has 12 per cent. more turns than there are in the ordinary wound magnet. Price, $218.70 net. This is 10 per cent. less than your wire bill and we charge nothing for winding.

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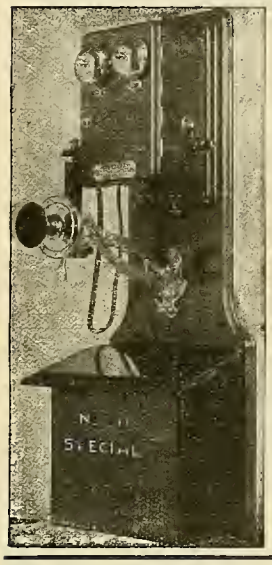
THE VARLEY DUPLEX MAGNET CO. DOES IT BY MACHINERY

1387 7TH ST. JERSEY CITY N.J. *WE CAN SAVE YOU CONSIDERABLE MONEY.*



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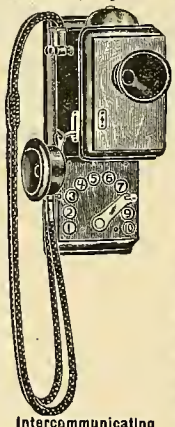

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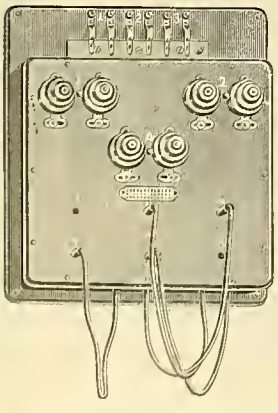

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In the Manufacture of

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NEW MANAGEMENT, AMPLE CAPITAL, LARGE FACILITIES, RELIABLE PRODUCTS, RIGHT PRICES.

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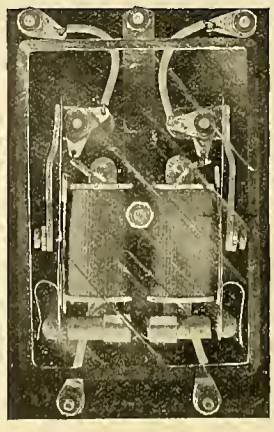

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No fuse to burn out, line is never open, service never interrupted; it works automatically, is guaranteed not to burn out, requires no attention whatever after being installed.

It has less resistance than any other arrester, resistance being less than one ohm.

The working parts are mounted on porcelain base and are ornamental in appearance.

We put them up single for individual 'phones, and in cabinets for exchange use; the cabinets require but small floor space.

Protection without annoyance is what you want; try this device on some of your toll or worst lines and see for yourself what it will do.

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Butler-Taylor Co.,

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Our new No. 1900 Telephones, with Disc-Carbon Lightning Arrester, for **Series** and **Bridging** work, are by far the Best Type of Telephones on the Market. Try them.

TELEPHONE APPARATUS of all Kinds Manufactured.

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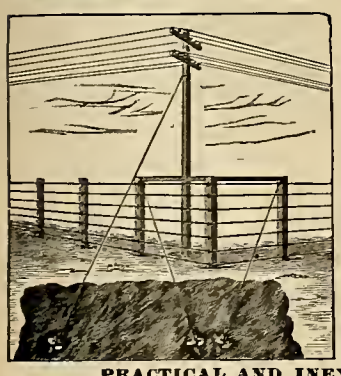

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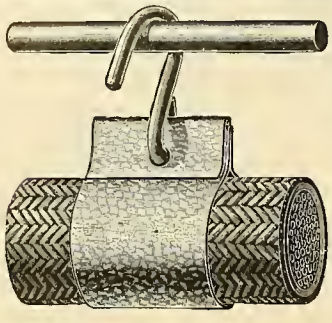

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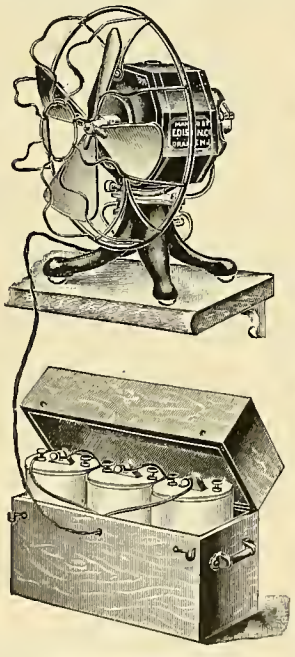

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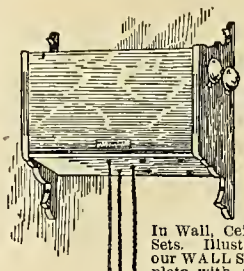

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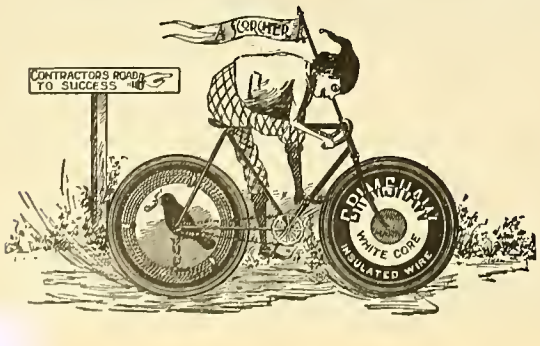

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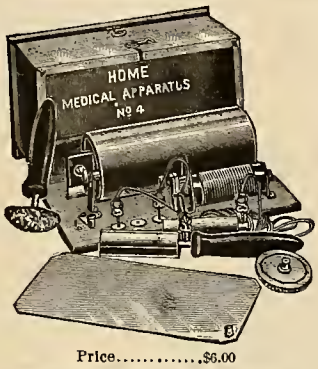

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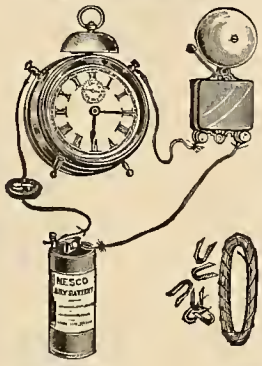

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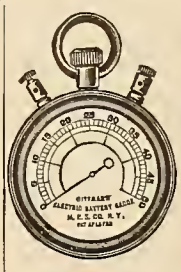

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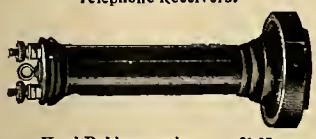

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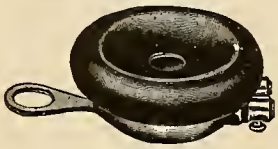

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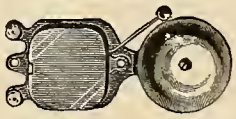

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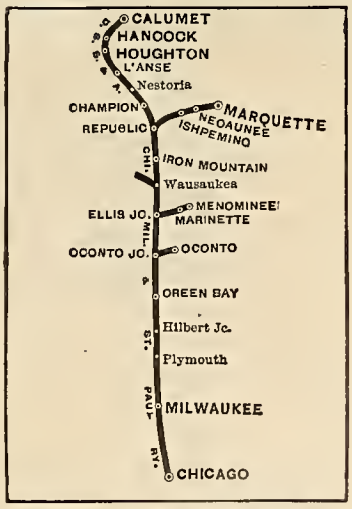

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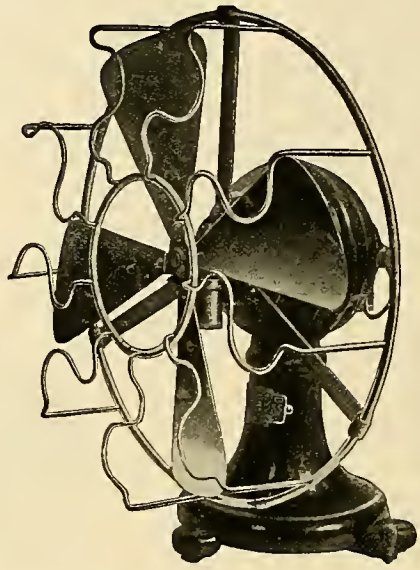

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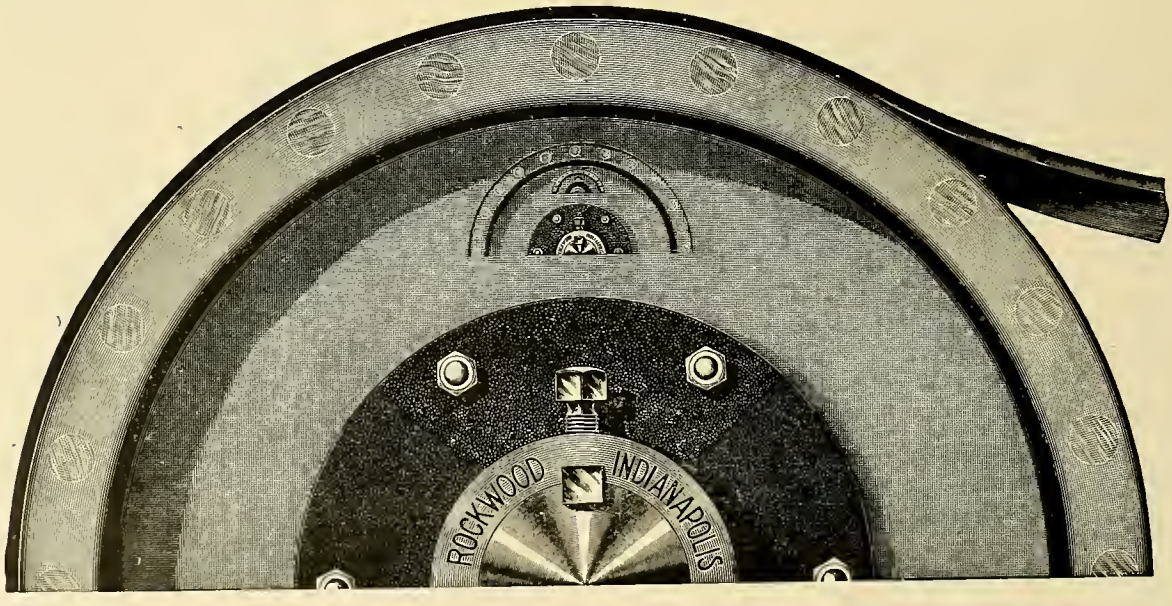

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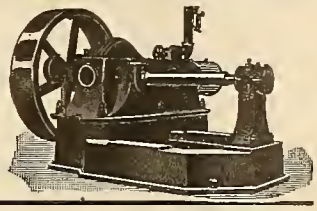

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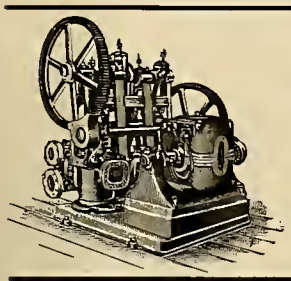

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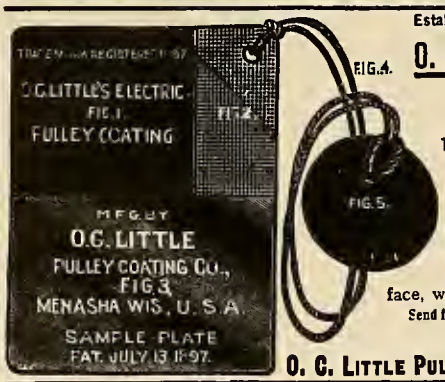

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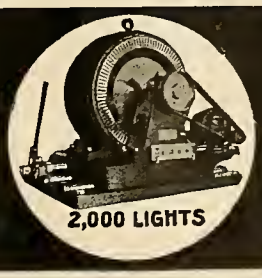

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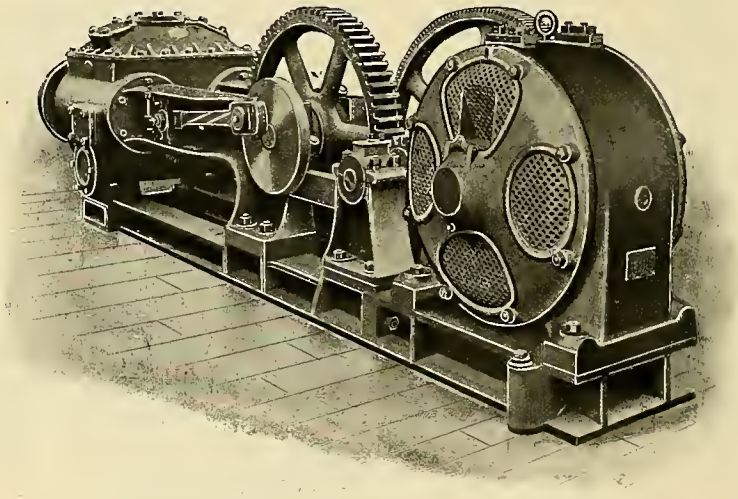

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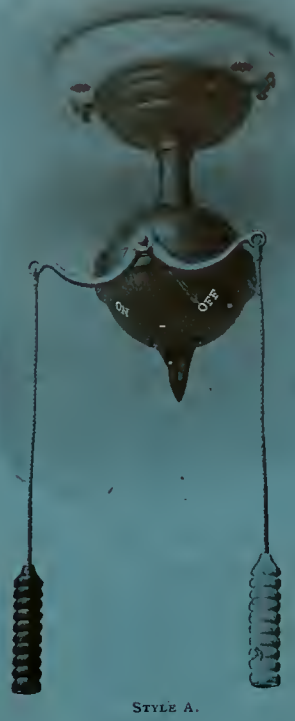

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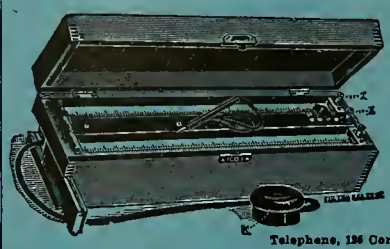

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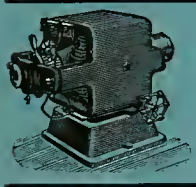

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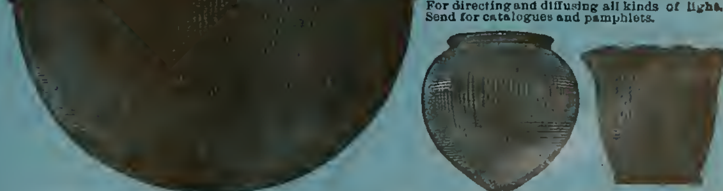

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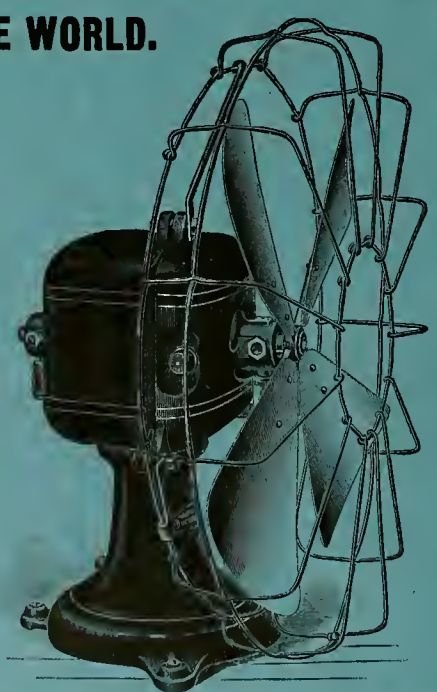

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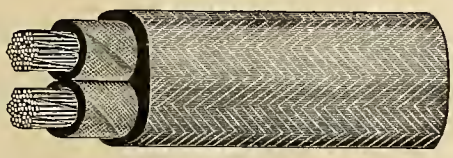

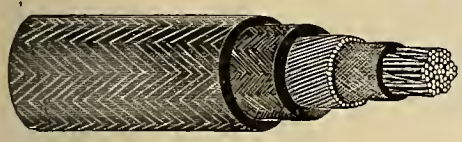

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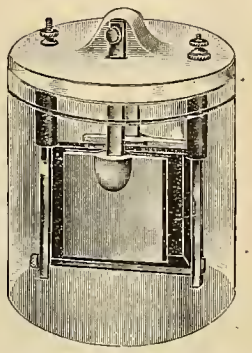

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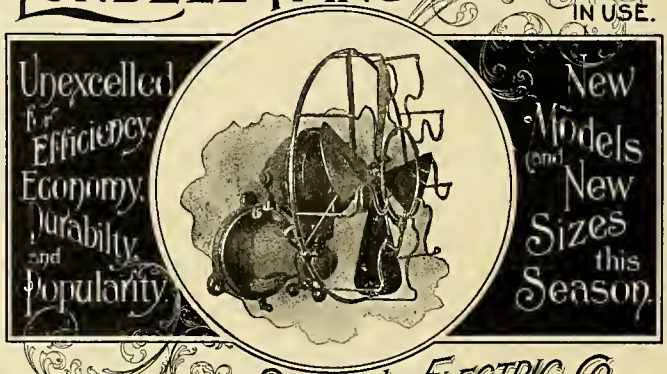

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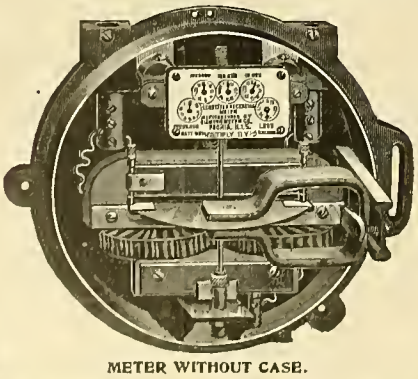

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Accurate on All Loads.
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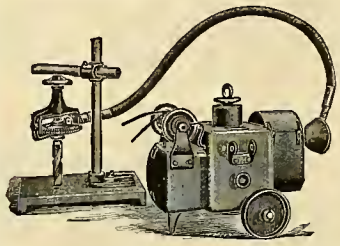

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Johnston, Thomas J.
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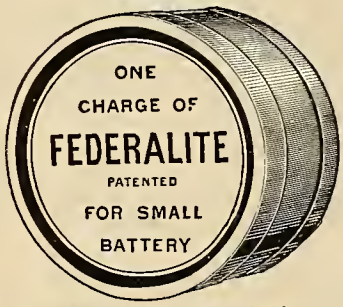

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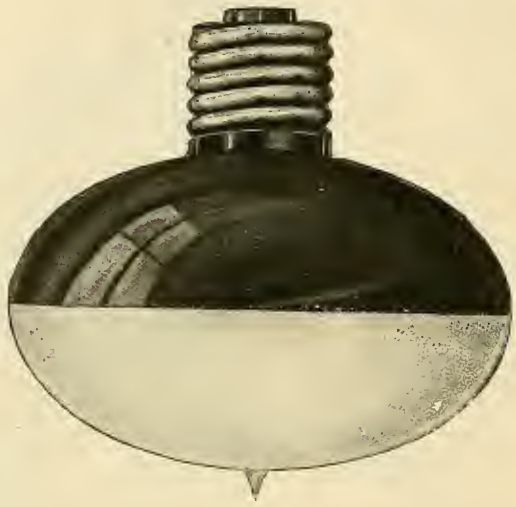

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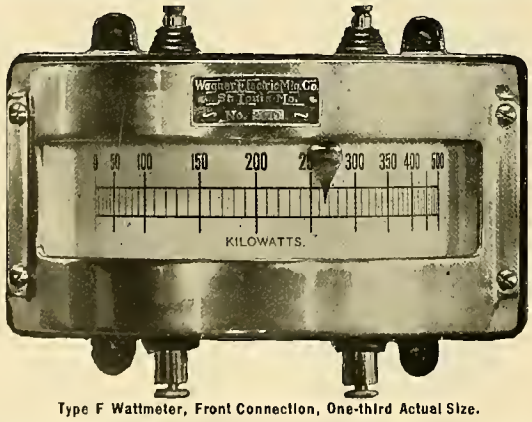

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5 " 18 "	1,048	8 " 30 "	120	7 " 55 "	124
6 " 18 "	398	6 " 35 "	1,000	8 " 55 "	1
4 " 20 "	4,481	8 " 35 "	147	6 " 60 "	13
5 " 20 "	3,474	6 " 40 "	300	7 " 60 "	36
6 " 20 "	1,234	7 " 40 "	1,000	8 " 60 "	1
7 " 20 "	127	8 " 40 "	44	6 " 65 "	3
4 " 25 "	7,050	6 " 45 "	343	7 " 65 "	5
5 " 25 "	6,000	7 " 50 "	200	7 " 70 "	1
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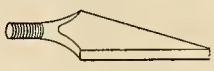

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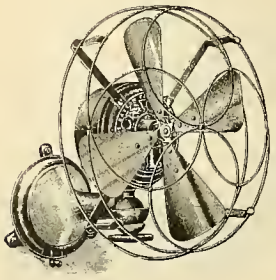

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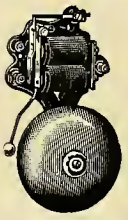

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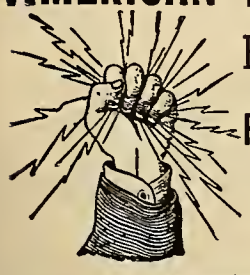

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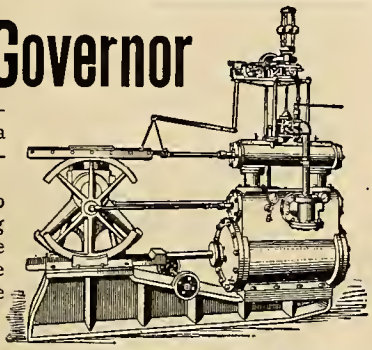

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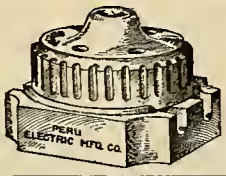

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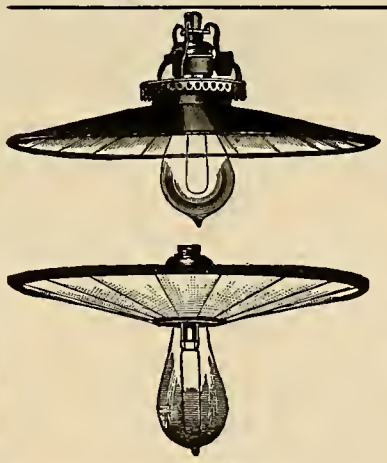

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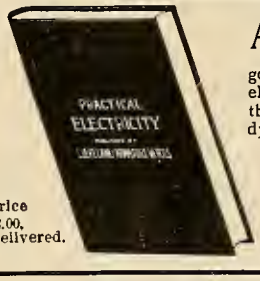

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1 160-light Rockford.
1 210-light Triumph, self-oiler.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp., self-oiler.
1 250-light Siemens & Halske, 15 K. W., multipolar.
1 260-light National, compound, self-oiler.
1 270-light T.-H., comp., self-oiler.
3 270-light Westinghouse, M. P., slow speed.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp. wound.
1 350-light National, self-oiler, compound.
1 360-light Rockford, self-oiler, compound.
1 350-light Edison, 20 K. W., shunt.
3 350-light Edison, 20 K. W., self-oilers.
1 350-light Edison, 20 K. W., self-oiler, compound.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
1 540-light Edison, 30 K. W.
4 540-light Edison, 30 K. W., self-oilers.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Eickmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers.
1 800-light Rockford, self-oiler, new arm't.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., direct connected to 125 H. P., self-oiling, 14x14 engine.

220-Volt Generators.

1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 12 K. W. Westinghouse, multipolar, self oiler.
1 25 K. W. Edison, self-oiler.
1 25 K. W. E. & C., multipolar, slow speed.
1 45 K. W. Edison, self-oiler, new arm't, compound.
1 50 K. W. Westinghouse, self-oiler, horizontal type, compound.
1 200 K. W. Crocker-Wheeler, multipolar, slow speed, practically new.

GREGORY ELECTRIC CO.
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500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.
1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
1 45 K. W. Edison, compound, self-oiler.
1 150 K. W. Detroit (Rae), multipolar, compound, self-oiler.
1 100 H. P. 500-volt Westinghouse, Kodak set generator and comp. engine.

Alternating Generators.

1 350-light Thomson-Houston, A. 48, comp.
1 600-light Bain, 30 K. W., self-oiler, toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
1 650-light Thomson-Houston, A. 35, s. o., composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp.
1 1200-light Westinghouse, 60 K. W., self-oiler, compound, toothed arm't.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
2 1400-light Westinghouse, 70 K. W., brand new.
2 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oilers, outboard bearings.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 25-light 2000 C. P. T.-H., ball armature.
1 25-light 2000 C. P. T.-H., ring armature.
1 30-light 2000 C. P. Western Electric.

Arc Dynamos.—Continued.

1 30-light 2000 C. P. Brush, No. 7, Steubenrausch commutator.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
4 45-light 1200 C. P. T.-H., M. 12, ball arnt.
1 45-light 1200 C. P. T.-H., M. 12, ring arnt.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 2000 C. P. Excelsior, latest type, newly rewound field and armature.
2 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 1200 C. P. T.-H., L. D., 12, new ring arm't, self-oiler.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. West. Elec., self-oiler.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse, self-oiler.
3 60-light 2000 C. P. Wood, No. 8.
3 65-light 2000 C. P. Brush, No. 8, new armature, Steubenrausch commutators.
1 75-light 1200 C. P. Standard, self-oiler, air insulated commutator.
2 75-light 2000 C. P. Westingh'se, self-oilers.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

110-Volt Motors.

1 ¼ H. P. Sprague.
1 ¼ H. P. Elbridge.
1 ½ H. P. Roth.
1 ½ H. P. Keller, self-oiler.
2 1 H. P. Belding, M. P.
1 1 H. P. Roth, self-oiler, new armature.
2 1 H. P. Edison, ¾ K. W., self-oilers.
1 1 H. P. Lundell, self-oiler.
1 1½ H. P. C. & C., self-oiler.
1 2 H. P. Bernard, self-oiler.
1 3 H. P. Hawkeye.
1 3 H. P. Westinghouse.
1 3 H. P. Jenney, self-oiler.

110 Volt Motors.—Continued.

1 3 H. P. Bain, self-oiler.
1 3 H. P. Nowotny, self-oiler.
1 5 H. P. Wood.
1 3 H. P. Card, self-oiler, Manchester type.
1 3 H. P. C. & C., self-oiler.

220-Volt Motors.

1 1 H. P. Eddy, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P.
1 3 H. P. Kester, self-oiler.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 15 H. P. Westinghouse, multipolar, self-oiler, 15 K. W.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 40 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 60 H. P. Edison, self-oiler, 45 K. W.
1 60 H. P. Westinghouse, horizontal type, self-oiler.
1 75 H. P. Sprague, self-oiler, new arm't.

500-Volt Motors.

2 1 H. P. Crocker-Wheeler, self-oilers, slow speed.
1 1 H. P. C. & C., self-oiler.
1 2½ H. P. Wood, self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 5 H. P. D. & D.
1 7½ H. P. Edison, self-oiler.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
2 18 H. P. C. & C., self-oilers.
1 20 H. P. Commercial, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

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1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
1 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oiler, single-phase.
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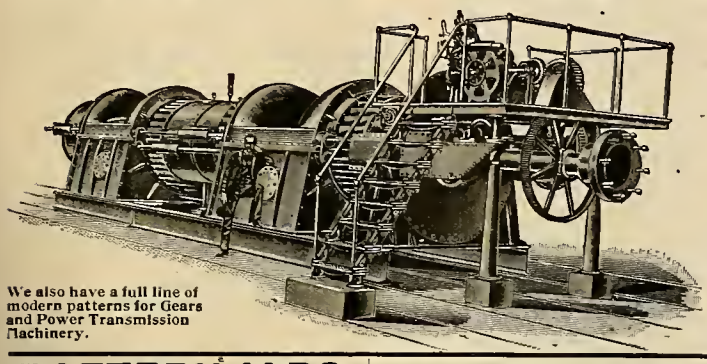

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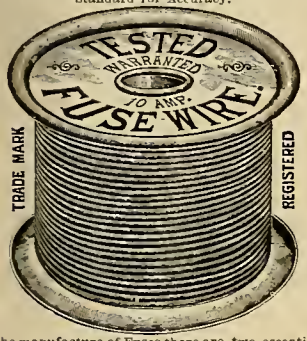

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One Ft. Wayne Wood, 35-light, 1,200 c. p.
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One T.-H. m.p. 75, 500 r., 75 k.w.
One Edison b.p. 500 r., 100 k.w.

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One Diehl, ⅛ h. p.
One Edison, ¾ h. p.
One Elhridge, ¾ h. p.
One Card, 1 h. p.
One Sprague, 1 h. p.
One Nowotny, 3 h. p.
One Daft, 10 h. p.
One U. S., 20 h. p.
One Q. C., 28 h. p.

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One Nowotny, 1 h. p., new.
One Nowotny, 1 h. p.
One Davis, 5 h. p.
One Daft, 10 h. p.
One E. R. & C. C., 10 h. p.
One Edison b. p., 15 h. p.

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One Davis, 20 h. p.
One Brush, 25 h. p.
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One No. 1 Russell high-speed auto. engine, 7x16.
One 60 arc light Wood dynamo, 2,000 c. p.
One 620-light General Electric dynamo with 52-volt exciter.
38 assorted Transformers.
One Station Transformer and Ground Tester with three miles of Nos. 4 and 6 Weatherproof Wire.
One Westinghouse Alternator and Fan Motor, 16,000 alt., 100 volts.
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One D. 62 T.-H. 500-volt Railway Generator.
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One 15x14 Ideal engine.
One 14x14 Ideal engine.
One 12x18 Lansing engine.
One 25-light, 2,000 c. p. Westinghouse low-tension arc dynamo.
Two 50-light Standard arc dynamos.
One 20-light Sperry arc dynamo.
One 500-light, 100-volt Edison dynamo.
One 1,000-light 1,000-volt Wood Ft. Wayne alternating dynamo, complete with switchboard and exciter.
One 1,000-light, 1,000-volt Westinghouse dynamo, complete with switchboard and exciter.
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One 15x14 Ideal automatic engine.
One 14½x13 Armington & Sims auto. engine.
One 12x21 Buckeye automatic engine.
One 12x12 Armington & Sims automatic engine.
One 12x12 Ideal automatic engine.
One 250 h. p. Baragwanath feed-water heater.
One Stilwell-Bierce live steam heater and purifier.
One 150 h. p. Berryman heater.
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One 60x18 horizontal tubular boiler.
Two 60x16 horizontal tubular boilers.
Five 54x16 horizontal tubular boilers.
Two 54x14 horizontal tubular boilers.
Two 48x16 horizontal tubular boilers.
Two 48x14 horizontal tubular boilers.
Ten Hill friction-clutch pulleys, 52x22x6 inch bore, double arm, double crown, double belt.
3 Thompson recording wattmeters, 10 ampere.
2 Thompson recording wattmeters, 15 ampere.
2 Thompson recording wattmeters, 25 ampere.
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1 12x12 center crank engine.
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1 3x5 upright engine.
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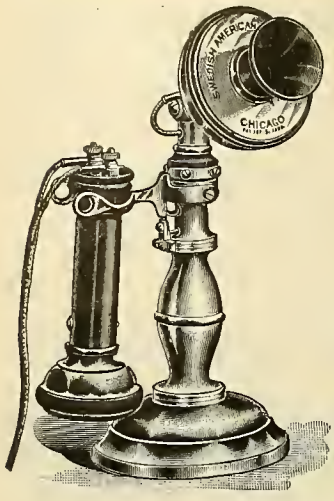

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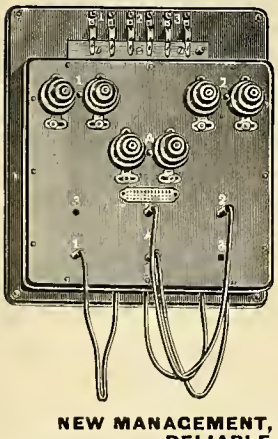

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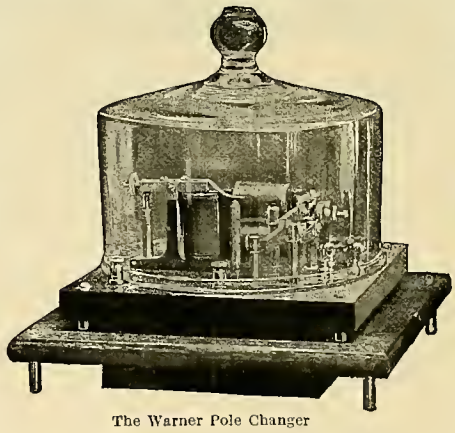

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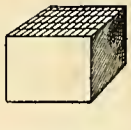

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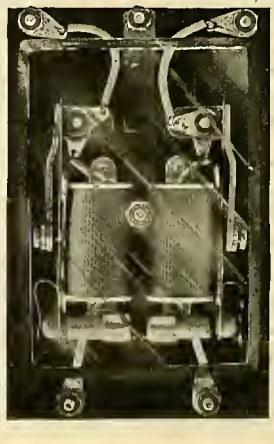

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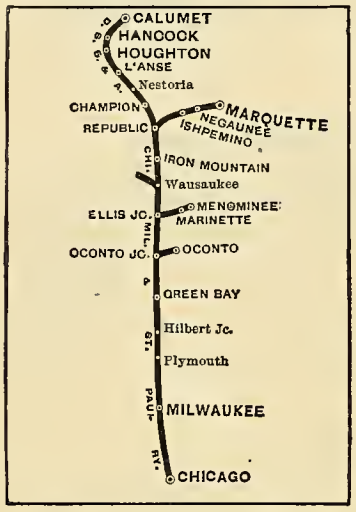

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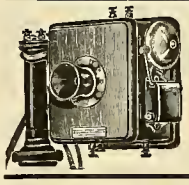

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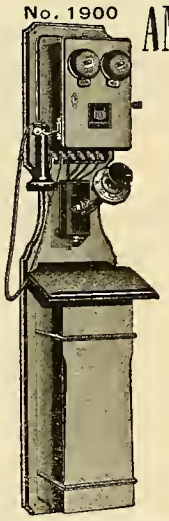

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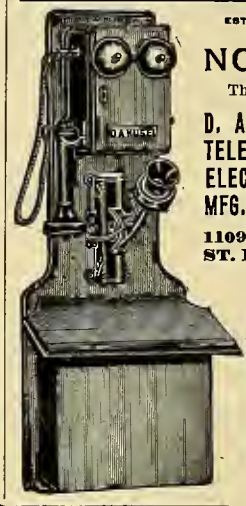

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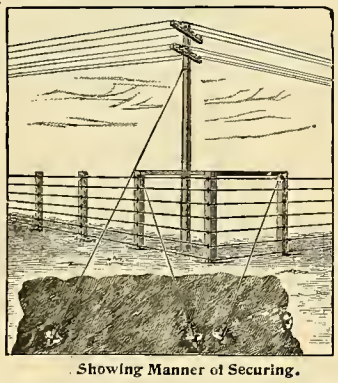

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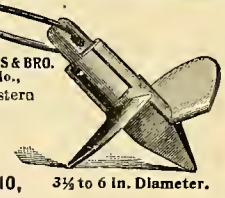

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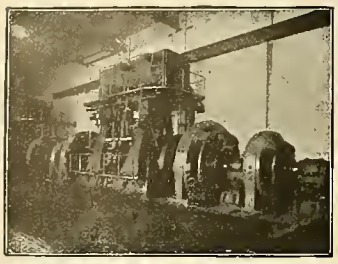

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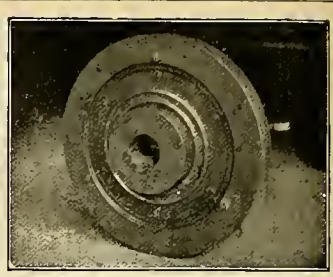

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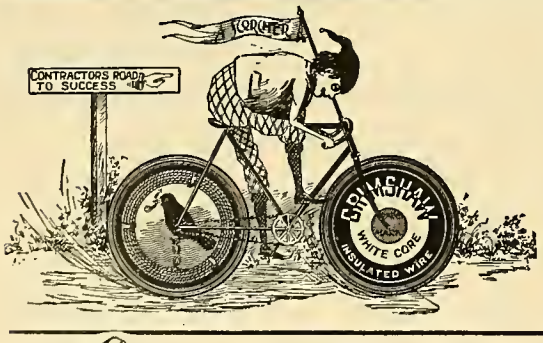

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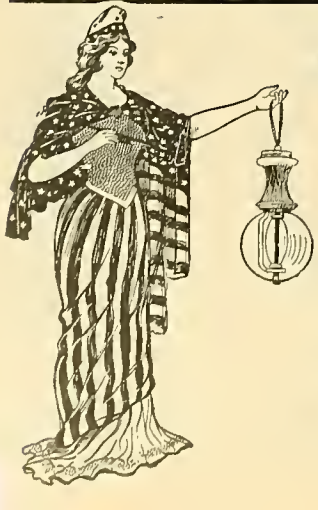

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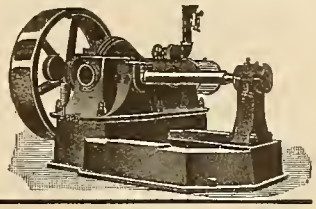

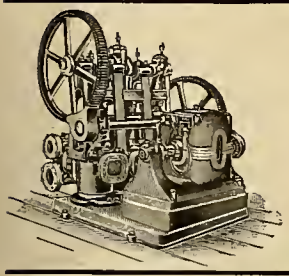

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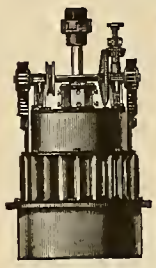

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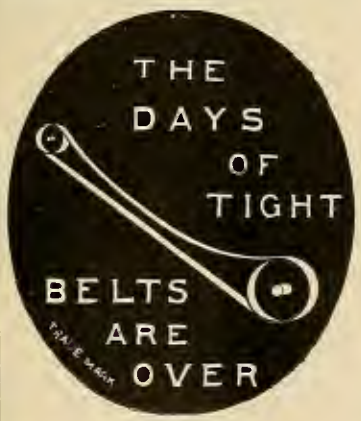

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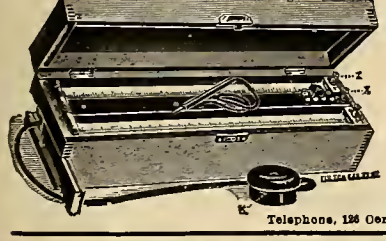

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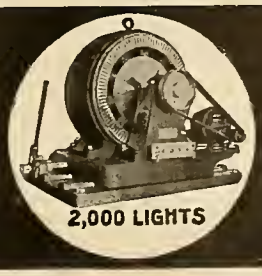

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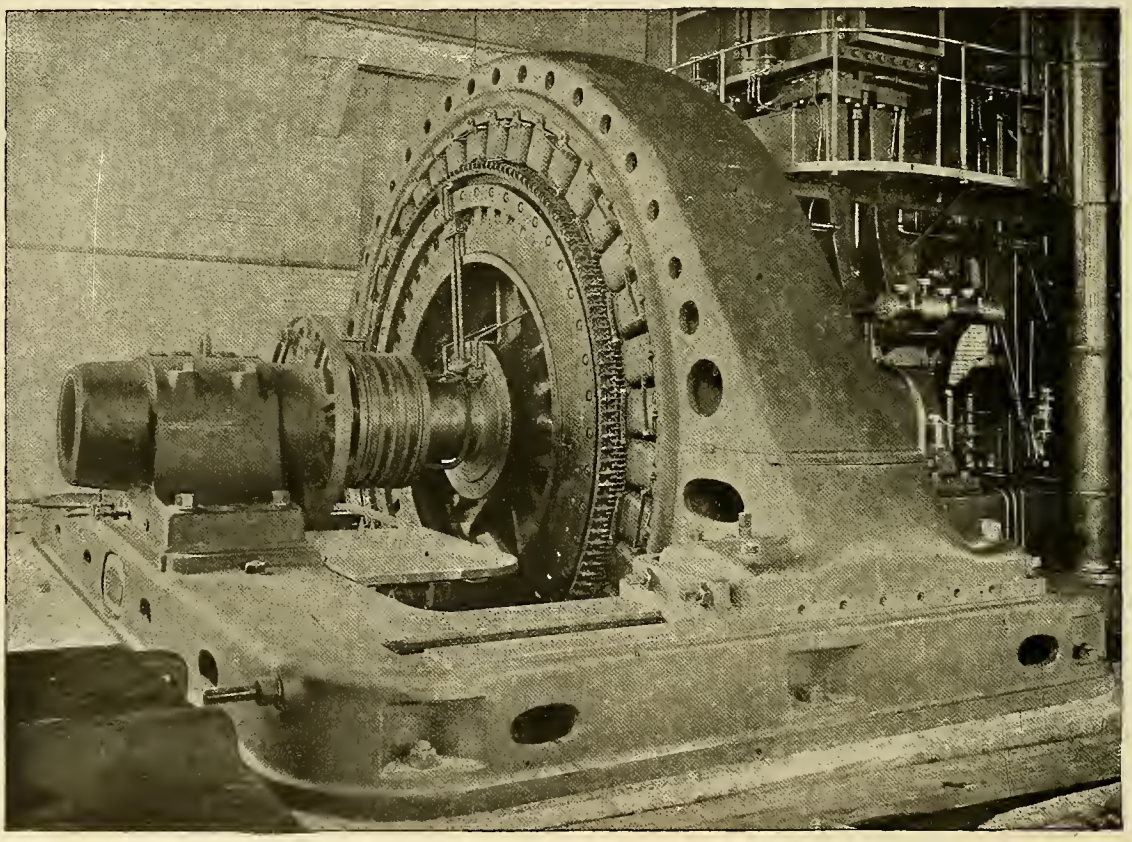

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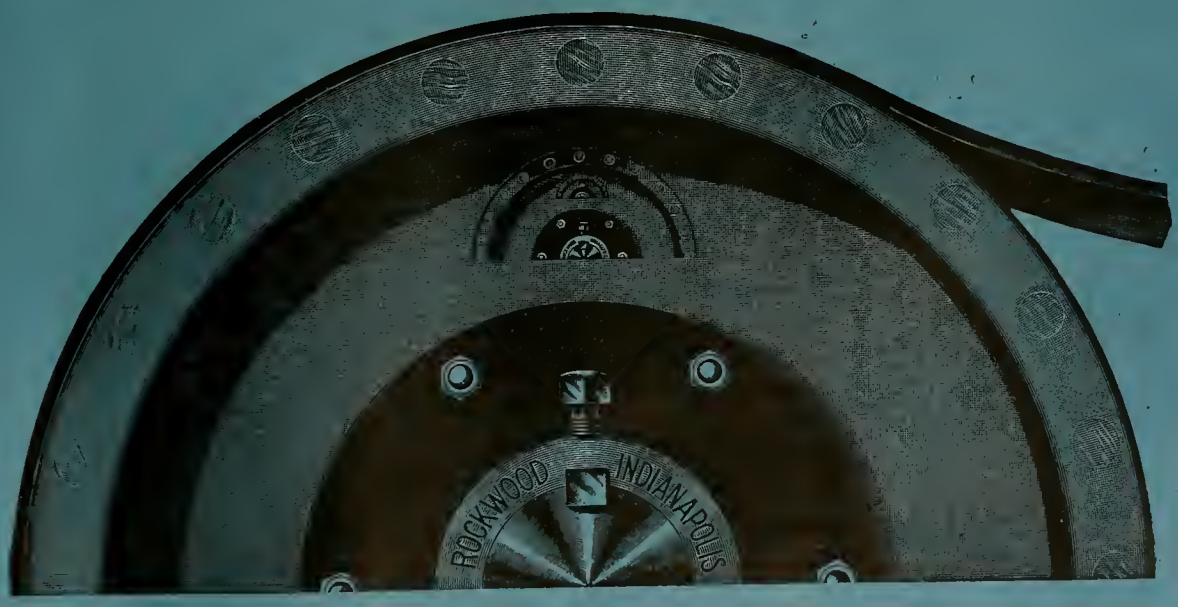

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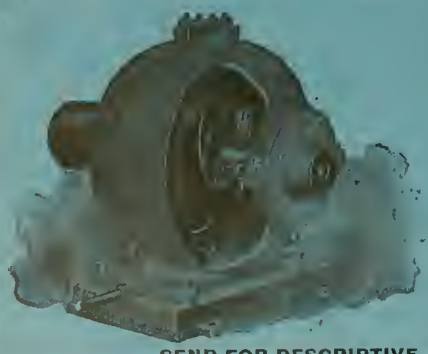

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Western Electrician

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Vol. XXVII. CHICAGO, JULY 28, 1900. No. 4

SIMPLEX INSULATED WIRES AND CABLES.
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WESTERN SELLING AGENT, H. R. HIXSON, ... CHICAGO.
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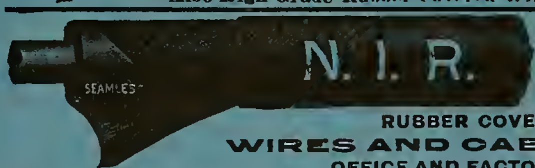

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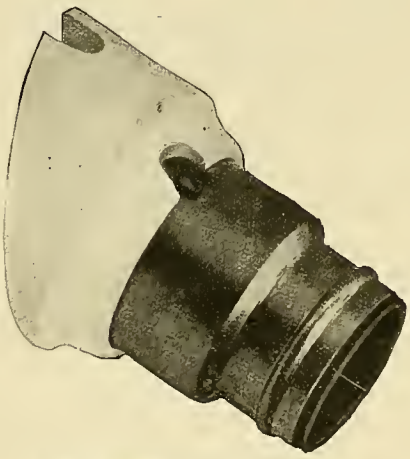
CHICAGO EDISON COMPANY, **FAN MOTORS**

139 ADAMS ST., CHICAGO.

THE GENERAL ELECTRIC COMPANY'S

A New Angle-Base Receptacle.



Key Catalogue No. 50753.
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Sockets and Receptacles

For Edison Base Lamps.

FULLY DESCRIBED IN CATALOGUE 7523. WRITE FOR ONE.

General Office: Schenectady, N. Y.

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There is No Higher-Class India-Rubber Insulation For Wires and Cables than

HABIRSHAW.

Authorized Manufacturers of the

ATTIX FLEXIBLE TUBE WIRE.

The India-Rubber and Gutta-Percha Insulating Co.,

MAIN OFFICE, Glenwood Works,

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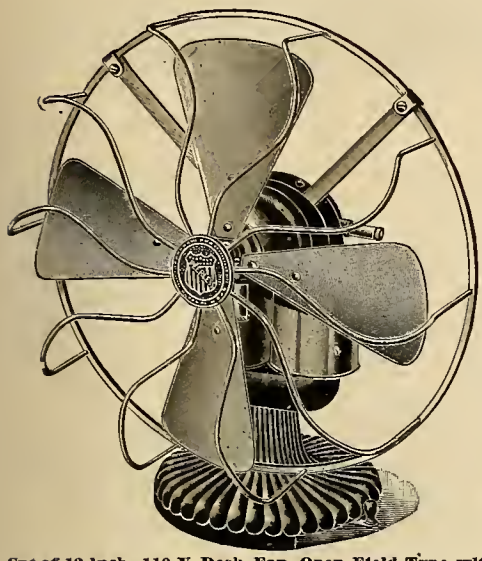
YONKERS, N. Y.

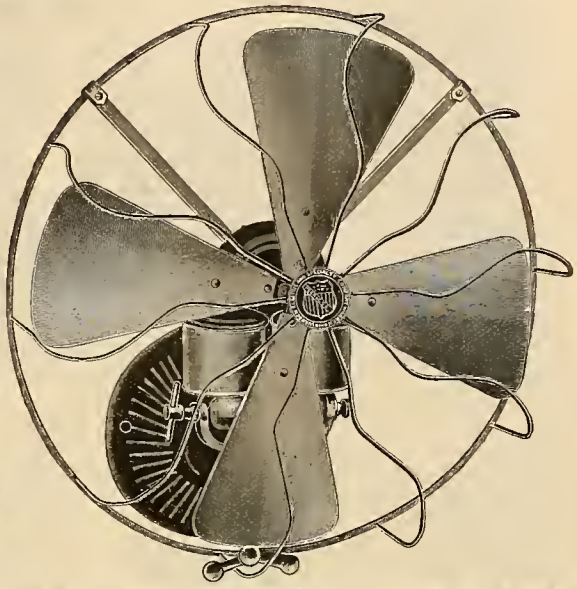
(10923)

PEERLESS

DIRECT-CURRENT DESK AND CEILING FANS.



Cut of 12-inch, 110-V. Desk Fan, Open Field Type with polished brass hoods and field coverings, the handsomest and most efficient Fan on the market.



Cut of 16-inch Wall Fan, same finish as 12-inch and having a swivel joint. By simply turning a handle this Fan can be adjusted to blow air up, down or on either side.

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7. The Devere Electric Co., 430 Plum St., Cincinnati, O.
8. Doubleday-Hill Electric Co., 535 Wood St., Pittsburg, Pa.
9. Julius Andrae & Sons Co., 225 W. Water St., Milwaukee, Wis.
10. H. S. Sands El. & Mfg. Co., 1153 Market Street, Wheeling, W. Va.
11. Electric Supply & Const. Co., 80 E. Gay St., Columbus, O.
12. Robert L. McGuat, 125 S. Meridian St., Indianapolis, Ind.
13. W. G. Nagel & Co., 510 Adams St., Toledo, O.
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Manufacturers PEERLESS Direct-Current Desk and Ceiling Fan Motors, Transformers, Incandescent Lamps.

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Insulate your Electrical Machinery with Electric Varnish and protect your line with the Wood Lightning Arrester. Then you are safe.

OKONITE IT NEVER DISAPPOINTS

THE WOOD LIGHTNING ARRESTER—Ready to use.

Took years of study.
Cost lots of money.
Well spent, though.
Good things are expensive.
Have good tools to work with.
Pays in the end.
Use no coils.
Simple, isn't it?

NON-INDUCTIVE.

MADE FOR VOLTAGES UP TO 600.

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GENERAL SELLING AGENTS,

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OKONITE IT NEVER DISAPPOINTS

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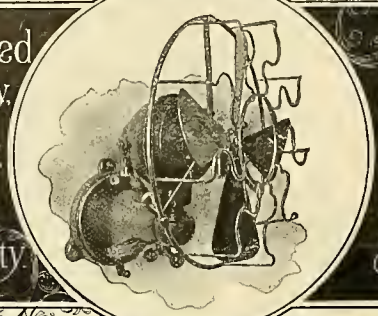
THOUSANDS IN USE.

Unexcelled for Efficiency, Economy, Durability and Popularity.



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INTERIOR UNDERGROUND CONDUIT AND ALL FITTINGS

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Western Elec. Supply Co.

Arc Lamps.
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Manhattan Elec. Supply Co.
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American Steel & Wire Co.
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Eastern Electric Cable Co.
General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
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Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
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Munsell & Co., Eugene.
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New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
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Sterling Varnish Co.
Vulcanized Fibre Co.
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American Electrical Works.
American Steel & Wire Co.
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Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Illinois Insulated Wire Co.
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India Rubber & Gutta Percha Insulating Co.
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National India Rubber Co.
New York Insulated Wire Co.
Northwestern Elec. Mfg. Co.
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Phillips, Eugene F.
Phillips Insulated Wire Co.
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Eureka Electric Co.
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Klein & Son, Mathias.

Magnet Wires.
(See Insulated Wires.)

Mechanical Machinery.
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Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

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General Electric Co.
Siemens & Halske Electric Co. of America.
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Motors — See Dynamos and Motors.

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Robertson & Sons, Jas. L.

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Bamlin, Geo. R.
Johnston, Thomas J.
Page & Durand.

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Phosphor Bronze Sm. Co., Ltd.

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Electric Appliance Co.
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Western Elec. Supply Co.

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Western Elec. Supply Co.

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Bunnell & Co., J. B.
Central Electric Co.
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Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
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Roebling's Sons Co., J. A.
Standard Underground C. Co.
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Noblett, E. J.

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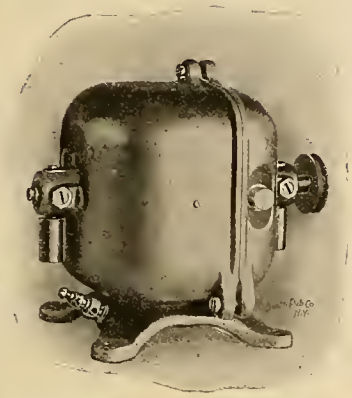
SMALL MOTORS FOR SEWING MACHINES AND SPECIAL PURPOSES.

Highly Efficient.
Durable and Serviceable.
Iron Clad Armature.



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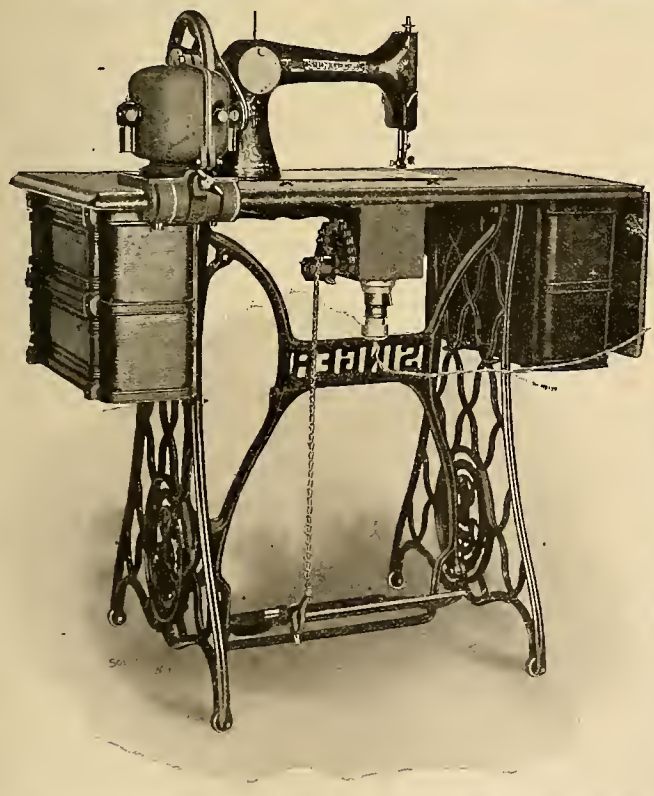

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HAVING A CONSTANT POWER FACTOR WITH ANY NUMBER OF LAMPS IN SERIES. NO REGULATOR REQUIRED.

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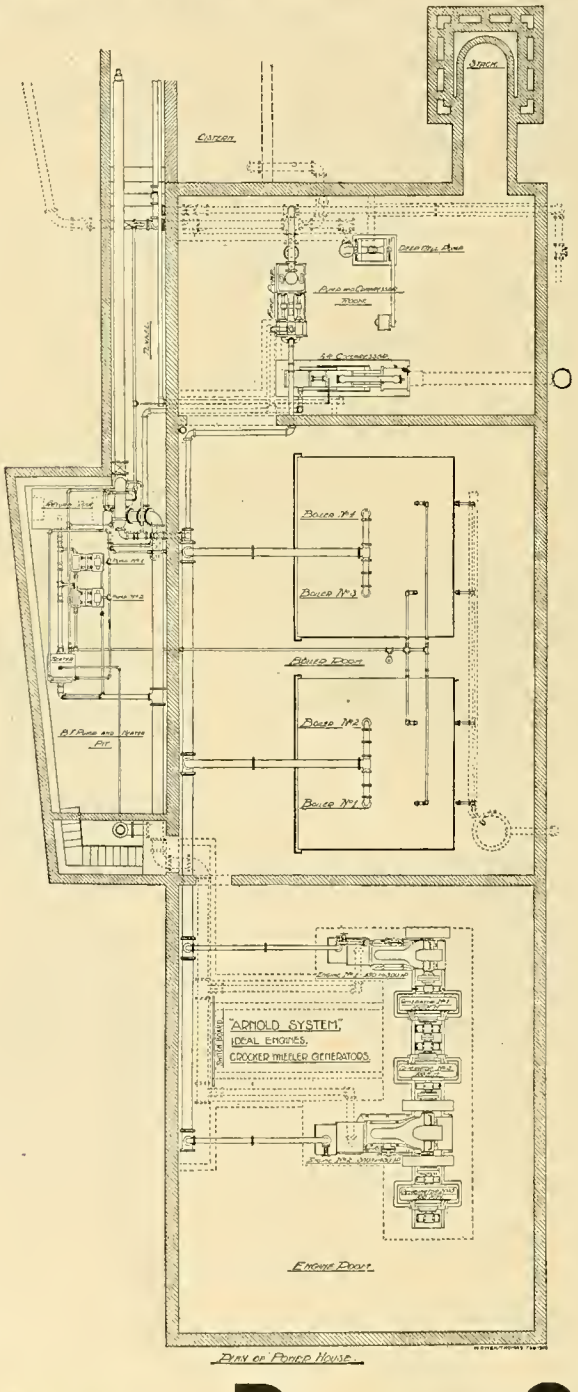
— 1898 — CHICAGO — 1899 —

WE DESIGN AND BUILD COMPLETE ELECTRIC POWER PROPERTIES.

WHAT WE HAVE DONE FOR OTHERS WE CAN DO FOR YOU.

WHEN WE BUILD A COMPLETE PLANT WE GUARANTEE ITS ECONOMY AS A WHOLE.



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WE FURNISH THE PARTS OF THE "ARNOLD SYSTEM" CONNECTING ANY MAKE OF ENGINES AND GENERATORS.

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4 inches, 18 feet	200	5 inches, 30 feet	1,534	6 inches, 55 feet	32
5 " 18 "	1,048	8 " 30 "	120	7 " 55 "	124
6 " 18 "	398	6 " 35 "	1,000	8 " 55 "	1
4 " 20 "	4,481	8 " 35 "	147	6 " 60 "	13
5 " 20 "	3,474	6 " 40 "	300	7 " 60 "	36
6 " 20 "	1,234	7 " 40 "	1,000	8 " 60 "	1
7 " 20 "	127	8 " 40 "	44	6 " 65 "	3
4 " 25 "	7,050	6 " 45 "	343	7 " 65 "	5
5 " 25 "	6,000	7 " 50 "	200	7 " 70 "	1
6 " 25 "	3,000	8 " 50 "	8		

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Seven factories in operation. Capacity, 60,000 per day. Write for prices on pin and bracket specialties

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Electricity, Mechanics,
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Delivered prices quoted, F. O. B. cars, your city, in any quantity. ☞WRITE US.

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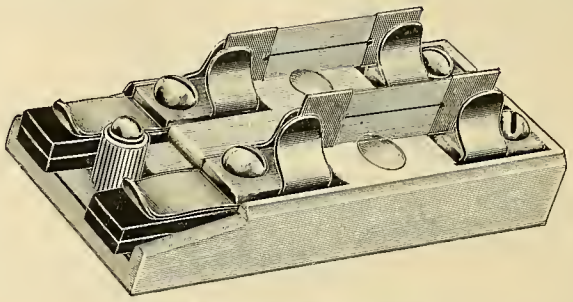

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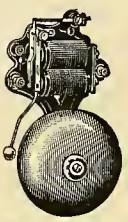

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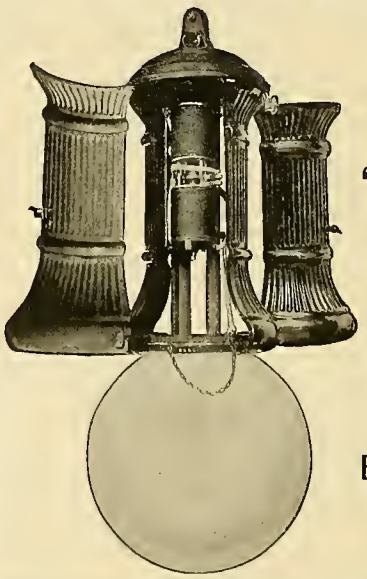

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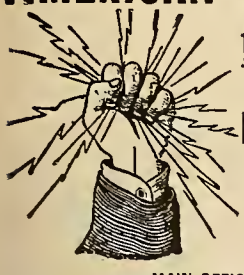

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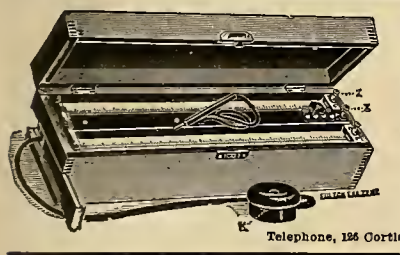

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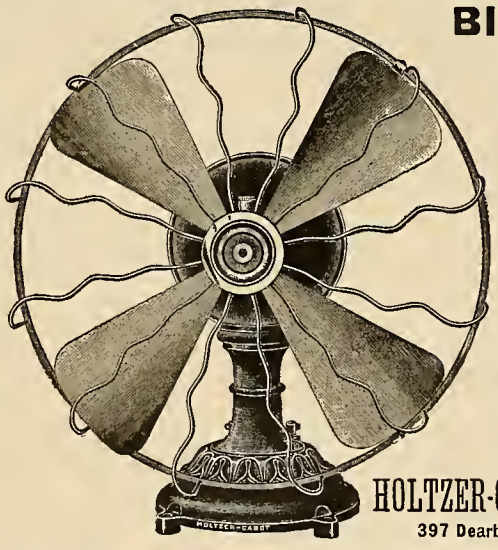

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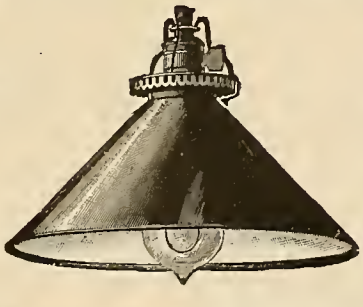

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1 1 H. P. Lundell, self-oiler.
1 1½ H. P. C. & C., self-oiler.
1 2 H. P. Bernard, self-oiler.
1 3 H. P. Hawkeye.
1 3 H. P. Westinghouse.
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1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
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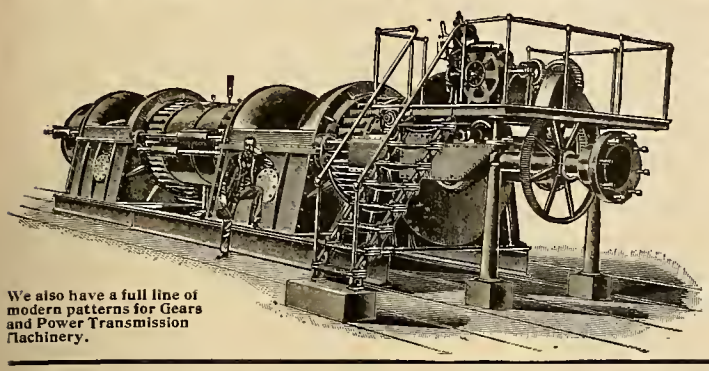

We also have a full line of modern patterns for Gears and Power Transmission Machinery.

That there are more Victor Turbines in use supplying power for electric generators than any other is due to the many points of superiority possessed by this Turbine.

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High Speed, Close Regulation,
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5—M. P. 75 G. E. 500-Volt Railway Generators.
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1—300-Amp. U. S. Dynamo, 125 Volts.
1—400-Lt. National Bipolar Dynamo, 125 Volts.
2—50-Lt. Excelsior Arc Dynamos.
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600—Ft. Wayne Wood, Western Electric, Excelsior, Helios and A-B Arc Lamps.
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1—16x16 Ideal Simple Engine, 175 h. p.
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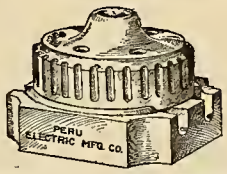

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One D. 62 T.-H. 500-volt Railway Generator.
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One 14x14 Ideal engine.
One 12x18 Lansing engine.
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Two 50-light Standard arc dynamos.
One 20-light Sperry arc dynamo.
One 500-light, 100-volt Edison dynamo.
One 1,000-light 1,000-volt Wood Ft. Wayne alternating dynamo, complete with switchboard and exciter.
One 1,000-light, 1,000-volt Westinghouse dynamo, complete with switchboard and exciter.
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One 18x28 Watertown automatic engine.
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One 9½x16x14 Payne compound engine.
One Armington & Sims cross-compound condensing engine, 30x20x15.
One 15x14 Ideal automatic engine.
One 14½x13 Armington & Sims auto. engine.
One 12x21 Buckeye automatic engine.
One 12x12 Armington & Sims automatic engine.
One 12x12 Ideal automatic engine.
One 250 h. p. Baragwanath feed-water heater.
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One 150 h. p. Berryman heater.
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Five 54x16 horizontal tubular boilers.
Two 54x14 horizontal tubular boilers.
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Ten Hill friction-clutch pulleys, 52x22x6 inch bore, double arm, double crown, double belt.
3 Thompson recording wattmeters, 10 ampere.
2 Thompson recording wattmeters, 15 ampere.
2 Thompson recording wattmeters, 25 ampere.
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1 20x22 Corliss engine.
1 9x12 center crank engine.
1 12x12 center crank engine.
1 7x10 slide valve center crank.
1 3x5 upright engine.
1 80 h. p. A. B. Farquahar Co. engine.
1 horizontal pattern Lansing engine, 12-in. stroke.
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1 14x24 box bed engine.
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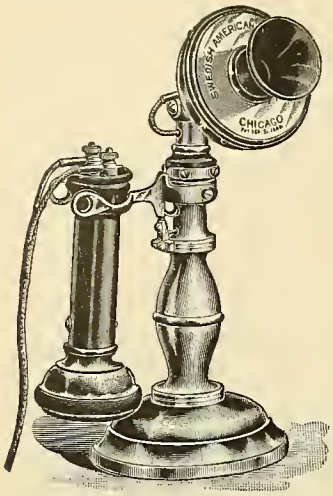

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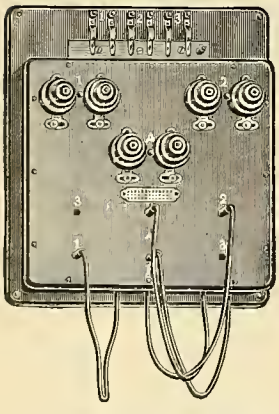

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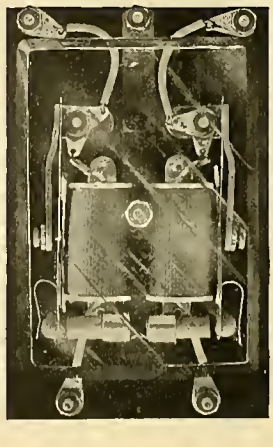

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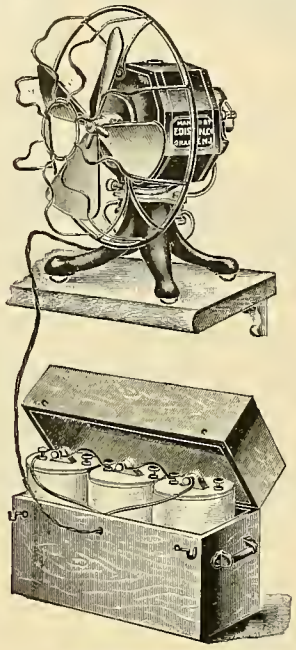

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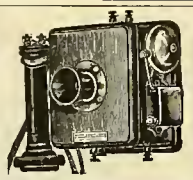

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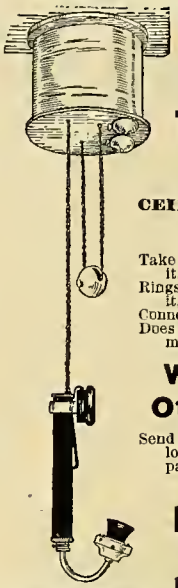

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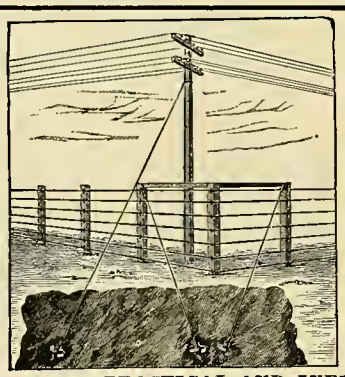

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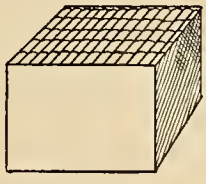

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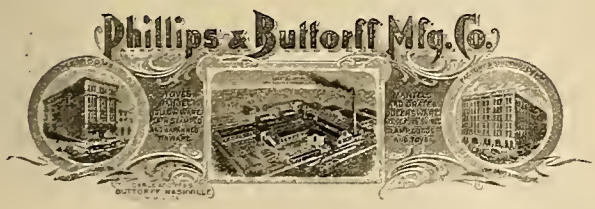

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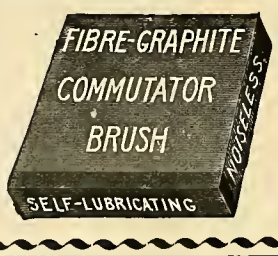

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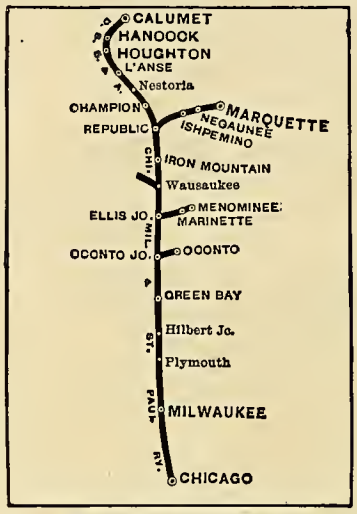

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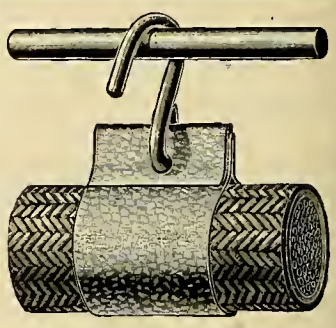

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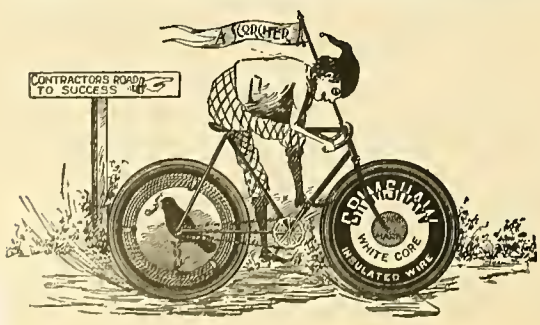

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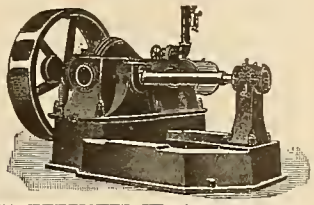

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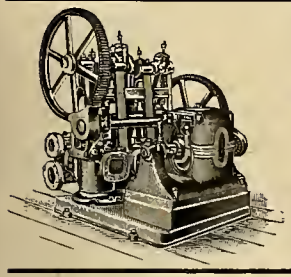

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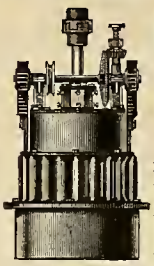

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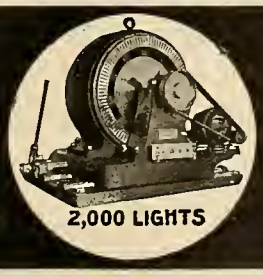

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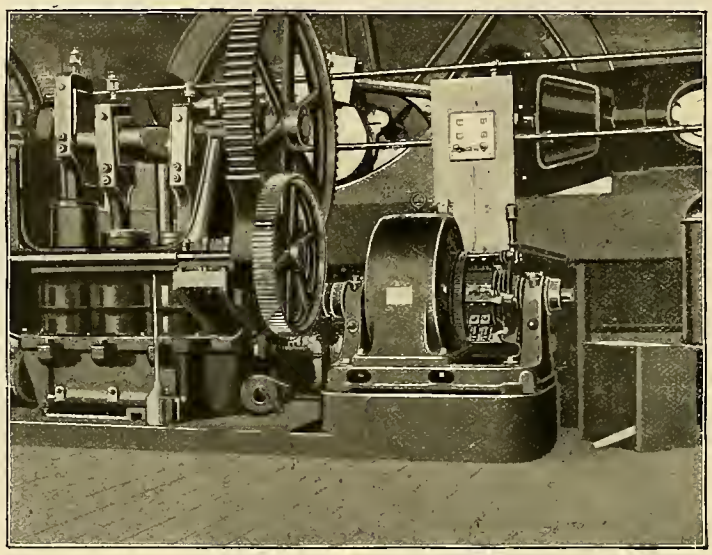

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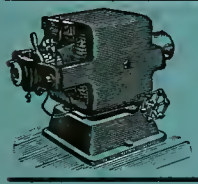

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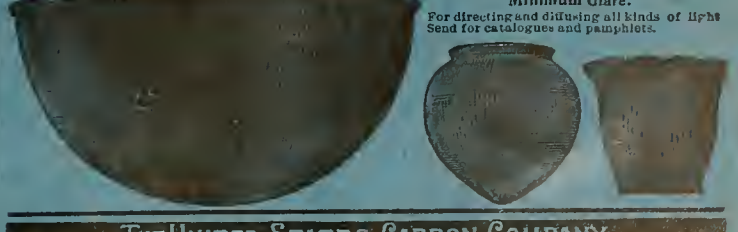

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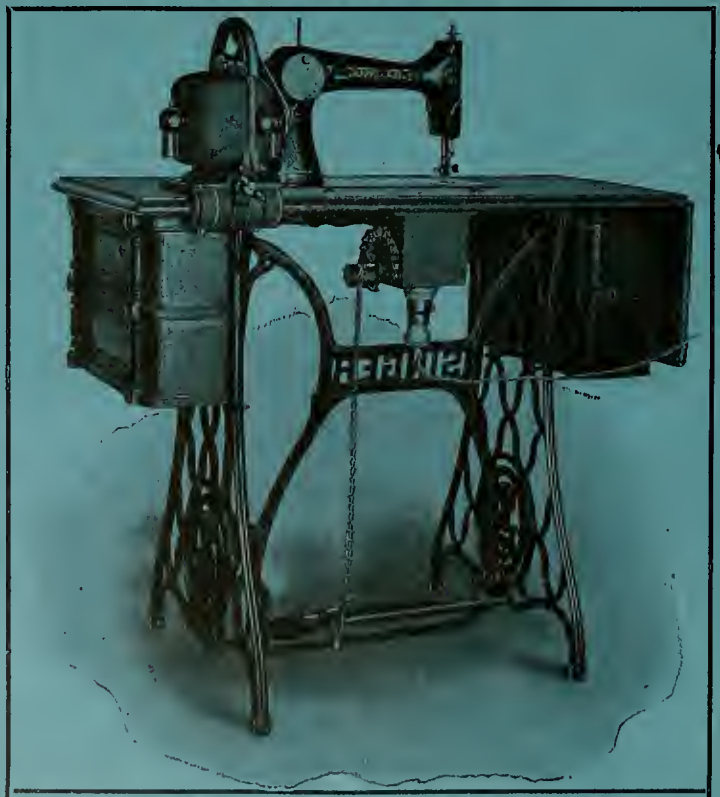

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NEW STANDARD "AUTOGAS" FOR Automobile Gasoline Engine Ignition, Picture Machines, Surgical and Dental purposes, and for Carriage Lights. Also Electric Ruby Lamps for Photographers.
WILLIAM ROCHE, INVENTOR AND SOLE MANUFACTURER, 42 Vesey St., NEW YORK CITY.

DE DION-BOUTON "Motorette" COMPANY.
Sole Agents and Licensed Manufacturers in the United States of America for
De Dion-Bouton & Co., FRANCE.

Motors, Motorcycles, Motorettes.
Our New York Type Motorette, Weight 700 pounds. Capacity 3 Persons. Price $1,200.00.
SIMPLICITY, FLEXIBILITY, LIGHTNESS, STRENGTH, RELIABILITY, EASILY OPERATED, PERFECTLY CONTROLLED, ABSOLUTELY SAFE, ABSENCE OF ALL OIL AND DIRT, ECONOMY.
Not an EXPERIMENT, but a TRIED and PROVED SUCCESS.
Over 20,000 DE DION-BOUTON MOTORS operating Motorcycles and Motorettes.
GENERAL OFFICES AND FACTORY: CHURCH LANE AND 37TH ST., BROOKLYN, N. Y.
De Dion Motor Supplies and Batteries Always in Stock.

COLORED LACQUERS,
FOR INCANDESCENT LAMPS.
In brilliant rainbow colors. Easily applied. Will not peel or fade.
SAMPLES FREE.

DEAD BLACK LACQUER,
FOR METAL WORK.
Most Satisfactory Imitation of Bauer-Barff in the Market.
WRITE TO US.

M. L. BARRETT & CO., CHICAGO.

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PARAGON

CHICAGO EDISON COMPANY, **FAN MOTORS**

139 ADAMS ST., CHICAGO.

THE GENERAL ELECTRIC COMPANY'S

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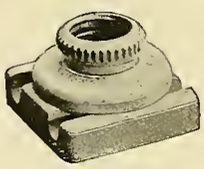


CATALOGUE No. 50744.

Sockets

AND

Receptacles

FOR EDISON BASE LAMPS.

Two New Porcelain Receptacles.

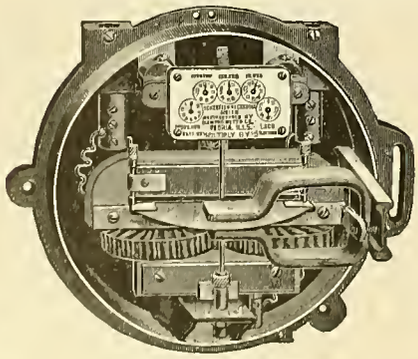
Fully described in Catalogue 7523. Write for one.

General Office: Schenectady, N. Y.

SALES OFFICES IN ALL LARGE CITIES.

CHICAGO OFFICE, MONADNOCK BUILDING.

SCHEEFFER RECORDING WATT-METERS.



METER WITHOUT CASE.

Accurate on All Loads.
Will Start and Register Correctly on 5 Watts.
Shunt loss LESS than one Watt on 60 Cycles.
Dust Proof.
Correct on All Inductive Loads.

DIAMOND METER CO.,
PEORIA, ILL., U. S. A.

METER WITH CASE.

COLUMBIA CARBONS

FOR ENCLOSED ARCS

Guaranteed superior to any imported Carbon in uniformity of size and straightness, or subject to return at our expense. Try us and be convinced.

NATIONAL CARBON COMPANY,

1198 West Madison Avenue, Cleveland, Ohio.

FRED H. ALDEN, Pres. **J. GEISEROWICH, Secy. and Treas.**

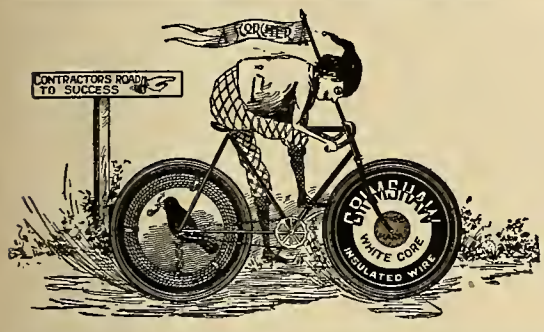
WEATHER-PROOF WIRE INDEX BRAND WE SHOW THE WAY

ILLINOIS INSULATED WIRE CO.,

MANUFACTURERS OF

High-Grade Weatherproof Wire,

NO TRUST PRICES. SYCAMORE, ILL. ALL SAMPLES FREE.



Grimshaw White Core,

RAVEN WHITE CORE, RAVEN BLACK CORE, COMPETITION LINE WIRE, GRIMSHAW AND COMPETITION TAPES AND SPLICING COMPOUNDS.

New York Insulated Wire Company,

MAIN OFFICE: 12-17 Cortlandt St., New York — BRANCHES: CHICAGO: 320 Dearborn St. — BOSTON: 134 Congress St. — SAN FRANCISCO: 71 Flood Building

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OKONITE IT NEVER DISAPPOINTS

A Complete Line of Electrical Supplies.

WE carry in Chicago stock a selected line of electrical supplies, each article superior in some essential point over other makes of the same class of goods.

That our goods give satisfaction, is evinced by the fact that our list of regular customers is steadily growing larger.

We cater to all classes of trade. We carry arc and incandescent lamp supplies, central station material, telephone and speaking tube essentials, house goods, construction material and tools, and electrical equipment for street railways and mines.

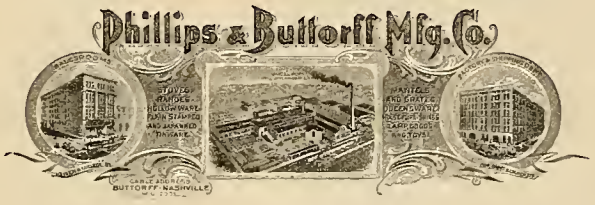
If you want special information on any article or class of equipment, write us and we will send trade literature covering the point.

Central Electric Company,

264, 266, 268, 270 FIFTH AVENUE,

CHICAGO.

OUR SELF-STARTING SINGLE-PHASE A. C. MOTORS AND WHAT A CUSTOMER THINKS OF THEM.



Nashville, Tenn. Jan 1, 1900

Mr. Jas Shingleton.

Dear Sir:

The Four Wagner Motors you installed in our Work Shop last Summer, have proven satisfactory in every respect, not requiring any attention whatever, and the current consumption has been remarkably low, exceeding our most sanguine expectations.

Yours Truly

Phillips & Buttorff Mfg Co.

P. H. Buttorff

WRITE FOR BULLETINS "Z 24, 3[illegible], 37 and 39."

WAGNER ELECTRIC MFG. CO.,

GENERAL OFFICES AND FACTORY, ST. LOUIS, U. S. A.

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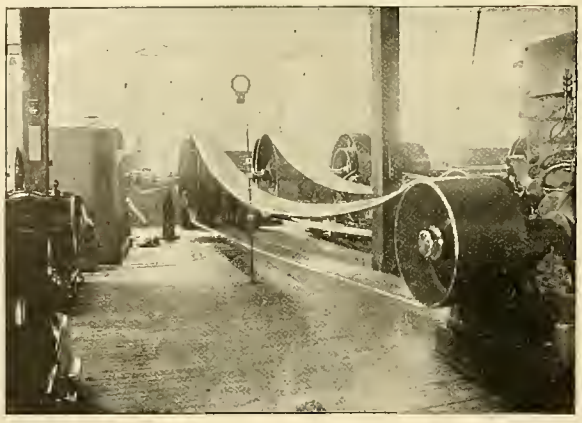
NEW YORK, Havemeyer Bldg. PHILADELPHIA, 1000 Betz Bldg. BOSTON, 620 Atlantic Ave.
CHICAGO, 1519 Marquette Bldg. BALTIMORE, 204 East Lexington St.
SPOKANE, WASH., 603 West Sprague Ave., Mr. Geo Nixon, Sales Agent
SAN FRANCISCO, 120 Sutter St. YOKOHAMA, JAPAN. LONDON, ENGLAND. CITY OF MEXICO.
FOREIGN DEPARTMENT, Havemeyer Bldg., New York City.



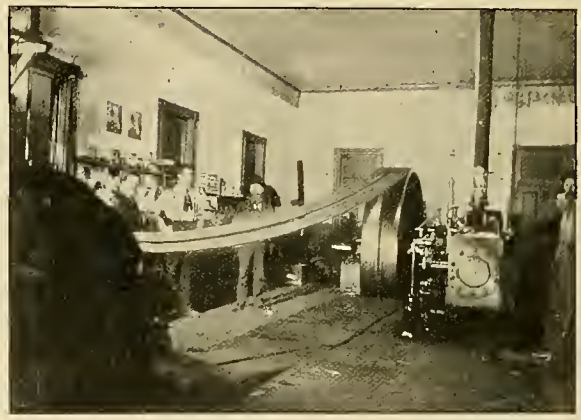
CLING-SURFACE.

We guarantee these results from Cling-Surface:
Slipping stopped.
Belts made pliable and elastic.
Power increased at least 15%.
Belts will run easy or slack.

ASK US FOR THE ONLY BOOKLET OF SLACK BELTS YOU EVER SAW.

CLING-SURFACE MFG. CO.,
177-182 Virginia St., BUFFALO, N. Y.

Chicago, St. Louis, New York, Boston, New Orleans.



ROCKLAND, ME., February 22, 1900.
Cling-Surface Mfg. Co, New England Branch, Boston.
GENTLEMEN:—These two 16-in. belts have been treated with Cling-Surface for some time. They run this way all the time. The load sometimes jumps from zero to full load, yet there is no slip.
ROCKLAND, THOMASTON & CAMDEN ST. RY. CO.

MOUND CITY, Mo., March 5, 1900.
Cling-Surface Mfg. Co.
GENTLEMEN:—Have used Cling-Surface four months. It has stopped all slipping. Belts 10 in., 30-ft. centers, run with 22-in. sag, yet carry full load, are pliable and in fine condition. Used to run very tight. We highly recommend Cling-Surface.
MOUND CITY ELEC. LT. & TELEPHONE CO.

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Western Electric Co.
Western Elec. Supply Co.

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Central Electric Co.
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General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Lea Arc Lamp Co.
Siemens & Halske Electric Co. of America.
Western Electric Co.
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Westinghouse El. & Mfg. Co.

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Peru Elec. Mfg. Co.
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Western Elect. Supply Co.

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Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Belt Dressing.
Cling-Surface Mfg. Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Belting.
Chicago House Wrecking Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Blowers.
Fuller Co., The
Sturtevant Co., H. F

Books, Electrical.
Electrician Publishing Co.

Bridges and Buildings (Steel).
American Bridge Co.

Brushes.
Becker Bros.
Central Electric Co.
General Electrical Repair Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.

Burglar Alarms.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Elect. Supply Co.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
American Steel & Wire Co.
Central Electric Co.
Eastern Electric Cable Co.
General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Carbons, Points & Plates
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Chicago Edison Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
National Carbon Co.
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Speer Carbon Co.
United States Carbon Co.
Western Elect. Supply Co.

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Cleats.
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Link Belt Machinery Co.

Circuit Breakers.
Cutter Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Coils and Magnets.
Northwestern Elec. Mfg. Co.
Varley Duplex Magnet Co.

Coloring (Inc. Lamp).
Barrett & Co., M. L.
Vitro Chrome Chemical Co.

Compound.
Amer. Battery Compound Co.
Dearborn Drug & Chem. Wks.
McLennan & Co., K.
Western Electric Co.
Western Elect. Supply Co.

Conduit and Conduits.
Amer. Vitrified Conduit Co.
Central Electric Co.
Electric Appliance Co.
Electrolysis Proof Conduit Mfg. Co.
McRoy, John T.
Richmondt Conduit Co.
Sprague Electric Co.
Western Elect. Supply Co.

Connectors and Terminals (Patent).
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McIntire Co., The C.

Construction & Repairs.
Becker Bros.
Chicago Edison Co.
General Electrical Repair Co.
Hodge-Walsh Elec. Eng. Co.
Western Electric Co.

Contractors and Electric Light Plants.
Arnold El. Power Station Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
National India Rubber Co.
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.

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Elec. Engineer Corr. Inst.
Int. Correspond. Schools.

Cross-Arms, Pins and Brackets.
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Central Electric Co.
Central Mfg. Co.
Independent Tel. Supply Co.
Indpls. Arm, Brack. & Pin Co.
Kans. City & So. Lum. Co.
Leavitt, E. H.
Tennent Insulator Pin Co.
Texas Arm & Pin Co.
Valentine-Clark Co., The.
Western Elect. Supply Co.

Cut-Outs and Switches.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
General Elec. Co.
General Inc. Arc Light Co.
Hill, W. S., Electric Co.
Manhatten Elec. Supply Co.
McOuat, Robert L.
Palste Co., H. T.
Siemens & Halske Electric Co. of America.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Cuts.
Franklin Eng. & Electro Co.

Dimmers (Theatre).
Iron Clad Resistance Co.

Dynamos and Motors.
Central Electric Co.
Chicago Motor and Dyn. Co.
Chicago House Wrecking Co.
Crocker-Wheeler Company.
Diehl Manufacturing Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Matthews & Bro., W. N.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
Schureman & Hayden.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Star Dynamo Works.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Electric Supply Co.
Westinghouse El. & Mfg. Co.

Elec. Heating Devices.
Simplex Electrical Co.

Electric Railways.
Arnold El. Power Station Co.
Crocker-Wheeler Company.
General Electric Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold El. Power Station Co.
Hain, Foree.
Crocker-Wheeler Company.
Hodge-Walsh Elec. Eng. Co.
Humphrey, Henry H.
Northern Elec. Mfg. Co.
Sargent & Lundy.

Electrical Instruments.
American El. Specialty Co.
Central Electric Co.
Electric Apoliance Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Manhatten Elec. Supply Co.
Queen & Co.
Siemens & Halske Electric Co. of America.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
Crocker-Wheeler Company.
General Electric Co.

Elevators-Conveyors.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Engines, Steam.
Ball Engine Co.
Camp Engineering Co.
Chicago House Wrecking Co.
Sturtevant Co., B. F.

Exh'st Steam Apparatus.
American District Steam Co.

Fan Outfits.
Central Electric Co.
Crocker-Wheeler Company.
Diehl Manufacturing Co.
Edison Mfg. Co.
Emerson El. Mfg. Co.
Fuller Co., The.
General Electric Co.
General Inc. Arc Light Co.
Holtzer-Cabot Elec. Co.
Paragon Fan Motor Co.
Roth Bros. & Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Fire Extinguishers.
Monarch Fire Appliance Co.

Flexible Shafts.
Stow Mfg. Co.

Forges.
Sturtevant Co., B. F.

Fuses.
American Elec. Fuse Co.
McIntire Co., The C.

Fuse Wire.
American Elec. Fuse Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
Electric Appliance Co.
McIntire Co., The C.
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Western Electric Co.

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Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Manhattan Elec. Supply Co.
McOuat, Robert L.
Mianus Electric Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Holophene Glass Co.
Phœnix Glass Co.
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Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

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Palste Co., H. T.
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Robertson & Sons, Jas. L.
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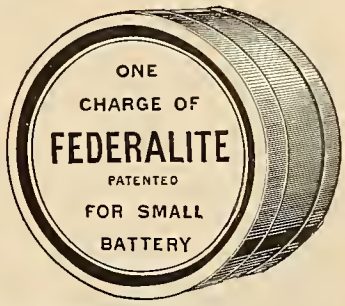

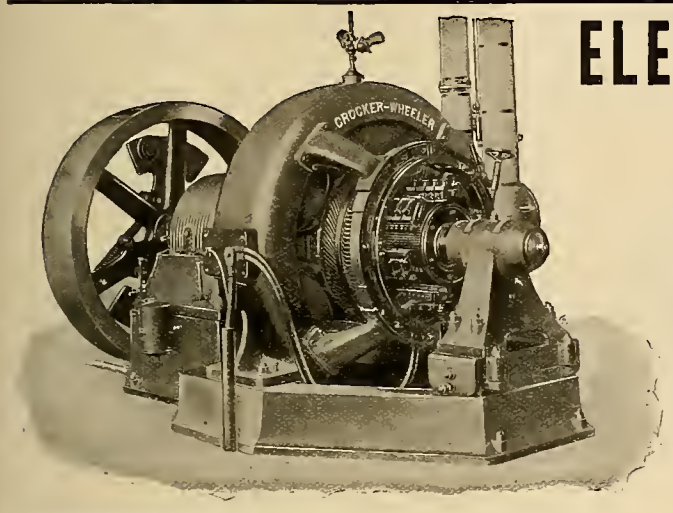

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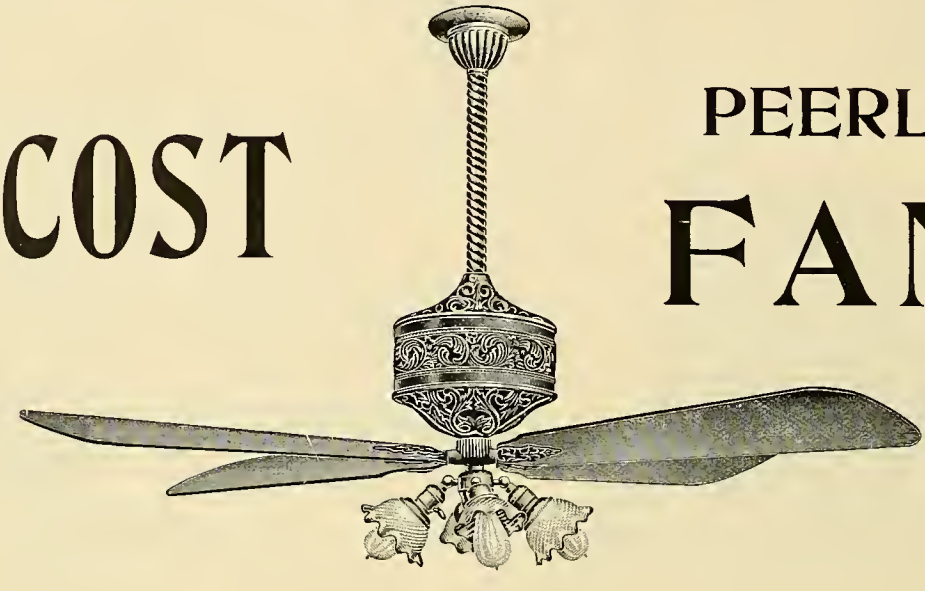
TO WIND UP
THE SEASON

AT COST

PEERLESS
FANS



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25 220-volt 4- "
20 170-volt 4- "
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5 " 18 "	1,048	8 " 30 "	120	7 " 55 "	124
6 " 18 "	398	6 " 35 "	1,000	8 " 55 "	1
4 " 20 "	4,481	8 " 35 "	147	6 " 60 "	13
5 " 20 "	3,474	6 " 40 "	300	7 " 60 "	36
6 " 20 "	1,234	7 " 40 "	1,000	8 " 60 "	1
7 " 20 "	127	8 " 40 "	44	6 " 65 "	3
4 " 25 "	7,050	6 " 45 "	343	7 " 65 "	5
5 " 25 "	6,000	7 " 50 "	200	7 " 70 "	1
6 " 25 "	3,000	8 " 50 "	8		

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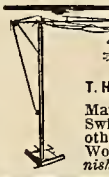

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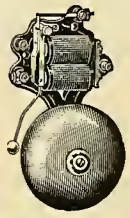

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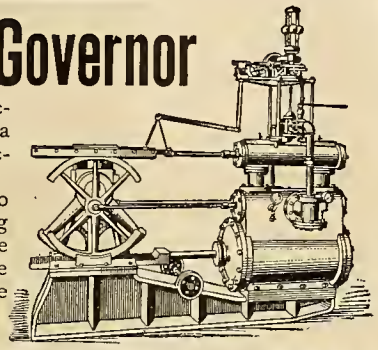

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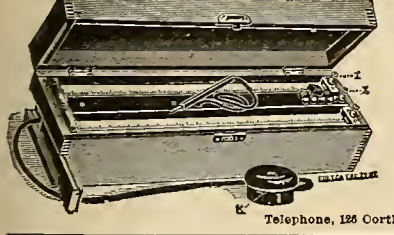

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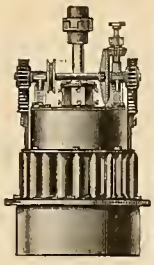

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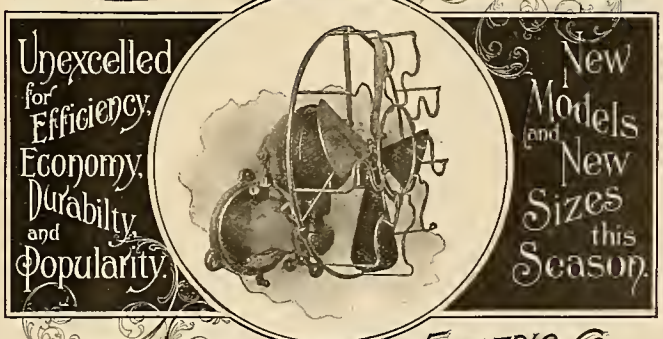

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Dr. J. S. Romine of Chadron, Neb., will sell $10,000 stock of Chadron Electric Light and Power Co. for $3,000 cash; balance stock, $4,000, held by J. D. Bacon of Chadron, a retired banker, he will sell on account of my selling, for $2,000 cash or on time, or keep his stock. Plant cost over $16,000; no bonds, mortgages or debts; no other light plant; city contract. Coal, $2.95 per ton. Pure city spring water. City of 3,000, healthy, good school, academy, six churches. Business can be greatly increased. Reason for selling, age and business keep me away all the time.

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Five Station Thomson Recording Wattmeters, for Series Arc Light circuits; sizes as follows:

2 65-Light, 9.6 Amperes.
2 65-Light, 6.6 Amperes.
1 35-Light, 6.6 Amperes.

These meters are very accurate, were used eight months, are in perfect condition, and complete with resistance boxes; have taken out our high tension circuit, hence sale at a special bargain.

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Dynamos and Motors.

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AUCTION SALE.——BANKRUPT SALE.

Entire Property of The Suburban Electric Co., Covington, Ky., Offered For Sale.

Notice is hereby given that pursuant to an order in bankruptcy, in the matter of the Suburban Electric Company, a corporation organized under the laws of the state of Kentucky, bankrupt, No. 276, in the District Court of the United States for the District of Kentucky, I will, on the 25th day of September, 1900, at 10 o'clock a. m., at the Scott street entrance of the United States Court in Covington, Ky., sell at public auction to the highest bidder, all the property, real and personal, of every kind and description belonging to the Suburban Electric Company, bankrupt, including all the rights, privileges and franchises, except the franchise to be a corporation, and also its electric lighting plant, power station, machinery, engines, boilers, dynamos, electric machines, electric lamps and other appliances and appurtenances, poles, lines, wires and all contracts, claims and demands, and all other property of every kind and description, also the following described real estate belonging to the said bankrupt, situated in the city of Covington, Kenton County, Kentucky, and bounded as follows:

1. Beginning at a point on the east line of Madison avenue at the northeast corner of Madison avenue and an alley running parallel to and between Fourth and Fifth streets; thence northwardly along the east line of said Madison avenue towards Fourth street ninety (90) feet; thence at right angles to Madison avenue one hundred and ninety (190) feet to another alley; thence with said other alley and at right angles to said first-named alley ninety (90) feet to said first-named alley; thence westwardly along the same one hundred and ninety (190) feet to the place of beginning.

And also the following described piece of real estate belonging to said bankrupt, situated in the city of Newport, Campbell County, Kentucky, to wit:

2. Lot No. 260 in the Cotes Brilliant Lot & Home Company's subdivision, fronting thirty (30) feet on the west side of Park avenue, and extending back one hundred and twenty (120) feet to an alley.

The first tract of real estate above described will be sold subject to such lien as Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, or either of them, may have upon said real estate, which lien is as yet undetermined in amount.

The property above described will be sold free from any and all liens or encumbrances, except the lien or encumbrance in favor of Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, upon the said first described real estate aforesaid.

The second piece of real estate described aforesaid will be sold separately.

All the balance of the real estate, and all the other property and assets of every kind, and the rights, privileges and franchises of the Suburban Electric Company will be sold as an entirety and as a going concern.

The terms of the sale will be one-third (⅓) cash, to be paid upon the confirmation of the sale, the balance in equal installments of six and twelve months from date of sale, deferred payments to draw six (6%) per cent interest and to be secured by lien upon the property sold and also by bond with sureties satisfactory to the referee in bankruptcy herein; or purchaser may pay cash for said property upon the confirmation of the sale. No bid for said property will be received from any bidder who shall not place in the hands of the undersigned at the time of making said bid, as a pledge that said bidder will make good his bid if the sale is confirmed, the sum of fifteen thousand ($15,000) dollars, which sum of fifteen thousand dollars will be credited upon the first payment of the purchase money for said sale.

Inspection of property invited. Full information given upon application at the office of the bankrupt in Covington, Ky.

CHARLES H. SHAW,
Trustee in Bankruptcy of the Suburban Electric Company.

SIMRALL & GALVIN,
Attorneys for Trustee in Bankruptcy.

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2 12-light Edison, ¾ K. W.
1 16-light Lundell, self-oiler.
1 25-light C. & C., self-oiler.
1 35-light Westinghouse, self-oiler.
1 36-light Bernard, self-oiler.
1 50-light Hawkeye, self-oiler.
1 50-light Bain, self-oiler.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 50-light C. & C., self-oiler.
1 55-light Edison, 3 K. W., self-oiler.
1 80-light Wood, self-oiler.
1 110-light Edison, 6 K. W., compound.
1 90-light Westinghouse.
1 160-light Rockford.
1 210-light Triumph, self-oiler.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp., self-oiler.
1 250-light Siemens & Halske, 15 K. W., multipolar.
1 260-light National, compound, self-oiler.
1 270-light T.-H., comp., self-oiler.
3 270-light Westinghouse, M. P., slow speed.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp. wound.
1 350-light National, self-oiler, compound.
1 360-light Rockford, self-oiler, compound.
1 350-light Edison, 20 K. W., shunt.
3 350-light Edison, 20 K. W., self-oilers.
1 350-light Edison, 20 K. W., self-oiler, compound.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
1 540-light Edison, 30 K. W.
4 540-light Edison, 30 K. W., self-oilers.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elckmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers.
1 800-light Rockford, self-oiler, new arm't.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., direct connected to 125 H. P., self-oiling, 14x14 engine.

220-Volt Generators.

1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 12 K. W. Westinghouse, multipolar, self oiler.
1 25 K. W. Edison, self-oiler.
1 35 K. W. E. & C., multipolar, slow speed.
1 45 K. W. Edison, self-oiler, new arm't, compound.
1 50 K. W. Westinghouse, self-oiler, horizontal type, compound.
1 200 K. W. Crocker-Wheeler, multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.
1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
1 45 K. W. Edison, compound, self-oiler.
1 150 K. W. Detroit (Rae), multipolar, compound, self-oiler.
1 100 H. P. 500-volt Westinghouse, Kodak set generator and comp. engine.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp.
1 600-light Bain, 30 K. W., self-oiler, toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
1 650-light Thomson-Houston, A. 35, s. o., composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp.
1 1200-light Westinghouse, 60 K. W., self-oiler, compound, toothed arm't.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
2 1400-light Westinghouse, 70 K. W., brand new.
2 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oilers, outboard bearings.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 25-light 2000 C. P. T.-H., ball armature.
1 25-light 2000 C. P. T.-H., ring armature.
1 30-light 2000 C. P. Western Electric,

Arc Dynamos.—Continued.

1 30-light 2000 C. P. Brush, No. 7, Steubenrausch commutator.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. 9.
4 45-light 1200 C. P. T.-H., M. 12, ball armt.
1 45-light 1200 C. P. T.-H., M. 12, ring armt.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 2000 C. P. Excelsior, latest type, newly rewound field and armature.
2 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 1200 C. P. T.-H., L. D., 12, new ring arm't, self-oiler.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. West. Elec., self-oiler.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse, self-oiler.
3 60-light 2000 C. P. Wood, No. 8.
3 65-light 2000 C. P. Brush, No. 8, new armature, Steubenrausch commutaters.
1 75-light 1200 C. P. Standard, self-oiler, air insulated commutator.
2 75-light 2000 C. P. Westingh'se, self-oilers.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

110-Volt Motors.

1 ¼ H. P. Sprague.
1 ¼ H. P. Elbridge.
1 ½ H. P. Roth.
1 ½ H. P. Keller, self-oiler.
2 1 H. P. Belding, M. P.
1 1 H. P. Roth, self-oiler, new armature.
2 1 H. P. Edison, ¾ K. W., self-oilers.
1 1 H. P. Lundell, self-oiler.
1 1½ H. P. C. & C., self-oiler.
1 2 H. P. Bernard, self-oiler.
1 3 H. P. Hawkeye.
1 3 H. P. Westinghouse.
1 3 H. P. Jenney, self-oiler.

110 Volt Motors.—Continued.

1 3 H. P. Bain, self-oiler.
1 3 H. P. Newotny, self-oiler.
1 5 H. P. Wood.
1 3 H. P. Card, self-oiler, Manchester type.
1 3 H. P. C. & C., self-oiler.

220-Volt Motors.

1 1 H. P. Eddy, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P.
1 3 H. P. Kester, self-oiler.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 15 H. P. Westinghouse, multipolar, self-oiler, 15 K. W.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 40 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 60 H. P. Edison, self-oiler, 45 K. W.
1 60 H. P. Westinghouse, horizontal type, self-oiler.
1 75 H. P. Sprague, self-oiler, new arm't.

500-Volt Motors.

2 1 H. P. Crocker-Wheeler, self-oilers, slow speed.
1 1 H. P. C. & C., self-oiler.
1 2½ H. P. Wood, self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 5 H. P. D. & D.
1 7½ H. P. Edison, self-oiler.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
2 18 H. P. C. & C., self-oilers.
1 20 H. P. Commercial, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

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SINGLE PHASE.

1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
1 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

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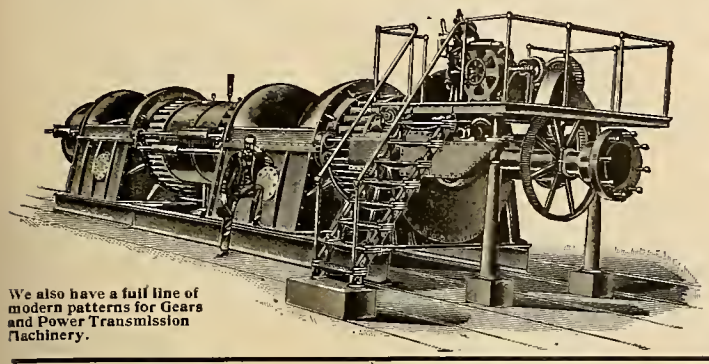

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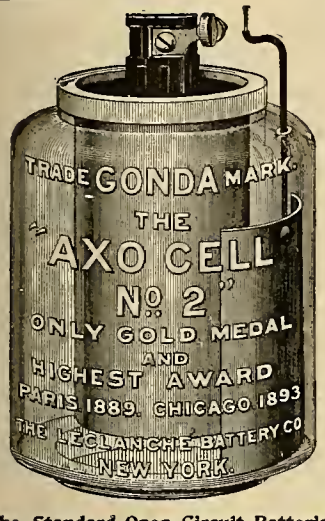

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One 12-light Elbridge.
One 5C-light Nowotny, new.
One 100-light Daft.
One 250-light U. S.
One 350-light Davis.
One 800-light G. E.
One 1,800-light Ft. Wayne, new.

DYNAMOS—ARC.

One Brush, 1-light, 3,000 c. p.
One Brush, 3-light, 2,000 c. p.
One Amer. Wood, 20-light, 2,000 c. p.
One West. Elec., 30-light, 2,000 c. p.
One Ft. Wayne Wood, 35-light, 1,200 c. p.
One T. H. L. D., 35-light, 2,000 c. p.

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One 3A Slattery.
One A60 G. E.

STEWART ELECTRICAL CO.,
S. E. Cor. Fifth and Sycamore,
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GENERATORS.

One Wood b. p., 500 v., 45 k. w.
One T.-H. m. p. 75, 500 v., 75 k. w.
One Edison b. p., 500 v., 100 k. w.

110-VOLT MOTORS.

One Diehl, ⅛ h. p.
One Edison, ¾ h. p.
One Elbridge, ¾ h. p.
One Card, 1 h. p.
One Sprague, 1 h. p.
One Nowotny, 3 h. p.
One Daft, 10 h. p.
One U. S., 20 h. p.
One Q. C., 28 h. p.

220-VOLT MOTORS.

One Nowotny, 1 h. p., new.
One Nowotny, 1 h. p.
One Davis, 5 h. p.
One Daft, 10 h. p.
One E. R. & C. C., 10 h. p.
One Edison h. p., 15 h. p.

500-VOLT MOTORS.

One Davis, 20 h. p.
One Brush, 25 h. p.
One Wood b. p., 60 h. p.
One T.-H. m. p. 15, 90 h. p.
One Edison, 100 k. w., 120 h. p.

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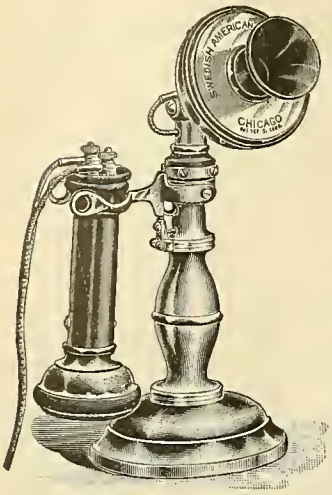

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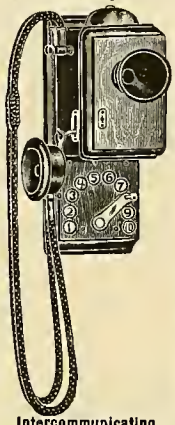

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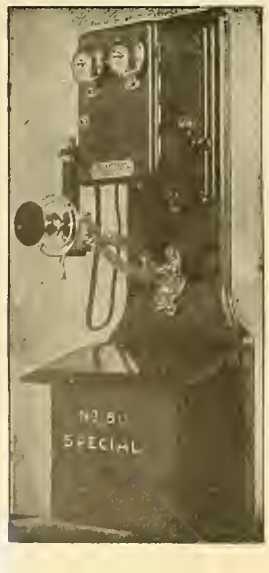

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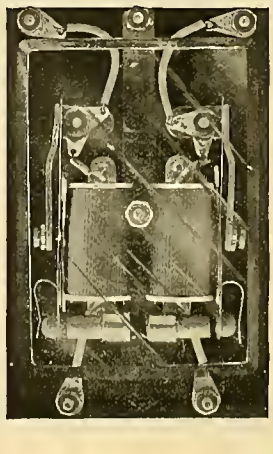

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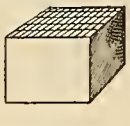

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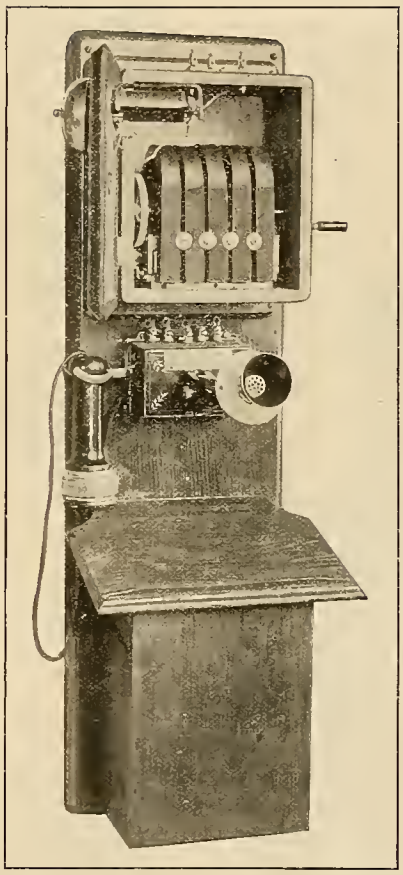

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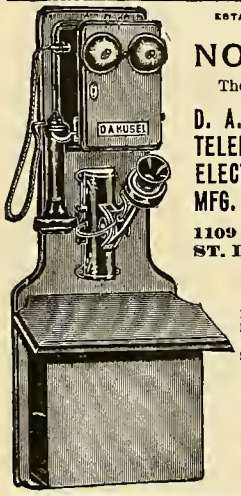

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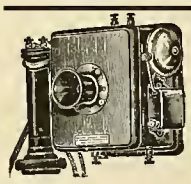

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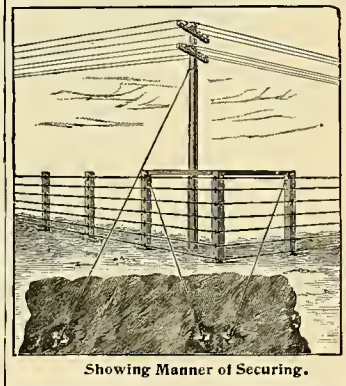

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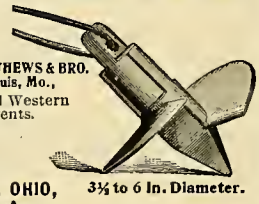

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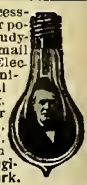

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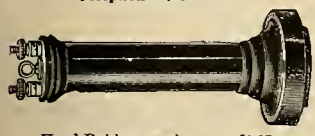

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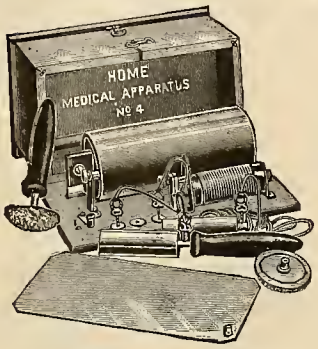

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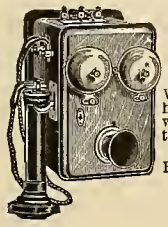

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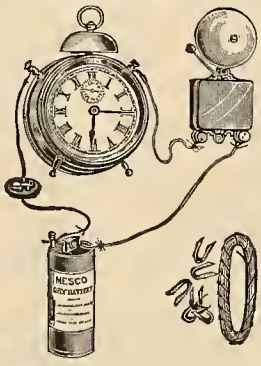

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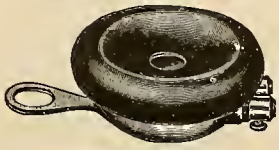

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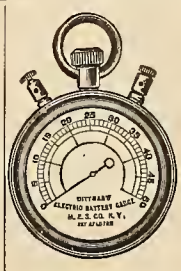

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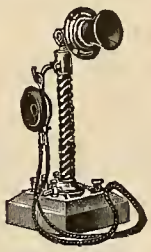

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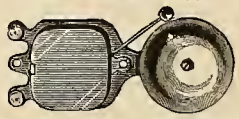

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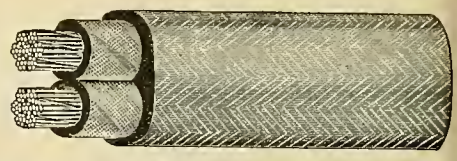

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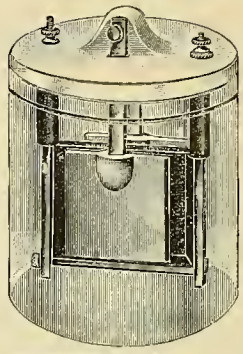

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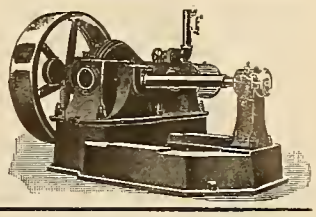

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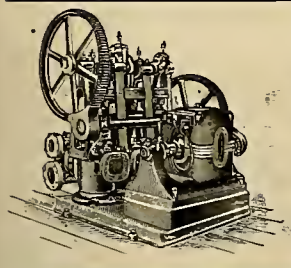

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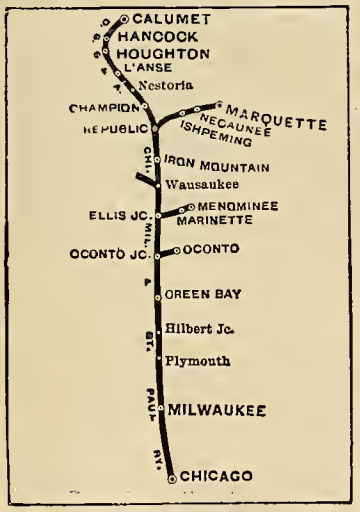

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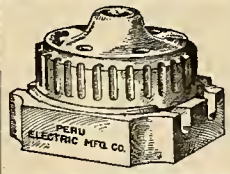

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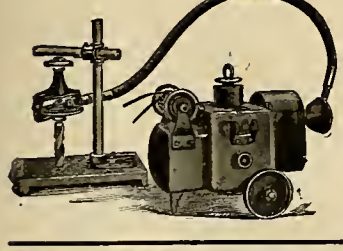

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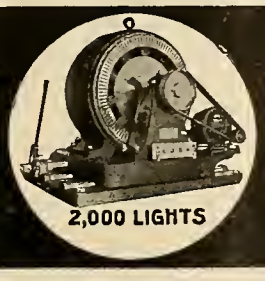

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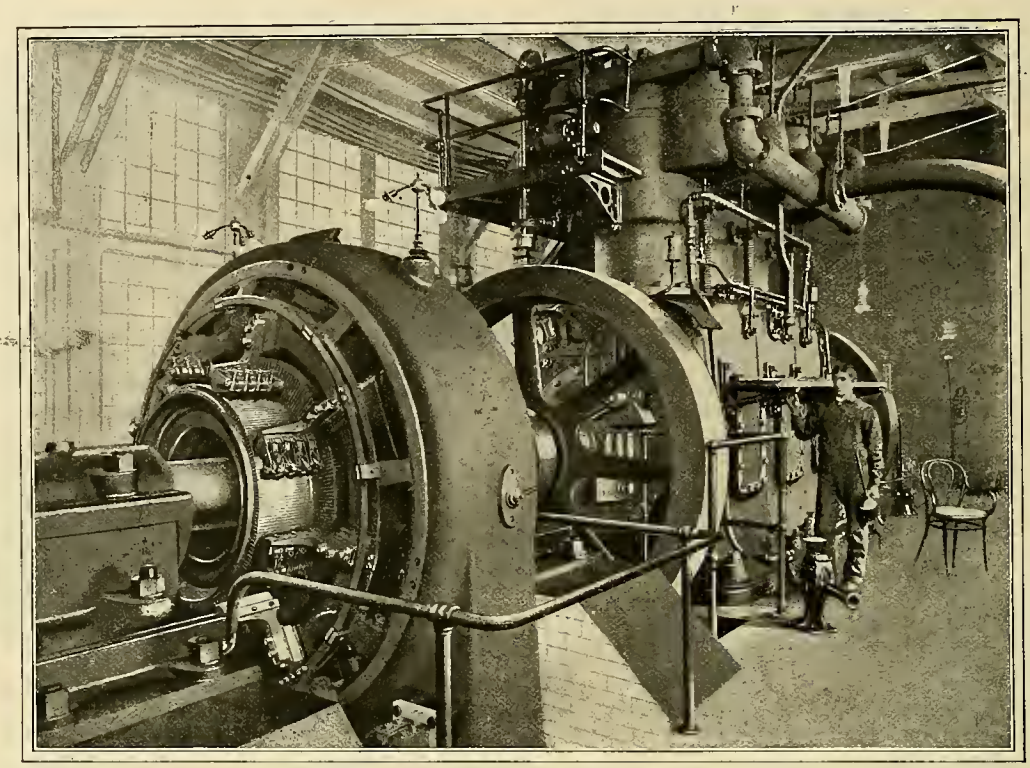

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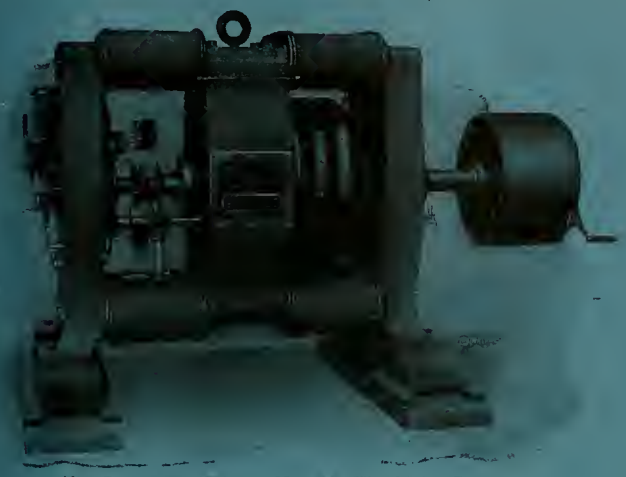

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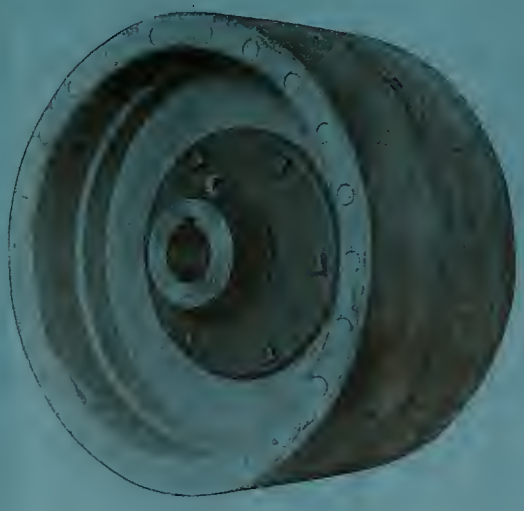

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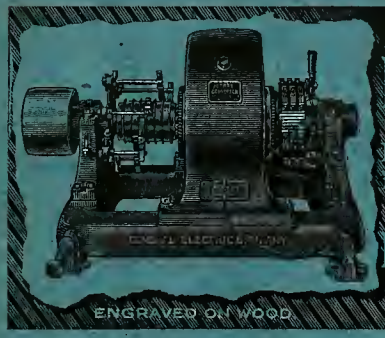

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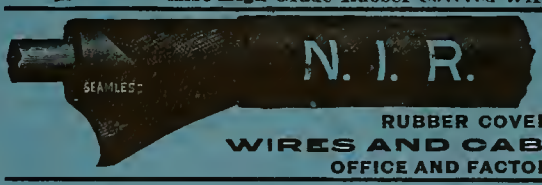

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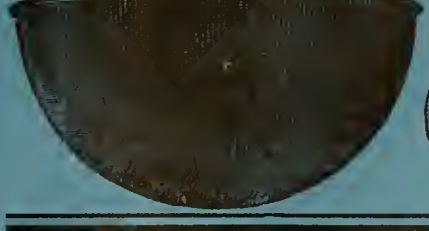

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PARAGON

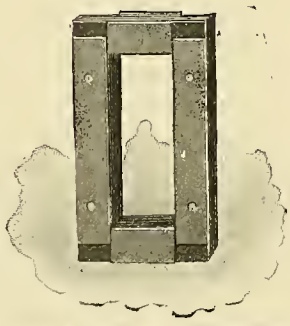
CHICAGO EDISON COMPANY, **FAN MOTORS**

139 ADAMS ST., CHICAGO.

THE GENERAL ELECTRIC COMPANY'S

TYPE H

Oil Transformers



Core of Type H Transformer.

Are built with cores composed of simple rectangular punchings insulated from each other and with joints so interlocked as to minimize the magnetizing current and prevent vibration or humming.

Write for information concerning special transformer tests.

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ATTIX FLEXIBLE TUBE WIRE.

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YONKERS, N. Y.

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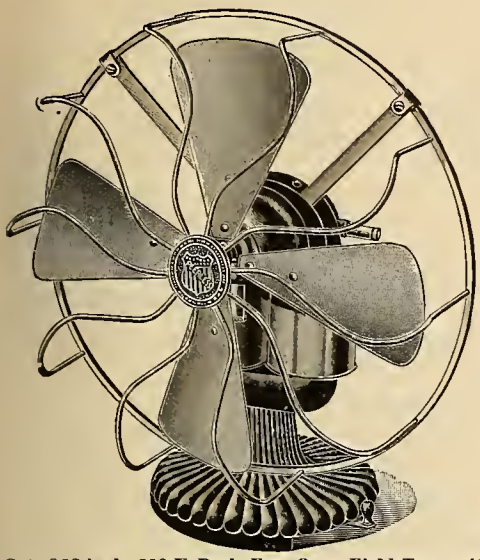
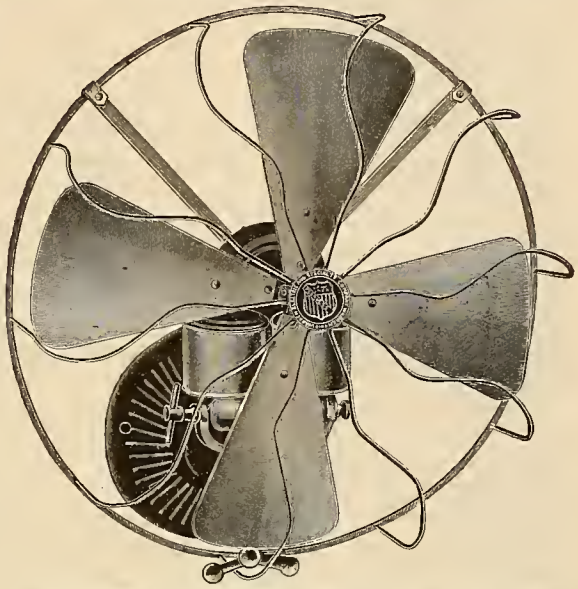
PEERLESS

DIRECT-CURRENT DESK AND CEILING FANS.



Cut of 12-inch, 110-V. Desk Fan, Open Field Type with polished brass hoods and field coverings, the handsomest and most efficient Fan on the market.



Cut of 16-inch Wall Fan, same finish as 12-inch and having a swivel joint. By simply turning a handle this Fan can be adjusted to blow air up, down or on either side.

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5. Frank H. Stewart & Co., 35 North 7th St., Philadelphia, Pa.
6. Electric Supply & Mfg. Co., 62 Public Square, Cleveland, Ohio.
7. The Devere Electric Co., 430 Plum St., Cincinnati, O.
8. Doubleday-Hill Electric Co., 535 Wood St., Pittsburg, Pa.
9. Julius Andrae & Sons Co., 225 W. Water St., Milwaukee, Wis.
10. H. S. Sands El. & Mfg. Co., 1153 Market Street, Wheeling, W. Va.
11. Electric Supply & Const. Co., 80 E. Gay St., Columbus, O.
12. Robert L. McCuat, 125 S. Meridian St., Indianapolis, Ind.
13. W. G. Nagel & Co., 510 Adams St., Toledo, O.
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It is common for electric companies who are now operating EXHAUST STEAM HEATING PLANTS to pay their entire coal and labor bills for the year and 6% on investment for steam mains from sale of exhaust steam. Why cant you do the same? Write for our pamphlet. Mention Western Electrician.

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ENCLOSED ARC LAMP
FOR ALL CIRCUITS.

One Piece Clutch.
No Sliding Contacts.
Does not feed through Clutch.
Spun Aluminum Case.
10-inch Globe with full size Carbon.
Artistic in design, light in weight, and mechanically perfect.
Catalogue for the asking.

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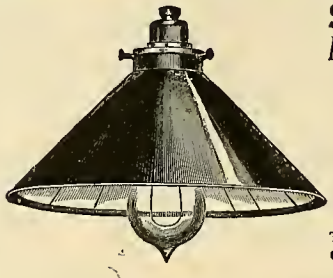

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A deep cone, for use with any system of incandescent electric light, where it is desired to concentrate a very powerful light on a small space. Lined with silver-plated mirror-plate glass. Increases the light from twelve to fifteen times. Most valuable in show windows and over machines, work-benches, type cases, etc., etc.

Thousands of this style used in show windows.
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Manhattan Elec. Supply Co.
Western Electric Co.
Western Elec. Supply Co.

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Electric Appliance Co.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elect. Supply Co.

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Cling-Surface Mfg. Co.
Leather Preserver Mfg. Corp.

Belting.
Chicago House Wrecking Co.
Leather Preserver Mfg. Corp.

Blowers.
Fuller Co., The
Sturtevant Co., H. F

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Electrician Publishing Co.

Bridges and Buildings (Steel).
American Bridge Co.

Brushes.
Becker Bros.
Central Electric Co.
General Electrical Repair Co,
Hobart Elec. Mfg. Co.
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Burglar Alarms.
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Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
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Eastern Electric Cable Co.
General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Carbons, Points & Plates
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
United States Carbon Co.
Western Elect. Supply Co.

Castings (Iron.)
Smith Co., S. Morgan.

Chains.
Jeffrey Mfg. Co,
Link Belt Machinery Co.

Circuit Breakers.
Cutter Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Coils and Magnets.
Northwestern Elec. Mfg. Co.
Varley Duplex Magnet Co.

Coloring (Inc. Lamp).
Barrett & Co., M. L.
Vitro Chrome Chemical Co.

Compound.
Amer. Battery Compound Co.
Dearborn Drug & Chem. Wks.
McLennan & Co., K.
Western Electric Co.
Western Elect. Supply Co.

Conduit and Conduits.
Amer. Vitrified Conduit Co.
Central Electric Co.
Electric Appliance Co.
Electrolysis Proof Conduit Mfg. Co.
McRoy, John T.
Richmondt Conduit Co.
Sprague Electric Co.
Western Elect. Supply Co.

Connectors and Terminals (Patent).
American Elec. Fuse Co.
McIntire Co., The C.

Construction & Repairs.
Hecker Bros.
Chicago Edison Co.
General Electrical Repair Co.
Hodge-Walsh Elec. Eng. Co.
Western Electric Co.

Contractors and Electric Light Plants.
Arnold El. Power Station Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
National India Rubber Co.
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.

Correspondence Schools
Elec. Engineer Corr. Inst.
Int. Correspond. Schools.

Cross-Arms, Pins and Brackets.
Hine Ridge Locust Pin Co.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Independent Tel. Supply Co.
Indpls. Arm, Brack. & Pin Co.
Kans. City & So. Lum. Co.
Leavitt, R. H.
Tennent Insulator Pin Co.
Texas Arm & Pin Co.
Valentine-Clark Co., The.
Western Elect. Supply Co.

Cut-Outs and Switches.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
General Elec. Co.
General Inc. Arc Light Co.
Hill, W. S., Electric Co.
Manhattan Elec. Supply Co.
McOuat, Robert L.
Paiste Co., H. T.
Siemens & Halske Electric Co. of America.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Cuts.
Franklin Eng. & Electro Co.

Dimmers (Theatre).
Iron Clad Resistance Co.

Dynamos and Motors.
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Chicago Motor and Dyn. Co.
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Crocker-Wheeler Company.
Diehl Manufacturing Co.
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General Electric Co.
General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
Schureman & Hayden.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Stanley Electric Mfg. Co.
Star Dynamo Works.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
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Western Electric Co.
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Wagner, Herbert A.

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Electric Appliance Co.
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General Electric Co.
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Queen & Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

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Crocker-Wheeler Company.
General Electric Co.

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Link Belt Machinery Co.

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Ball Engine Co.
Camp Engineering Co.
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Sturtevant Co., B. F.

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American District Steam Co.

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Emerson El. Mfg. Co.
Fuller Co., The.
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General Inc. Arc Light Co.
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Warren Elec. & Specialty Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Barnett Co., G. & H.

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Monarch Fire Appliance Co.

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Stow Mfg. Co.

Forges.
Sturtevant Co., B. F.

Fuses.
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McIntire Co., The C.

Fuse Wire.
American Elec. Fuse Co.
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Chicago Fuse Wire & Mfg. Co.
Electric Appliance Co.
McIntire Co., The C.
Western Elect. Supply Co.

Gas Lighting, Electric.
Western Electric Co.

Gears.
Besly & Co., Chas. H.

General Elec. Supplies.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Manhattan Elec. Supply Co.
McOuat, Robert L.
Mianus Electric Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Holophane Glass Co.
Phoenix Glass Co.
Western Elect. Supply Co

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Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

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Kelley & Son, Benj. F.

Heating and Ventilating Apparatus.
Sturtevant Co., B. F.

Holders, Inc. Lamp.
Crescent Mfg. Co.
Vought, M. I.

Igniters, Gas Engine.
Ziegler Electric Co.

Insulators and Insulating Materials.
Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Central Electric Co.
Chicago Edison Co.
Chicago Mica Co.
Eagle Paint & Varnish Wks,
Electric Appliance Co.
General Inc. Arc Light Co.
Illinois Insulated Wire Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
McOuat, Robert L.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Elec Fuse Co.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Illinois Insulated Wire Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
McDermid Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Northwestern Elec. Mfg. Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lacquers.
Barrett & Co., M. L.

Lamps, Incandescent.
Central Electric Co.
Chicago Edison Co.
Colonial Electric Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
Kentucky Electrical Co.
Manhattan Elec. Supply Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elec. Supply Co,
Westinghouse El. & Mfg. Co.

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Butler-Taylor Co.
Central Electric Co.
Electric Appliance Co.
Eureka Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Klein & Son, Mathias.

Magnet Wires.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Valle.

Meters.
Diamond Meter Co.
Fort Wayne Elec. Wks, Inc.
General Inc. Arc Light Co.
Siemens & Halske Electric Co. of America.

Mica.
Chicago Mica Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Siemens & Halske Electric Co. of America.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

Motors—See Dynamos and Motors.

Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Hamlin, Geo. R.
Johnston, Thomas J.
Page & Dursnd.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

Platinum Bought and Sold.
Baker & Co.
Goldsmith Bros.
Gt. West. Sm. and Refining Co.

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Berthold & Jennings.
Fowler, John H.
Lindsley Bros. Co.
Naugle, Holcomb & Co.
Perrizo & Sons.
Pittsburg & L. S. Iron Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester & Co., C. H.

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Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Peru Elec. Mfg. Co.

Power Transmission Machinery.
Jeffrey Mfg. Co.
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Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

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Link Belt Machinery Co.
Rockwood Mfg. Co
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Rail Bonds.
American Steel & Wire Co.

Refiners.
Gt. West. Sm. and Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.

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Becker Bros.
Chicago Edison Co.
Cleveland Armature Works.
General Electrical Repair Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
McOuat, Robert L.
Schureman & Hayden.
Stewart Electrical Co.
Westinghouse El. & Mfg. Co.

Salt (Battery).
Amer. Battery Compound Co,
Federal Battery Co.

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Chicago House Wrecking Co,
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Hodge-Walsh Elec. Eng. Co.
Rose Electric Co,
Schureman & Hayden.
Stewart Electrical Co.
Walsh's Sons & Co.

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Amer. Reflector & Ltg. Co.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elec. Supply Co.

Speed Indicators.
Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

Springs.
American Steel & Wire Co.
Barnes Co., The Wallace.
Manross, F. N.

Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.

Structural Iron Work.
American Bridge Co.

Tapes, Insulating.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The
Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.

Telephones, Telephone Material and Switchboards.
American Elec. Fuse Co.
American El. Telephone Co.
Bruckner Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Central Tel. & Elec. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Coos. Supply Co.
Garl Electric Co.
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Independent Tel. Supply Co
Kellogg Switchb. & Sup Co
Kokomo Tel & El. Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co.
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McDermid Mfg. Co.
Mianus Electric Co.
National Tel. Equipm. Co.
North Electric Co.
R. I. Telephone & Elec. Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Swedish-American Tel. Co.
Thomas, Wilcox & Dietz.
Viaduct Mfg. Co.
Warner Electric Co.
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Const. Co.

Tools.
Klein & Son, Mathias.

Transformers.
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Siemens & Halske Electric Co. of America.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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General Electric Co.
Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Universities.
Pratt Institute.
University of Notre Dame.

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co

Wire, Bare.
American Steel & Wire Co.
Besly & Co., Chas. H.
Central Electric Co.
Electric Appliance Co.
Independent Tel. Supply Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co.
Western Electric Co.
Western Electrical Sup. Co.

Woodwork, Electrical.
Noblett, E. J.

X-Ray Outfits.
Queen & Co.

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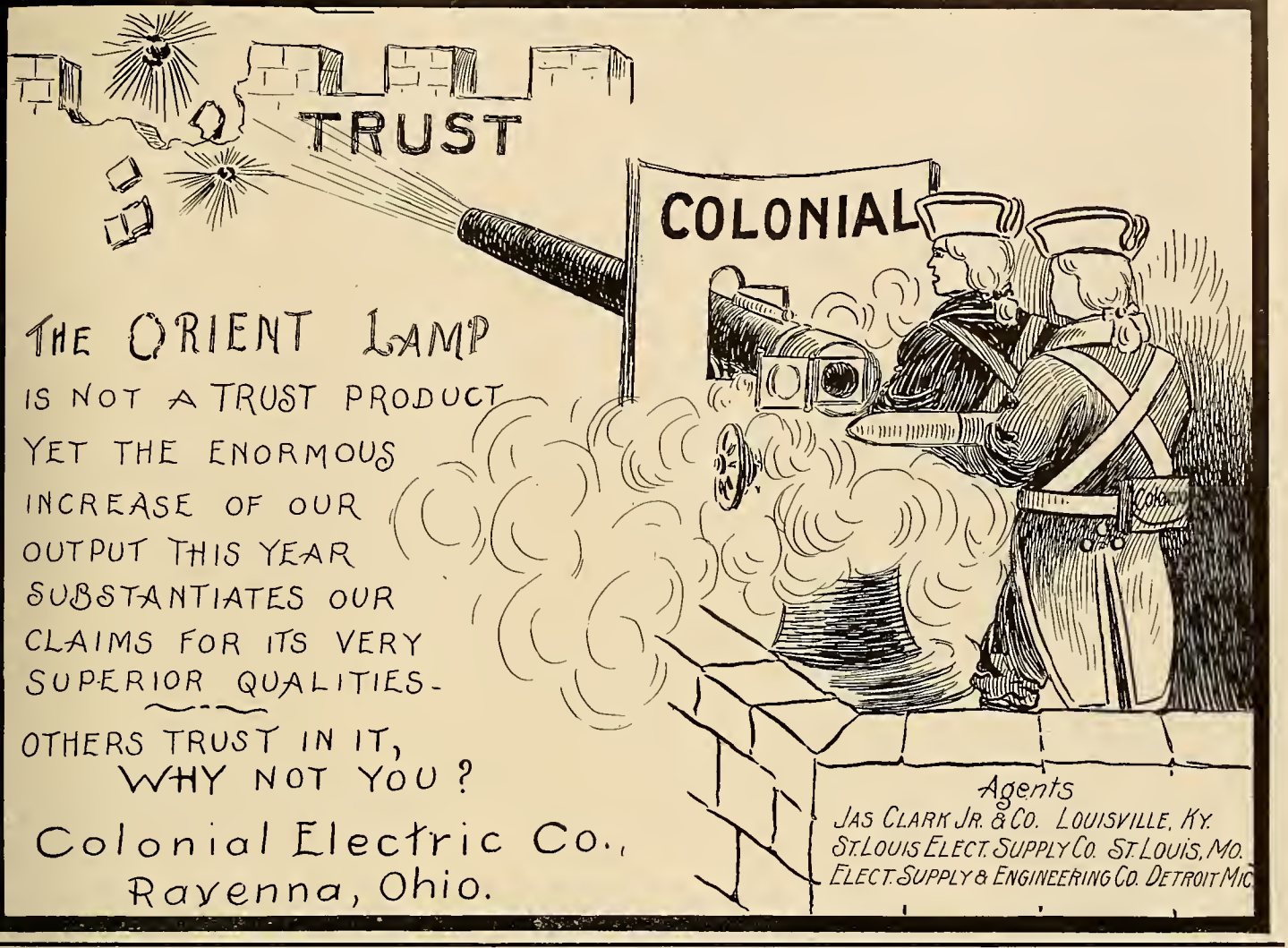

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GENERAL OFFICES, CHICAGO.

ELECTRICAL APPARATUS,

Railway, Lighting, Power Transmission.

IMPROVED DUNCAN INTEGRATING WATTMETERS.

DISTRICT OFFICES:

Boston, Chicago, Cincinnati, Denver, New York, Philadelphia, St. Louis, San Francisco.

NEW TYPE SUNBEAM.

16 Candlepower, 220 Volts.

Superior Quality
Because...

CARBON FILAMENT,
Purest and Most Uniform.

VACUUM,
More Perfect.

MATERIALS,
Highest Quality.

WORKMANSHIP,
Skilled Labor Employed.

TESTS,
Carefully Made.

High and Low Voltages Equally Efficient.

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CHICAGO. NEW YORK.

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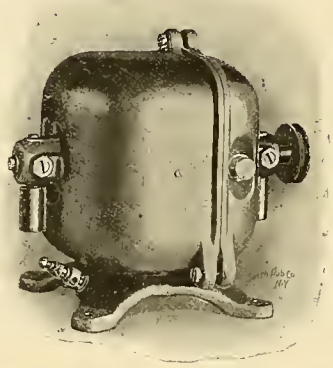
ANTWERP, 32 Rue Boudewyns.
PARIS, 46 Avenue de Breteuil.

St. Paul, Minn., American Electric Co., Northwestern Agents.
ST. LOUIS OFFICE, Security Building, ST. LOUIS, MO.

DIEHL

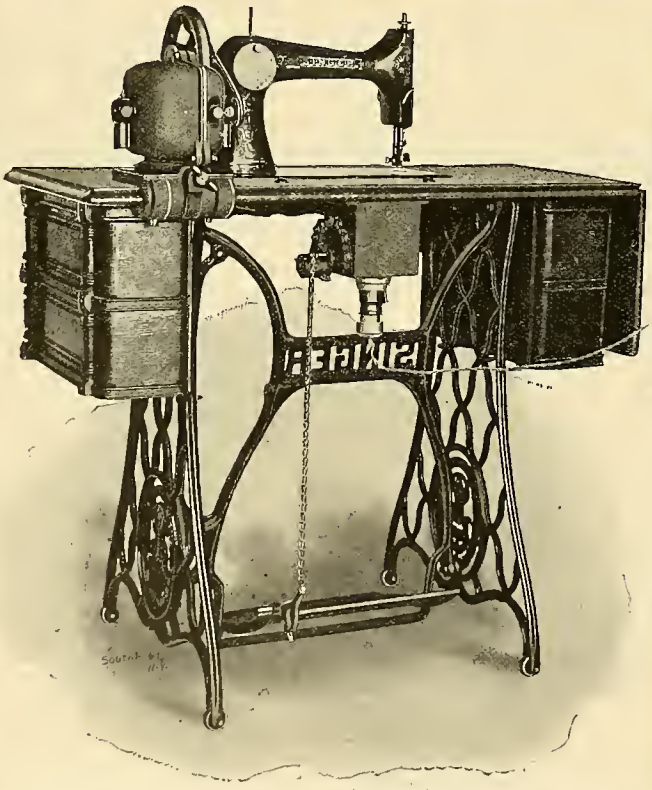
SMALL MOTORS FOR SEWING MACHINES AND SPECIAL PURPOSES.

Highly Efficient. Durable and Serviceable. Iron Clad Armature.



Applicable for any purpose where small machines are required.

HARD-DRAWN COPPER COMMUTATOR BARS.
SELF-ALIGNING AND SELF-OILING BEARINGS.



Iron Clad Motor operating sewing machine. Different speeds obtained by pressing treadle downward. Current automatically cut off by removing pressure from treadle. Motor and regulator easily installed on any make of machine.

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OKONITE IT NEVER DISAPPOINTS

PROTECTION

is one of the most important factors in the *economical operation* of a

Telephone Plant.

OUR LINE OF

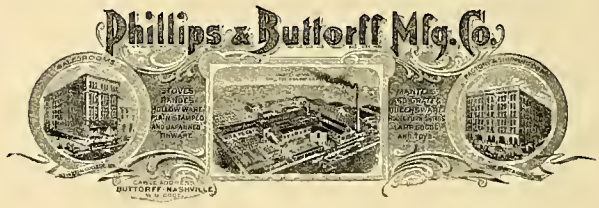
LIGHTNING ARRESTERS,
Sneak-Current Arresters,
Single and Double Pole Fuse-Blocks,
Fuses and Fuse Wires
IS COMPLETE AND CORRECTLY PRICED.

FOR TELEPHONE CONSTRUCTION
Okonite Wires,
Cables and Conductors
ARE STANDARD.

CENTRAL ELECTRIC CO.,

264-266-268-270 Fifth Avenue,
CHICAGO.

OUR SELF-STARTING SINGLE-PHASE A. C. MOTORS AND WHAT A CUSTOMER THINKS OF THEM.



Nashville, Tenn. June 1, 1900.

Mr. Jas. Shingleton.
Dear Sir—

The Four Wagner Motors you installed in our Mark shop last Summer, have proven satisfactory in every respect, not requiring any attention whatever, and the current consumption has been remarkably low, exceeding our most sanguine expectations.

Yours Truly
Phillips & Buttorff Mfg. Co.
P. B. Buttorff

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FOREIGN DEPARTMENT, Havemeyer Bldg., New York City.

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Drug and Chemical Works,
Laboratories---Water Chemists.
Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

29, 30, 31, 32 and 33 RIALTO BUILDING, CHICAGO, ILL.

Kokomo Telephones for 1900.

New Tubular Arm; No Cord In Sight.
High-Grade Full Nickel-Plated Bell,
Bipolar Receiver, together with the

Kokomo Long-Distance Transmitter,

Making up the most efficient Telephone on the market for Exchange and Toll-line work. We have improved the Telephone, also the price, to a point that will interest you. Write us for information.

KOKOMO TELEPHONE & ELECTRIC MFG. CO.,
KOKOMO, IND.

Prompt Shipments.

DESK AND CEILING FANS, 1900 MODELS.

Send for Catalogue 2110.

THE EMERSON ELECTRIC MFG. CO.,

Main Office and Factory, ST. LOUIS, MO.

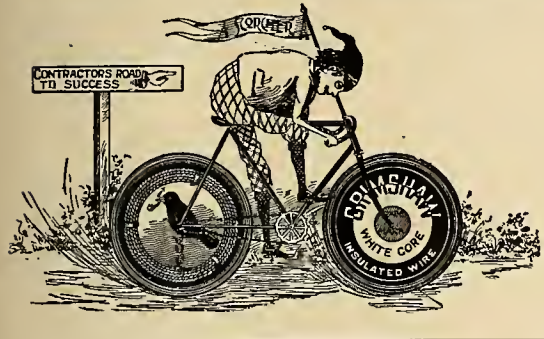
Eastern Office and Warehouse, 136 Liberty St., NEW YORK CITY.

This Trade-Mark

on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Cut-Outs Knife Switches, Jenkins Snap Switches, etc.

Guarantees Satisfaction

PHILADELPHIA. H. T. PAISTE CO. CHICAGO.



Grimshaw White Core,

RAVEN WHITE CORE, RAVEN BLACK CORE, COMPETITION LINE WIRE, GRIMSHAW AND COMPETITION TAPES AND SPLICING COMPOUNDS.

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MAIN OFFICE: 12-17 Cortlandt St., New York.
BRANCHES: CHICAGO: 320 Dearborn St. BOSTON: 134 Congress St. SAN FRANCISCO: 71 Flood Building

Both Alternating and Direct Current Apparatus.

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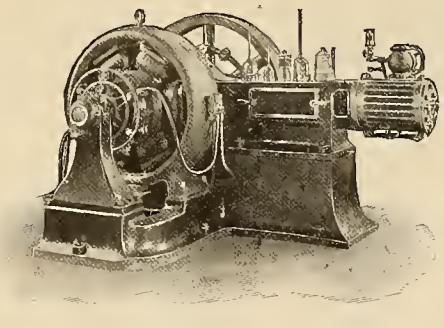

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Power Plants for the Longest Distances. Mining Equipments. Factory and Shop Equipments. Lighting and Railway Machinery. S. K. C. and Northern Systems.

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PITTSFIELD, MASS.

NORTHERN ELECTRICAL MFG. CO.,
MADISON, WIS.

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10
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10
THOUSAND CUSTOMERS.

AMERICA'S LARGEST ELECTRICAL SUPPLY HOUSE.

ELECTRIC APPLIANCE COMPANY, Chicago.

McINTIRE JOINTS.

AMERICAN JOINTS.

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MICA
IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.
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M·I·C· COMPOUND UNEQUALED.
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NEW YORK OFFICE, 50 Dey St.
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When you see "McRoy" on a conduit there's no doubt about the quality.
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138 WASHINGTON ST., CHICAGO

AMERICAN BATTERY COMPOUND
For all Zinc-Carbon Cells.

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THE PERFECT BATTERY SALT
For all Open-Circuit Work.

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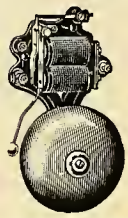

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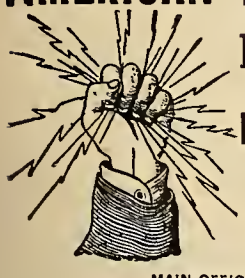

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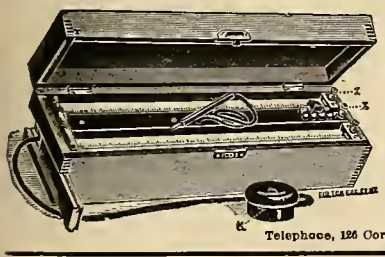

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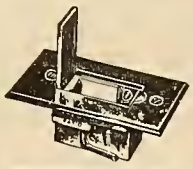

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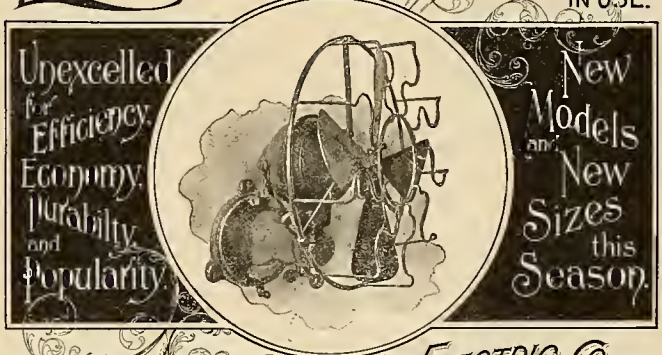

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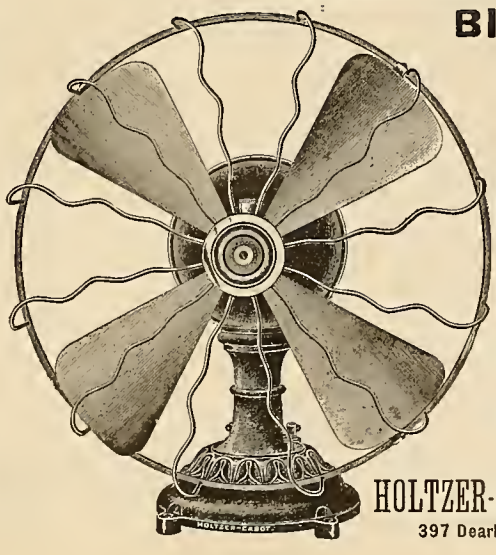

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1 50-light Bain, self-oiler.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 50-light C. & C., self-oiler.
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1 80-light Wood, self-oiler.
1 110-light Edison, 6 K. W., compound.
1 90-light Westinghouse.
1 160-light Rockford.
1 210-light Triumph, self-oiler.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp., self-oiler.
1 250-light Siemens & Halske, 15 K. W., multipolar.
1 260-light National, compound, self-oiler.
1 270-light T.-H., comp., self-oiler.
3 270-light Westinghouse, M. P., slow speed.
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2 350-light Hawkeye, comp. wound.
1 350-light National, self-oiler, compound.
1 350-light Rockford, self-oiler, compound.
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3 250-light Edison, 20 K. W., self-oilers.
1 350-light Edison, 20 K. W., self-oiler, compound.
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4 540-light Edison, 30 K. W., self-oilers.
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1 12 K. W. Westinghouse, multipolar, self oiler.
1 25 K. W. Edison, self-oiler.
1 35 K. W. E. & C., multipolar, slow speed.
1 45 K. W. Edison, self-oiler, new arm't, compound.
1 50 K. W. Westinghouse, self-oiler, horizontal type, compound.
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1 25 K. W. Edison, self-oiler.
1 30 K. W. Jenney, self-oiler.
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1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
1 650-light Thomson-Houston, A. 35, s. o., composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp.
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1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
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1 25-light 2000 C. P. T.-H., ring armature.
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2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
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1 45-light 1200 C. P. T.-H., M. 12, ring armt.
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1 50-light 2000 C. P. West. Elec., self-oiler.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
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1 1 H. P. Roth, self-oiler, new armature.
2 1 H. P. Edison, ¾ K. W., self-oilers.
1 1 H. P. Lundell, self-oiler.
1 1½ H. P. C. & C., self-oiler.
1 2 H. P. Bernard, self-oiler.
1 3 H. P. Hawkeye.
1 3 H. P. Westinghouse.
1 3 H. P. Jenney, self-oiler.

110 Volt Motors.—Continued.

1 3 H. P. Bain, self-oiler.
1 3 H. P. Nowotny, self-oiler.
1 5 H. P. Wood.
1 3 H. P. Card, self-oiler, Manchester type.
1 3 H. P. C. & C., self-oiler.

220-Volt Motors.

1 1 H. P. Eddy, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P.
1 3 H. P. Kester, self-oiler.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
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1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 15 H. P. Westinghouse, multipolar, self-oiler, 15 K. W.
1 30 H. P. Edison, 25 K. W., self-oiler.
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1 1 H. P. C. & C., self-oiler.
1 2½ H. P. Wood, self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 5 H. P. D. & D.
1 7½ H. P. Edison, self-oiler.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
2 18 H. P. C. & C., self-oilers.
1 20 H. P. Commercial, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler
1 40 H. P. Mather, self-oiler.
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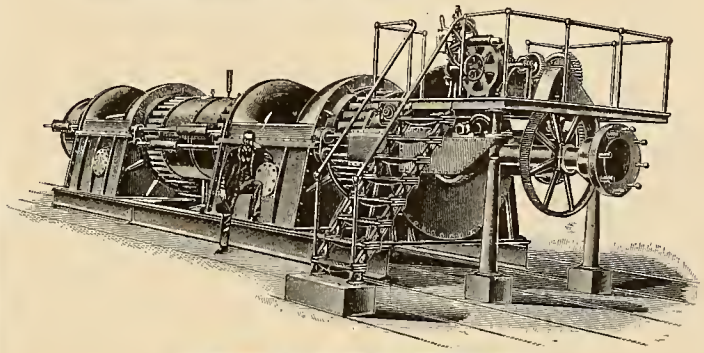

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One 12x12 Armington & Sims automatic engine.
One 12x12 Ideal automatic engine.
One 250 h. p. Baragwanath feed-water heater.
One Stilwell-Bierce live steam heater and purifier.
One 150 h. p. Berryman heater.
One 125 h. p. Baragwanath heater.
One 500 h. p. Hanover independent condenser.
Two 72x16 horizontal tubular boilers.
One 60x18 horizontal tubular boiler.
Two 60x16 horizontal tubular boilers.
Five 54x16 horizontal tubular boilers.
Two 54x14 horizontal tubular boilers.
Two 48x16 horizontal tubular boilers.
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Ten Hill friction-clutch pulleys, 52x22x6 inch bore, double arm, double crown, double belt.
3 Thompson recording wattmeters, 10 ampere.
2 Thompson recording wattmeters, 15 ampere.
2 Thompson recording wattmeters, 25 ampere.
1 12x24 engine made by Zeahm Bros.
1 20x22 Corliss engine.
1 9x12 center crank engine.
1 12x12 center crank engine.
1 7x10 slide valve center crank.
1 3x5 upright engine.
1 80 h. p. A. B. Farquahar Co. engine.
1 horizontal pattern Lansing engine, 12-in. stroke.
1 10x18 stationary engine.
1 12x20 Sinker & Davis engine.
1 diamond drill, Bullock Mfg. Co., capacity 1500 ft.
1 Crane passenger elevator.
1 14x24 box bed engine.
1 E. P. Allis coil heater for 80 h. p. engine.
1 25 h. p. Portable engine and boiler.
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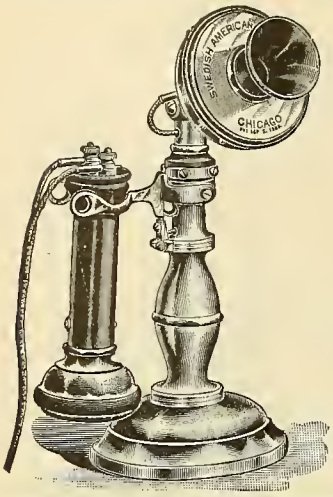

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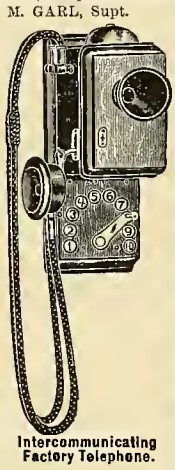

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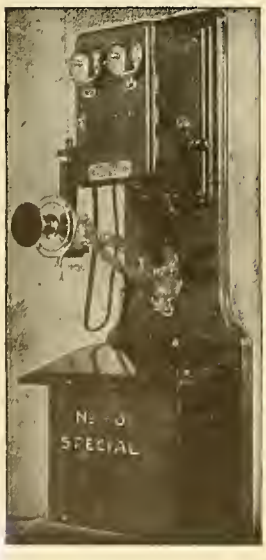

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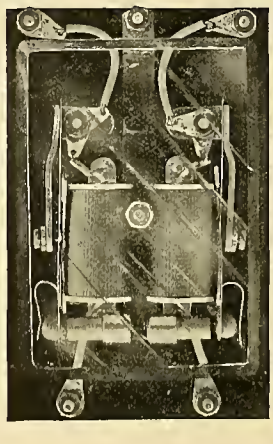

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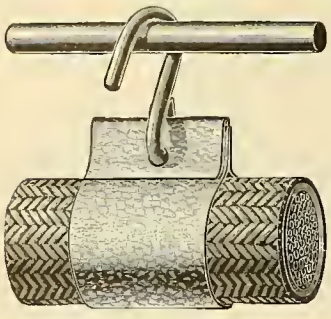

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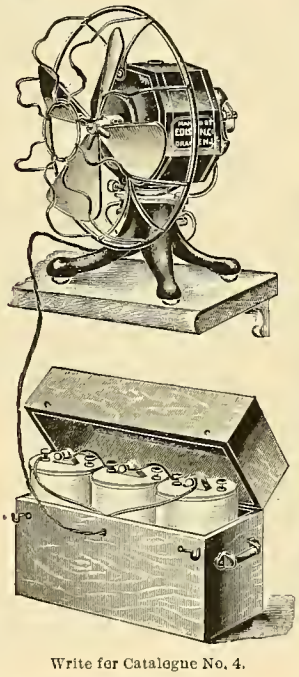

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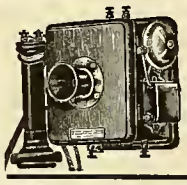

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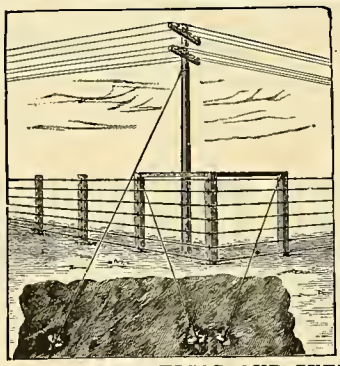

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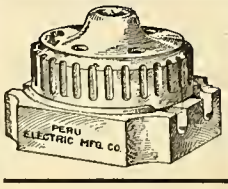

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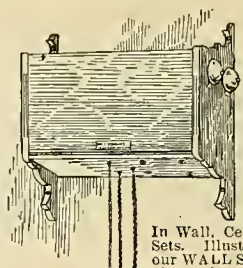

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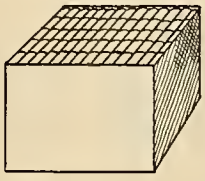

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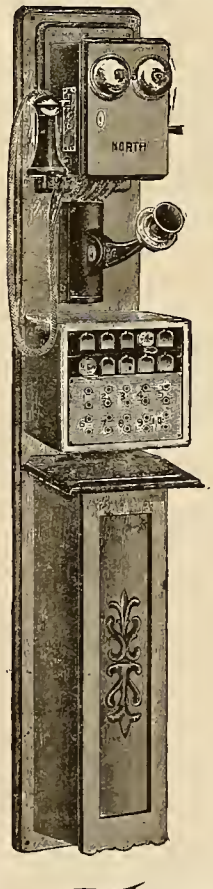

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6 " 18 "	398	6 " 35 "	1,000	8 " 55 "	
4 " 20 "	4,481	8 " 35 "	147	6 " 60 "	
5 " 20 "	3,474	6 " 40 "	300	7 " 60 "	
6 " 20 "	1,234	7 " 40 "	300	8 " 60 "	
7 " 20 "	127	8 " 40 "	44	6 " 65 "	
4 " 25 "	7,050	6 " 45 "	130	7 " 65 "	3
5 " 25 "	6,000	7 " 50 "	150	7 " 70 "	1
6 " 25 "	3,000	8 " 50 "			

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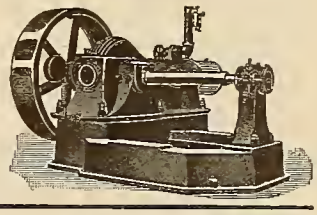

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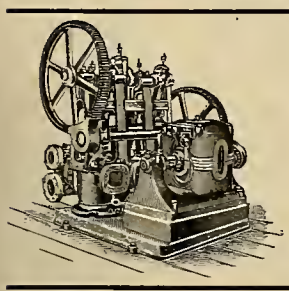

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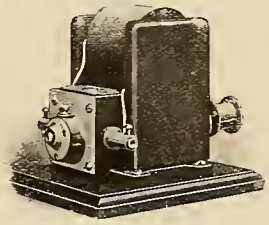

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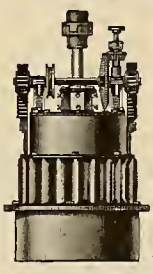

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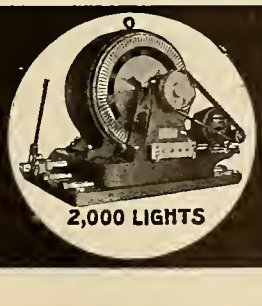

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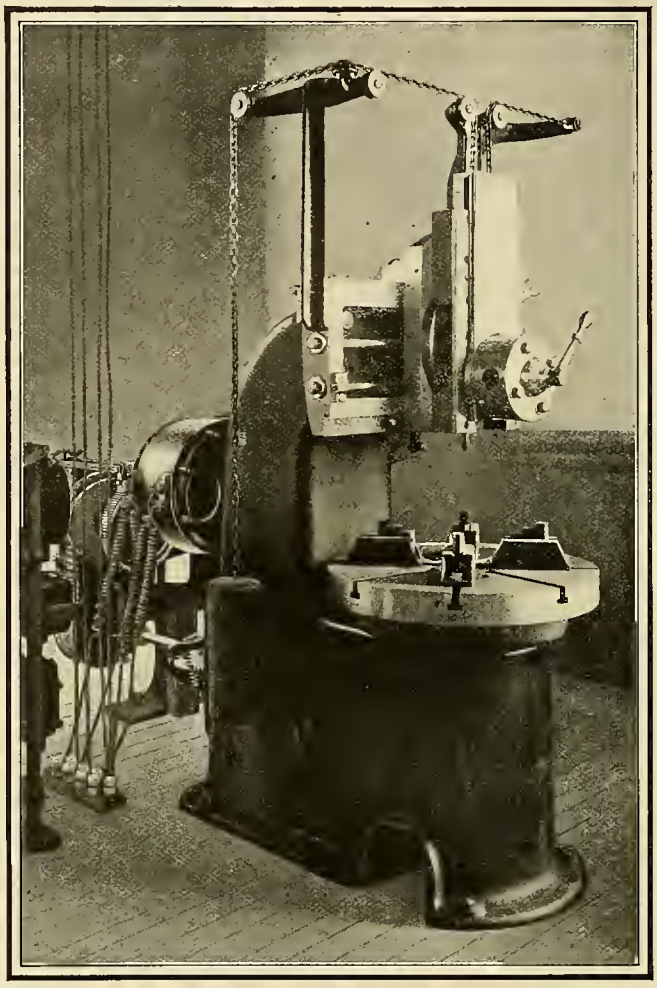

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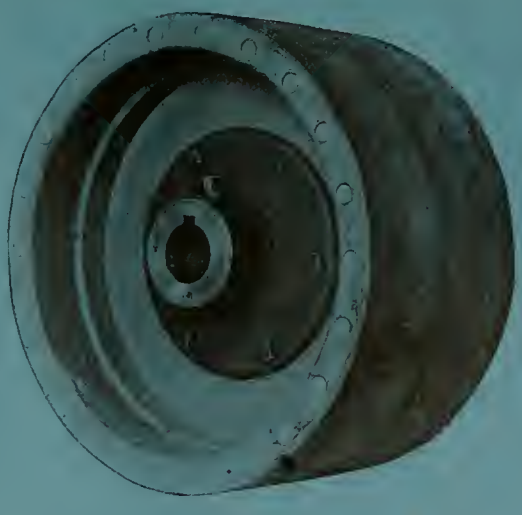

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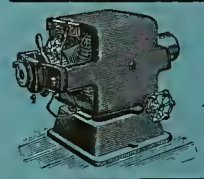

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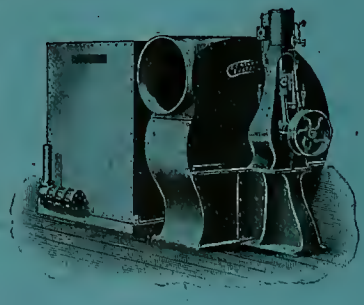

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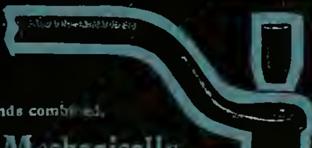

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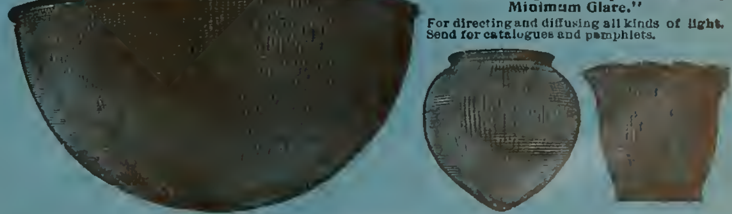

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Not an EXPERIMENT, but a TRIED and PROVED SUCCESS.

Over 20,000 De DION-BOUTON MOTORS operating Motorcycles and Motorettes.

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COLORED LACQUERS, FOR INCANDESCENT LAMPS.

In brilliant rainbow colors. Easily applied. Will not peel or fade.

DEAD BLACK LACQUER, FOR METAL WORK.

Most Satisfactory Imitation of Bauer-Barff in the Market.

SAMPLES FREE. **M. L. BARRETT & CO., CHICAGO.** WRITE TO US.

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PARAGON

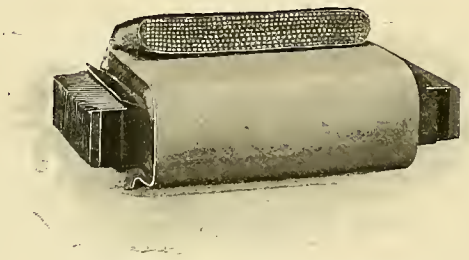
CHICAGO EDISON COMPANY, 139 ADAMS ST., CHICAGO.

FAN MOTORS

THE GENERAL ELECTRIC COMPANY'S

TYPE H

Oil Transformers



Coils of Type H Transformer.

Have compact form of winding which prevents vibration and presents large radiating surface to the oil. Therefore the insulation is permanent and the temperature rise small.

A careful test will reveal many other excellent qualities.

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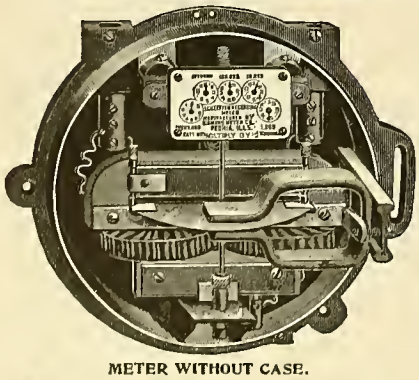

METER WITHOUT CASE.

Accurate on All Loads.
Will Start and Register Correctly on 5 Watts.
Shunt loss LESS than one Watt on 60 Cycles.
Dust Proof.
Correct on All Inductive Loads.

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PEORIA, ILL., U. S. A.

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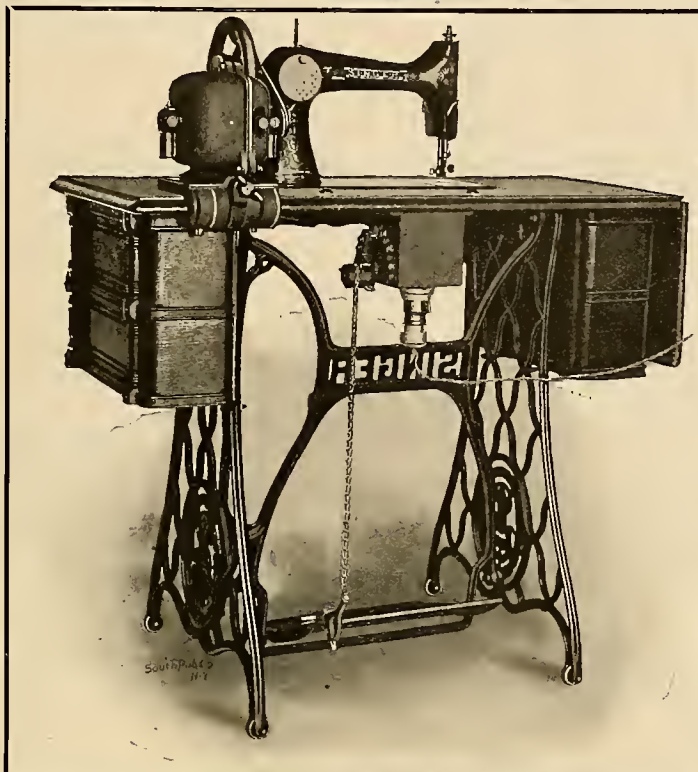
Iron Clad Armature.

Hard Drawn Copper Commutator Bars.

Self-Aligning and Self-Oiling Bronze Bearings.



Iron-Clad Motor Operating Sewing Machine. Different speeds obtained by pressing treadle downward. Current automatically cut off by removing pressure from treadle.

Applicable for any Purpose Where Small Machines Are Required.

Motor and Regulator Easily Installed On Any Make of Machine.

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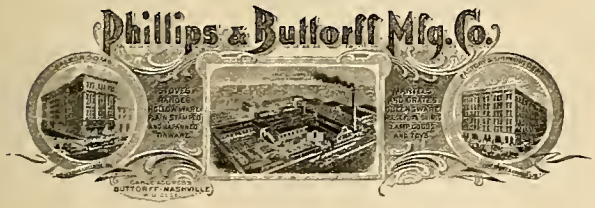
OUR SELF-STARTING SINGLE-PHASE A. C. MOTORS AND WHAT A CUSTOMER THINKS OF THEM.



Nashville, Tenn Jan 1, 1900

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The Four Wagner Motors you installed in our Work shop last Summer, have proven satisfactory in every respect, not requiring any attention whatever, and the current consumption has been remarkably low, exceeding our most sanguine expectations.

Yours Truly
Phillips & Buttorff Mfg Co
F. J. Buttorff

WRITE FOR BULLETINS "Z 24, 35, 37 and 39."

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PROTECTION

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Sneak-Current Arresters,
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10-inch Globe with full size Carbon.
Artistic in design, light in weight, and mechanically perfect.
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Switchboards, Panel Boards and Knife Switches.

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Western Elec. Supply Co.

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Belting.
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Leather Preserver Mfg. Corp.

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General Electrical Repair Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.

Burglar Alarms.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Elect. Supply Co.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
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General Electric Co.
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Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

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Hodge-Walsh Elec. Eng. Co.
Western Electric Co.

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Warren Elec. Mfg. Co.
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Standard Underground C. Co.

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Blue Ridge Locust Pin Co.
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Independent Tel. Supply Co.
Indpls. Arm, Brack. & Pin Co.
Kans. City & So. Lum. Co.
Leavitt, R. B.
Tennent Insulator Pin Co.
Texas Arm & Pin Co.
Valentine-Clark Co., The.
Western Elect. Supply Co.

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Westinghouse El. & Mfg. Co.

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Iron Clad Resistance Co.

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Diehl Manufacturing Co.
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General Electric Co.
General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
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Arnold El. Power Station Co.
Bain, Foree.
Bodge-Walsh Elec. Eng. Co.
Bumphrey, Beury H.
Sargent & Lundy.
Wagner, Herbert A.

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American El. Specialty Co.
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Jeffrey Mfg. Co.
Link Belt Machinery Co.

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Ball Engine Co.
Camp Engineering Co.
Chicago House Wrecking Co.
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American District Steam Co.

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Crocker-Wheeler Company.
Diehl Manufacturing Co.
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Emerson El. Mfg. Co.
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Roth Bros. & Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
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Fire Extinguishers.
Monarch Fire Appliance Co.

Flexible Shafts.
Stow Mfg. Co.

Forges.
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American Elec. Fuse Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
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Visduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Holophane Glass Co.
Phœnix Glass Co.
Western Elect. Supply Co

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heaters (Feed Water).
Kelley & Son, Benj. F.

Heating and Ventilating Apparatus.
Sturtevant Co., B. F.

Holders, Inc. Lamp.
Crescent Mfg. Co.
Vought, M. I.

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Akron Smoking Pipe Co.
Bowers Manufacturing Co.
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Chicago Edison Co.
Chicago Mica Co.
Eagle Paint & Varnish Wks,
Electric Appliance Co.
General Inc. Arc Light Co.
Illinois Insulated Wire Co.
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American Electrical Works.
American Steel & Wire Co.
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Electric Appliance Co.
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Hazard Manufacturing Co.
Illinois Insulated Wire Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
McDermid Mfg. Co.
Miller-Knoblock El. Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

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General Inc. Arc Light Co.

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Barrett & Co., M. L.

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Motors—See Dynamos and Motors.

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Johnston, Thomas J.
Page, Chas. G.

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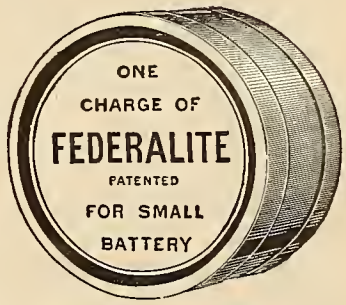

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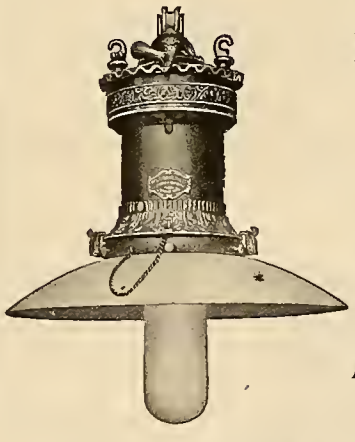

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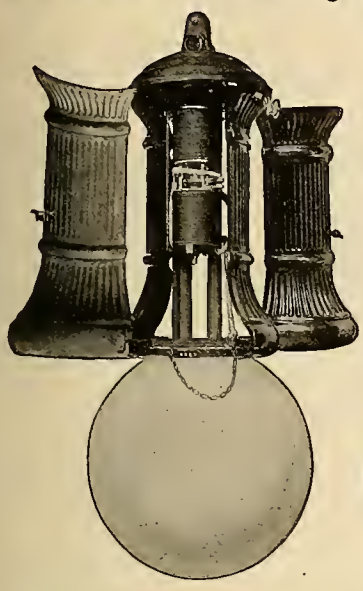

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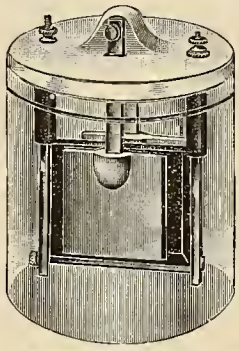

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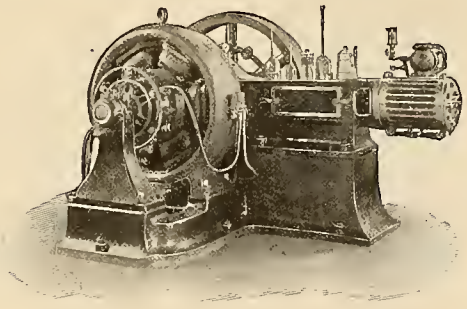

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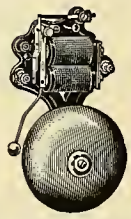

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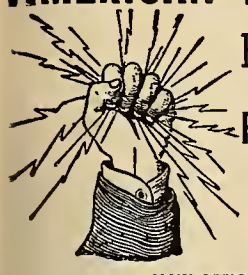

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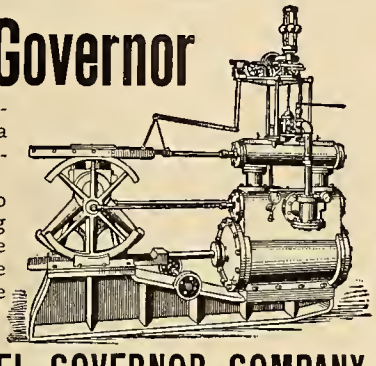

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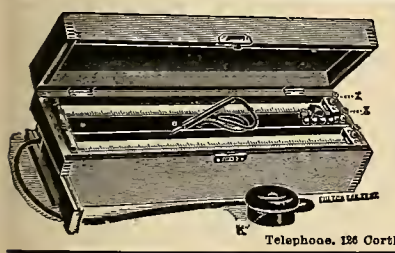

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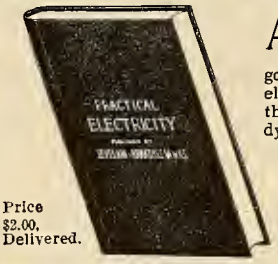

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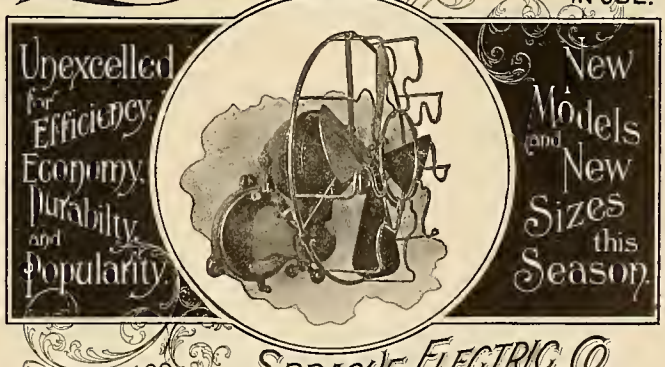

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BECAUSE YOU
Are "well up" in ELECTRICITY, are YOU as well posted in the matter of ECONOMY in your STEAM PLANT?
THE IMPROVED ROBERTSON THOMPSON INDICATOR will show you if engine is working economically and developing full power for amount of fuel consumed. The most modern. Fully guaranteed. One-third lower in price than others.
EUREKA PACKING makes a tighter joint with less friction, lasts two to three times longer, and costs no more than poor packing. EUREKA has the largest sale of any packing made.
HINE ELIMINATOR, the most successful device for separating water from live steam, and extracting oil from exhaust steam. Thousands in use. Sent out on approval. Prices very low.
ROBERTSON FEED WATER HEATER because of its return system will heat the water to 206 to 210° with exhaust steam, and shows more economy in fuel than any other. Moderate in price.
SEND FOR CATALOGUE.
JAS. L. ROBERTSON & SONS, 198 Fulton Street, New York.
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Electrical Instrument Makers Wanted.

First-class, steady men on ammeter and voltmeter work. Must thoroughly understand the work. Write

42 Center Street, Lynn, Mass.

WANTED TO BUY.

We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

CAMP ENGINEERING CO.,

18 South Canal Street, Chicago, Ill.

FOR SALE CHEAP.

Dr. J. S. Romine of Chadron, Neb., will sell $10,000 stock of Chadron Electric Light and Power Co. for $3,000 cash; balance stock, $4,000, held by J. D. Bacon of Chadron, a retired banker, he will sell on account of my selling, for $2,000 cash or on time, or keep his stock. Plant cost over $16,000; no bonds, mortgages or debts; no other light plant; city contract. Coal, $2.95 per ton. Pure city spring water. City of 3,000, healthy, good school, academy, six churches. Business can be greatly increased. Reason for selling, age and business keep me away all the time.

WE BUY AND SELL

SECOND-HAND ELECTRICAL MACHINERY.

WALSH'S SONS & CO.,

250 WASHINGTON ST., NEWARK, N. J.

WANTED.

An electrical engineer wishes to connect himself as chief electrician or superintendent of an electric light or power company. Westernly located. Can furnish unquestionable references. Address F. A. DARST, 530 Highland Avenue, Kansas City, Mo.

WANTED: SECOND-HAND APPARATUS.

One Simple Engine, direct connected to 75 K. W., 125 volt generator.

One Simple Engine, direct connected to 45 K. W., 125 volt generator.

Two 125 H.-P. Horizontal Water Tube Boilers.

Two 100 H.-P. Horizontal Tubular Boilers, for 100 pounds' steam pressure.

Give prices on apparatus, with capacities ranging near the above. State condition, type, maker's name and where it can be seen. Address

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209½ Main St. STREATOR, ILL.

Pratt Institute

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TWO YEAR COURSES IN

APPLIED ELECTRICITY

AND IN

STEAM & MACHINE DESIGN

Write for Catalogue and Particulars.

AUCTION SALE.——BANKRUPT SALE.

Entire Property of The Suburban Electric Co., Covington, Ky., Offered For Sale.

Notice is hereby given that pursuant to an order in bankruptcy, in the matter of the Suburban Electric Company, a corporation organized under the laws of the state of Kentucky, bankrupt, No. 276, in the District Court of the United States for the District of Kentucky, I will, on the 25th day of September, 1900, at 10 o'clock a. m., at the Scott street entrance of the United States Court in Covington, Ky., sell at public auction to the highest bidder, all the property, real and personal, of every kind and description belonging to the Suburban Electric Company, bankrupt, including all the rights, privileges and franchises, except the franchise to be a corporation, and also its electric lighting plant, power station, machinery, engines, boilers, dynamos, electric machines, electric lamps and other appliances and appurtenances, poles, lines, wires and all contracts, claims and demands, and all other property of every kind and description, also the following described real estate belonging to the said bankrupt, situated in the city of Covington, Kenton County, Kentucky, and bounded as follows:

1. Beginning at a point on the east line of Madison avenue at the northeast corner of Madison avenue and an alley running parallel to and between Fourth and Fifth streets; thence northwardly along the east line of said Madison avenue towards Fourth street ninety (90) feet; thence at right angles to Madison avenue one hundred and ninety (190) feet to another alley; thence with said other alley and at right angles to said first-named alley ninety (90) feet to said first-named alley; thence westwardly along the same one hundred and ninety (190) feet to the place of beginning.

And also the following described piece of real estate belonging to said bankrupt, situated in the city of Newport, Campbell County, Kentucky, to wit:

2. Lot No. 260 in the Cotes Brilliaut Lot & Home Company's subdivision, fronting thirty (30) feet on the west side of Park avenue, and extending back one hundred and twenty (120) feet to an alley.

The first tract of real estate above described will be sold subject to such lien as Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, or either of them, may have upon said real estate, which lien is as yet undetermined in amount.

The property above described will be sold free from any and all liens or encumbrances, except the lien or encumbrance in favor of Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, upon the said first described real estate aforesaid.

The second piece of real estate described aforesaid will be sold separately.

All the balance of the real estate, and all the other property and assets of every kind, and the rights, privileges and franchises of the Suburban Electric Company will be sold as an entirety and as a going concern.

The terms of the sale will be one-third (⅓) cash, to be paid upon the confirmation of the sale, the balance in equal installments of six and twelve months from date of sale, deferred payments to draw six (6%) per cent interest and to be secured by lien upon the property sold and also by bond with sureties satisfactory to the referee in bankruptcy herein; or purchaser may pay cash for said property upon the confirmation of the sale. No bid for said property will be received from any bidder who shall not place in the hands of the undersigned at the time of making said bid, as a pledge that said bidder will make good his bid if the sale is confirmed, the sum of fifteen thousand ($15,000) dollars, which sum of fifteen thousand dollars will be credited upon the first payment of the purchase money for said sale.

Inspection of property invited. Full information given upon application at the office of the bankrupt in Covington, Ky.

CHARLES H. SHAW,
Trustee in Bankruptcy of the Suburban Electric Company.

SIMRALL & GALVIN,
Attorneys for Trustee in Bankruptcy.

$400.00 Each.

Two 60-Light, 10-Ampere, Western Electric Arc Dynamos,

complete with automatic regulators, switchboard and instruments. Also two extra armatures, each $150.00.

100 narrow frame lamps, single rod, each $4.00.

Rose Electric Co., St. Louis, Mo.

FOR SALE.

Lot second-hand material. About 7,000 Westinghouse 110-volt lamps, little used; about 400 Doz. West sockets, 500 Doz. genuine K. W. Rosette cut-outs, 300 Doz S. M. cut-outs, plain mostly. Paiste switches and other material. Address

G. W. EDGEWORTH,

8 S. Commercial St., ST. LOUIS.

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ARE THE BEST. Send for descriptive Circular.

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DYNAMOS, MOTORS, ARC LAMPS, INSTRUMENTS, TRANSFORMERS, TELEPHONES.

EXPERIMENTAL APPARATUS BUILT AND DESIGNED

ROBERT L. McQUAT, REPAIR SHOPS, INDIANAPOLIS, IND.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO.

--FOR SALE--

110-Volt Incandescent Dynamos.

2 12-light Edison, ¾ K. W.
1 16-light Lundell, self-oiler.
1 25-light C. & C., self-oiler.
1 35-light Westinghouse, self-oiler.
1 36-light Bernard, self-oiler.
1 50-light Hawkeye, self-oiler.
1 50-light Bain, self-oiler.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 50-light C. & C., self-oiler.
1 55-light Edison, 3 K. W., self-oiler.
1 80-light Wood, self-oiler.
1 110-light Edison, 6 K. W., compound.
1 90-light Westinghouse.
1 160-light Rockford.
1 210-light Triumph, self-oiler.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp., self-oiler.
1 250-light Siemens & Halske, 15 K. W., multipolar.
1 260-light National, compound, self-oiler.
1 270-light T.-H., comp., self-oiler.
3 270-light Westinghouse, M. P., slow speed,
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp. wound.
1 350-light National, self-oiler, compound.
1 360-light Rockford, self-oiler, compound.
1 350-light Edison, 20 K. W., shunt.
3 350-light Edison, 20 K. W., self-oilers.
1 350-light Edison, 20 K. W., self-oiler, compound.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
1 540-light Edison, 30 K. W.
4 540-light Edison, 30 K. W., self-oilers.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Eickmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers.
1 800-light Rockford, self-oiler, new arm't.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Enz, 80 K. W., M. P., direct connected to 125 H. P., self-oiling, 14x14 engine.

220-Volt Generators.

1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 12 K. W. Westinghouse, multipolar, self oiler.
1 25 K. W. Edison, self-oiler.
1 35 K. W. E. & C., multipolar, slow speed.
1 45 K. W. Edison, self-oiler, new arm't, compound.
1 50 K. W. Westinghouse, self-oiler, horizontal type, compound.
1 200 K. W. Crocker-Wheeler, multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.
1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
1 45 K. W. Edison, compound, self-oiler.
1 150 K. W. Detroit (Rae), multipolar, compound, self-oiler.
1 100 H. P. 500-volt Westinghouse, Kodak set generator and comp. engine.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp.
1 600-light Bain, 30 K. W., self-oiler, toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
1 650-light Thomson-Houston, A. 35, s. o., composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp.
1 1200-light Westinghouse, 60 K. W., self-oiler, compound, toothed arm't.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
2 1400-light Westinghouse, 70 K. W., brand new.
2 5000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oilers, outboard bearings.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 25-light 2000 C. P. T.-H., ball armature,
1 25-light 2000 C. P. T.-H., ring armature.
1 30-light 2000 C. P. Western Electric,

Arc Dynamos.—Continued.

1 30-light 2000 C. P. Brush, No. 7, Steubenrausch commutator.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. g.
4 45-light 1200 C. P. T.-H., M. 12, ball armt.
1 45-light 1200 C. P. T.-H., M. 12, ring armt.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 2000 C. P. Excelsior, latest type, newly rewound field and armature.
2 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 1200 C. P. T.-H., L. D., 12, new ring arm't, self-oiler.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. West. Elec., self-oiler.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse, self-oiler.
3 60-light 2000 C. P. Wood, No. 8.
3 65-light 2000 C. P. Brush, No. 8, new armature, Steubenrausch commutators.
1 75-light 1200 C. P. Standard, self-oiler, air insulated commutator.
2 75-light 2000 C. P. Westingh'se, self-oilers,
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

110-Volt Motors.

1 ¼ H. P. Sprague.
1 ¼ H. P. Elbridge.
1 ½ H. P. Roth.
1 ½ H. P. Keller, self-oiler.
2 1 H. P. Belding, M. P.
1 1 H. P. Roth, self-oiler, new armature.
2 1 H. P. Edison, ¾ K. W., self-oilers.
1 1 H. P. Lundell, self-oiler.
1 1½ H. P. C. & C., self-oiler.
1 2 H. P. Bernard, self-oiler.
1 3 H. P. Hawkeye.
1 3 H. P. Westinghouse.
1 3 H. P. Jenney, self-oiler.

110 Volt Motors.—Continued.

1 3 H. P. Bain, self-oiler.
1 3 H. P. Nowotny, self-oiler.
1 5 H. P. Wood.
1 3 H. P. Card, self-oiler, Manchester type.
1 3 H. P. C. & C., self-oiler.

220-Volt Motors.

1 1 H. P. Eddy, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P.
1 3 H. P. Kester, self-oiler.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 15 H. P. Westinghouse, multipolar, self-oiler, 15 K. W.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 40 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 60 H. P. Edison, self-oiler, 45 K. W.
1 60 H. P. Westinghouse, horizontal type, self-oiler.
1 75 H. P. Sprague, self-oiler, new arm't.

500-Volt Motors.

2 1 H. P. Crocker-Wheeler, self-oilers, slow speed.
1 1 H. P. C. & C., self-oiler.
1 2½ H. P. Wood, self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 5 H. P. D. & D.
1 7½ H. P. Edison, self-oiler.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
2 18 H. P. C. & C., self-oilers.
1 20 H. P. Commercial, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 25 H. P. Jenney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

Alternating-Current Motors.

SINGLE PHASE.

1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
1 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

TRANSFORMERS, METERS AND ARC LAMPS.

NOTICE.—All machines are actually in stock ready for prompt delivery. All machines are guaranteed. Write for particulars and send for MONTHLY BARGAIN SHEET with net cash price.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,

140 S. Clinton St., Chicago.

THE **VIADUCT** CO.
BALTIMORE, MAKE
TELEPHONES
AND EVERYTHING ELECTRICAL

ELECTRICAL ENGINEERING TAUGHT BY MAIL

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BARGAINS in ELECTRICAL MACHINES.

The following list of thoroughly overhauled machines are in stock and ready for prompt delivery.

DYNAMOS—

110-Volt Incandescent.

One 12-light Elbridge.
One 50-light Nowotny, new.
One 100-light Daft.
One 250-light U. S.
One 350-light Davis.
One 800-light G. E.
One 1,800-light Ft. Wayne, new.

DYNAMOS—ARC.

One Brush, 1-light, 3,000 c. p.
One Brush, 3-light, 2,000 c. p.
One Amer. Wood, 20-light, 2,000 c. p.
One West. Elec., 30-light, 2,000 c. p.
One Ft. Wayne Wood, 35-light, 1,200 c. p.
One T. H. L. D., 35-light, 2,000 c. p.

ALTERNATORS.

One 3A Slattery.
One A60 G. E.

STEWART ELECTRICAL CO.,
S. E. Cor. Fifth and Sycamore,
CINCINNATI, O.

GENERATORS.

One Wood b. p., 500 v., 45 k. w.
One T.-H. m.p. 75,500 v., 75 k.w.
One Edison b.p., 500 v., 100 k.w.

110-VOLT MOTORS.

One Diehl, ½ h. p.
One Edison, ¾ h. p.
One Elbridge, ¾ h. p.
One Card, 1 h. p.
One Sprague, 1 h. p.
One Nowotny, 3 h. p.
One Daft, 10 h. p.
One U. S., 20 h. p.
One Q. C., 28 h. p.

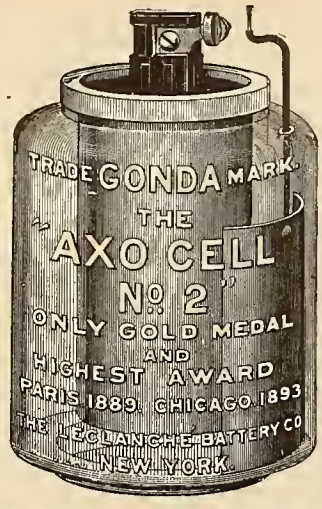
220-VOLT MOTORS.

One Nowotny, 1 h. p., new.
One Nowotny, 1 h. p.
One Davis, 5 h. p.
One Daft, 10 h. p.
One E. R. & C. C., 10 h. p.
One Edison b. p., 15 h. p.

500-VOLT MOTORS.

One Davis, 20 h. p.
One Brush, 25 h. p.
One Wood b. p., 60 h. p.
One T.-H. m. p., 15, 90 h. p.
One Edison, 100 k. w., 120 h. p.

WANTED FOR SPOT CASH
BURNED OUT INCANDESCENT LAMPS AND BASES.
Freight Paid and Highest Prices Guaranteed.
GEO. F. SCHWALM CO., - HARRISON, N. J.



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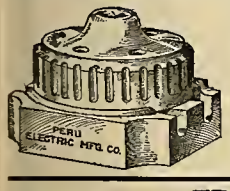

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"PEMCO," the new style Creole rosette. Insulation perfect, long fuse, superior in every detail.

Peru Electric Mfg. Co., Peru, Ind.

NOTE OUR PRICES ON DYNAMOS

COPPER COMMUTATORS GUARANTEED 3 YEARS.

10 LIGHT,	$30	30 LIGHT,	$65	75 LIGHT,	$115
20 "	50	50 "	85	100 "	145

Warranted free from mechanical and electrical defects. Armatures rewound, commutators refilled, machines repaired. All work guaranteed. Send for catalogue.

The Chicago Motor and Dynamo Co., Inc.,
39-43 WEST WASHINGTON ST., CHICAGO, ILL.

FRED H. ALDEN, Pres. **J. GEISEROWICH, Secy. and Treas.**

ILLINOIS INSULATED WIRE CO.,

MANUFACTURERS OF

High-Grade Weatherproof Wire,

WEATHER-PROOF WIRE INDEX BRAND WE SHOW THE WAY

NO TRUST PRICES. **SYCAMORE, ILL.** **ALL SAMPLES FREE.**

Machinery and Supplies at Bargain Prices.

We have the largest establishment of its kind on earth. Our plant and yards cover over a million feet of space. We are constantly buying factories and buildings. OUR MACHINERY HALL, a space 105x360 feet, is filled to overflowing with a complete assortment of machinery and electrical apparatus. WE PURCHASED THE OMAHA EXPOSITION, THE WORLD'S FAIR, THE CHICAGO POSTOFFICE BUILDINGS, ETC. Our facilities for rebuilding machinery are unsurpassed. We furnish a binding guarantee with all goods purchased. Our stock is constantly being added to. The following items are quoted, subject to prior sale:

One No. 8 Multipolar Machine, 75 K.W., 500-volt, speed 750, 150 to 160 h. p., Thomson-Houston.
One Allis Corliss engine, 26x48 in., 400 h. p.
One Replogle Electric Water-Wheel Governor.
One No. 1 Russell high-speed auto. engine, 7x16.
One 60 arc light Wood dynamo, 2,000 c. p.
One 620-light General Electric dynamo with 52-volt exciter.
38 assorted Transformers.
One Station Transformer and Ground Tester with three miles of Nos. 4 and 6 Weatherproof Wire.
One Westinghouse Alternator and Fan Motor, 16,000 alt., 100 volts.
One 14x24 Box Bed engine, shaft 8 ft. long, 6½ in. diam.
One M. P. 80 T.-H., 500-volt Railway Generator.
One D. 62 T.-H. 500-volt Railway Generator.
Two 25 S. S., v. 500, speed 900, Nos. 1041 and 1039 T.-H. Railway Generator.
One 15x14 Ideal engine.
One 14x14 Ideal engine.
One 12x18 Lansing engine.
One 25-light, 2,000 c. p. Westinghouse low-tension arc dynamo.
Two 50-light Standard arc dynamos.
One 20-light Sperry arc dynamo.
One 500-light, 100-volt Edison dynamo.
One 1,000-light 1,000-volt Wood Ft. Wayne alternating dynamo, complete with switchboard and exciter.
One 1,000-light, 1,000-volt Westinghouse dynamo, complete with switchboard and exciter.
One 1,200-light Slattery alternating dynamo.
One portable Weston ammeter, reading from 0 to 150.
Two Thompson alternating ammeters, reading from 0 to 100.
Fifty 10, 20, 40 and 80 ampere Westinghouse house meters.
200 series arc lamps, different makes.
Rubber-covered, weatherproof and bare copper wire.
5,000 assorted sizes clear and opal arc globes.
One 18x42 Frick Corliss engine.
One 20x32 Watertown automatic engine.
One 18x28 Watertown automatic engine.
One 12x20x14 Ball compound engine.
One 9½x16x14 Payne compound engine.
One Armington & Sims cross-compound condensing engine, 30x20x15.
One 15x14 Ideal automatic engine.
One 14½x13 Armington & Sims auto. engine.
One 12x21 Buckeye automatic engine.
One 12x12 Armington & Sims automatic engine.
One 12x12 Ideal automatic engine.
One 250 h. p. Baragwanath feed-water heater.
One Stilwell-Bierce live steam heater and purifier.
One 150 h. p. Berryman heater.
One 125 h. p. Baragwanath heater.
One 500 h. p. Hanover independent condenser.
Two 72x16 horizontal tubular boilers.
One 60x18 horizontal tubular boiler.
Two 60x16 horizontal tubular boilers.
Five 54x16. horizontal tubular boilers.
Two 54x14 horizontal tubular boilers.
Two 48x16 horizontal tubular boilers.
Two 48x14 horizontal tubular boilers.
Ten Hill friction-clutch pulleys, 52x22x6 inch bore, double arm, double crown, double belt.
3 Thompson recording wattmeters, 10 ampere.
2 Thompson recording wattmeters, 15 ampere.
2 Thompson recording wattmeters, 25 ampere.
1 12x24 engine made by Zeahm Bros.
1 20x22 Corliss engine.
1 9x12 center crank engine.
1 12x12 center crank engine.
1 7x10 slide valve center crank.
1 3x5 upright engine.
1 80 h. p. A. B. Farquahar Co. engine.
1 horizontal pattern Lansing engine, 12-in. stroke.
1 10x18 stationary engine.
1 12x20 Sinker & Davis engine.
1 diamond drill, Bullock Mfg. Co., capacity 1500 ft.
1 Crane passenger elevator.
1 14x24 box bed engine.
1 E. P. Allis coil heater for 80 h. p. engine.
1 25 h. p. Portable engine and boiler.
1 Atlas automatic engine, 9x14.
1 New York safety engine, 9x10.
1 30 h. p. stationary engine.
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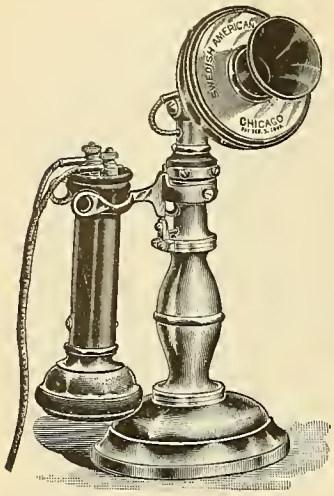

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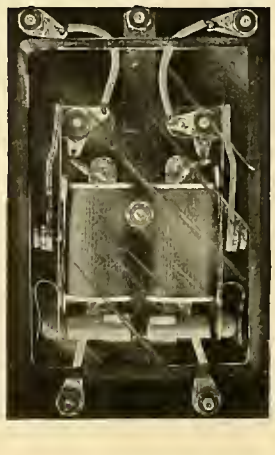

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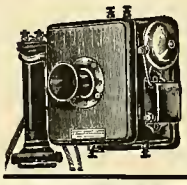

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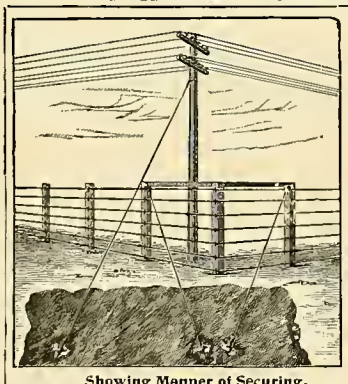

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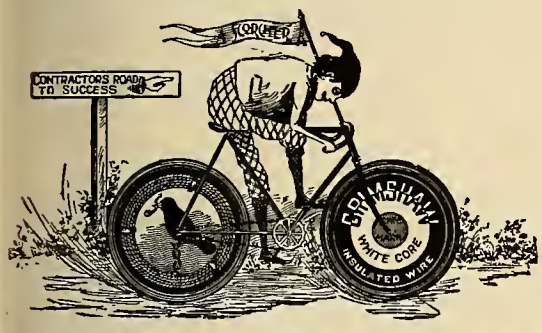

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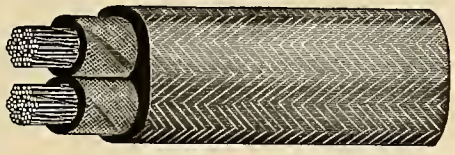

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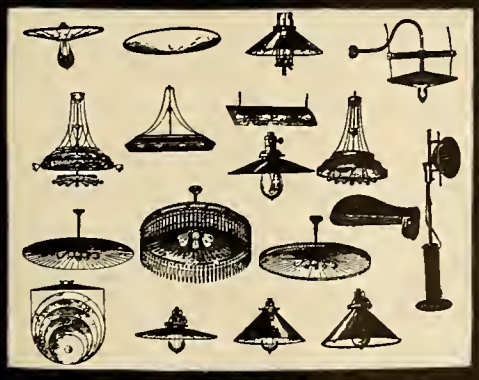

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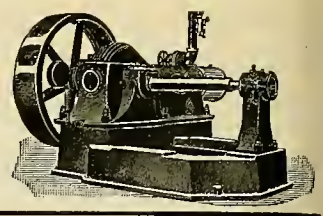

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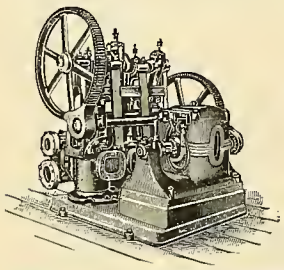

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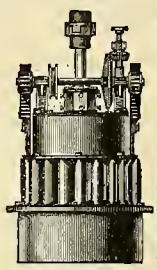

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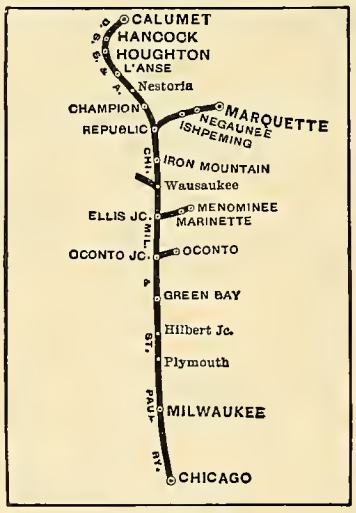

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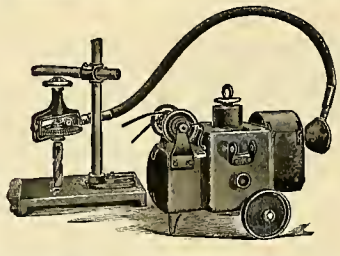

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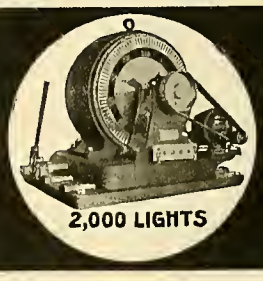

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5 " 18 "	1,048	8 " 30 "	120	7 " 55 "	124
6 " 18 "	398	6 " 35 "	1,000	8 " 55 "	
4 " 20 "	4,481	8 " 35 "	147	6 " 60 "	
5 " 20 "	3,474	6 " 40 "	300	7 " 60 "	
6 " 20 "	1,234	7 " 40 "	300	8 " 60 "	
7 " 20 "	127	8 " 40 "	44	6 " 65 "	
4 " 25 "	7,050	6 " 45 "	130	7 " 65 "	3
5 " 25 "	6,000	7 " 50 "	150	7 " 70 "	1
6 " 25 "	3,000	8 " 50 "			

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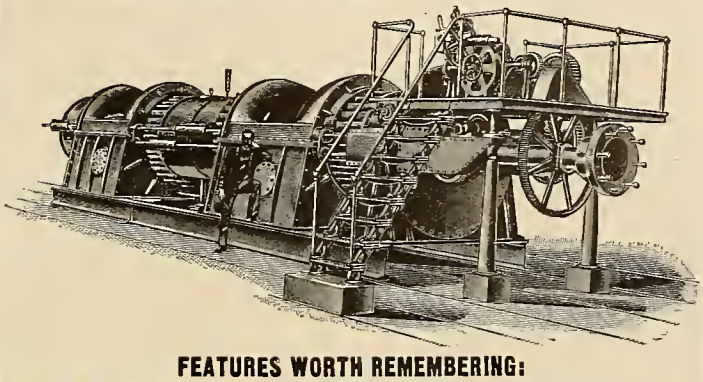

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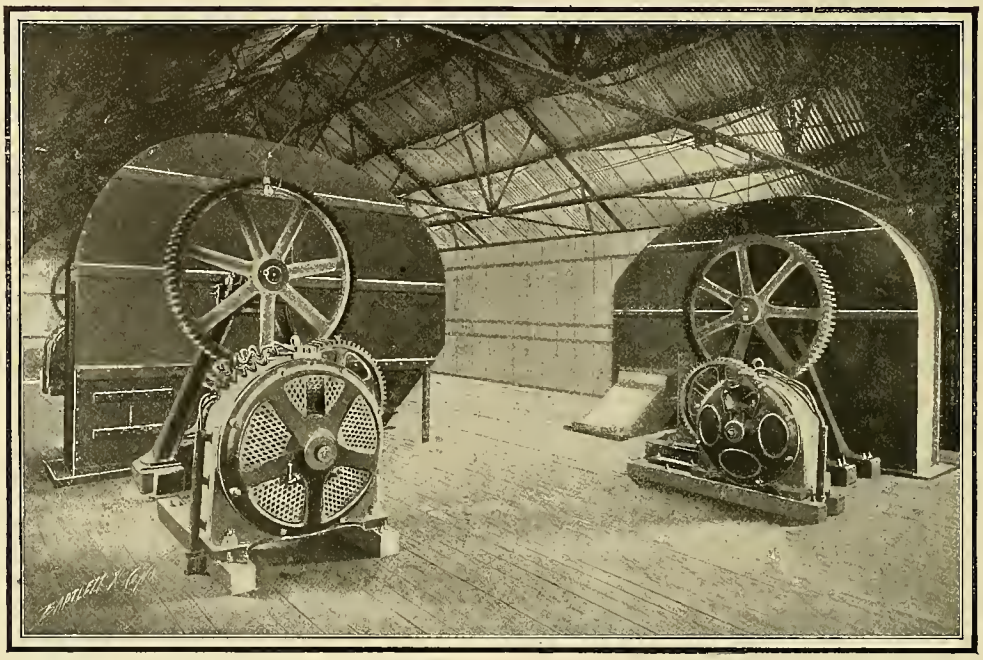

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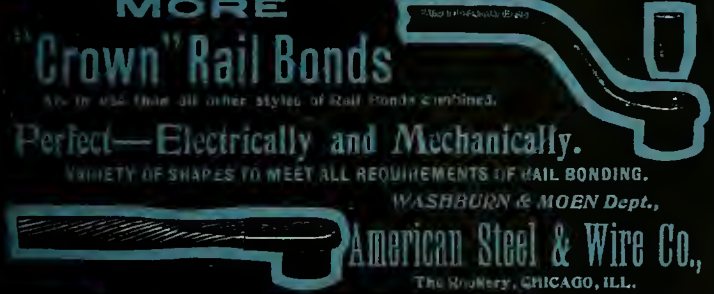

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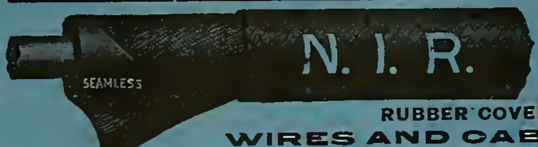

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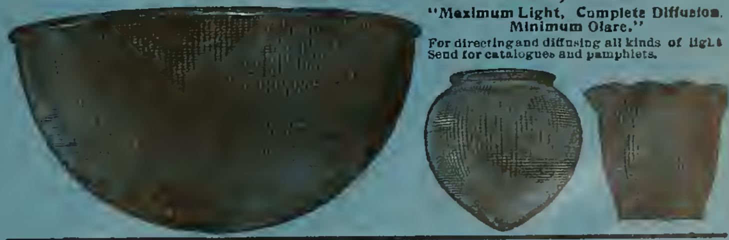

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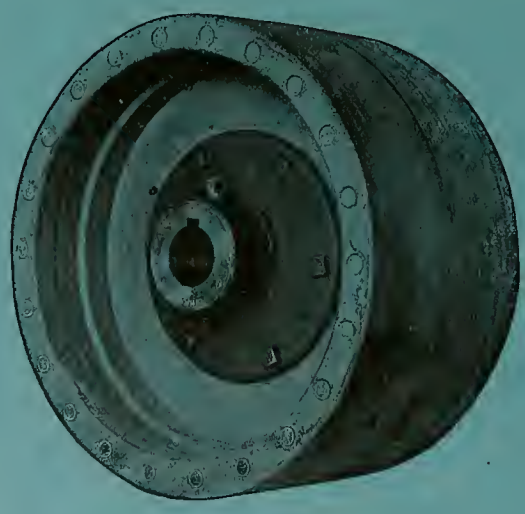

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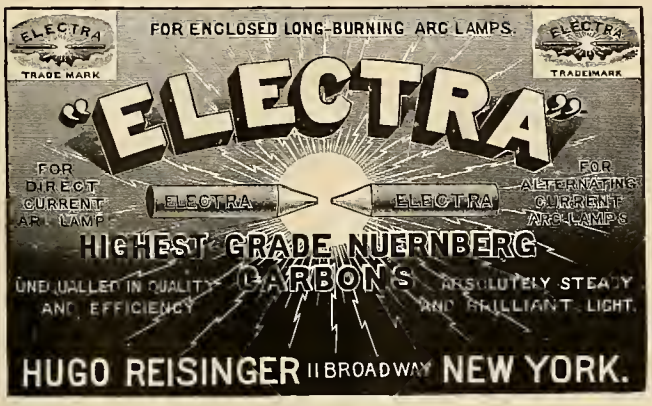

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PARAGON

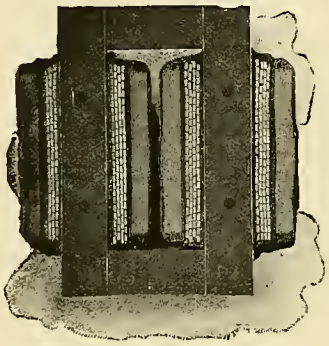
CHICAGO EDISON COMPANY, **FAN MOTORS**

139 ADAMS ST., CHICAGO.

THE GENERAL ELECTRIC COMPANY'S

TYPE H

Oil Transformer Coils



Section of Coils and Core.

Have no sharp corners and but one surface between the coils which is practically cylindrical, making possible the most effective insulation between the high and low potential windings.

General Office: Schenectady, N. Y.

Sales Offices in All Large Cities. Chicago Office, Monadnock Building.

There is No Higher-Class India-Rubber Insulation For Wires and Cables than

HABIRSHAW.

Authorized Manufacturers of the

ATTIX FLEXIBLE TUBE WIRE.

The India-Rubber and Gutta-Percha Insulating Co.,

MAIN OFFICE, Glenwood Works,

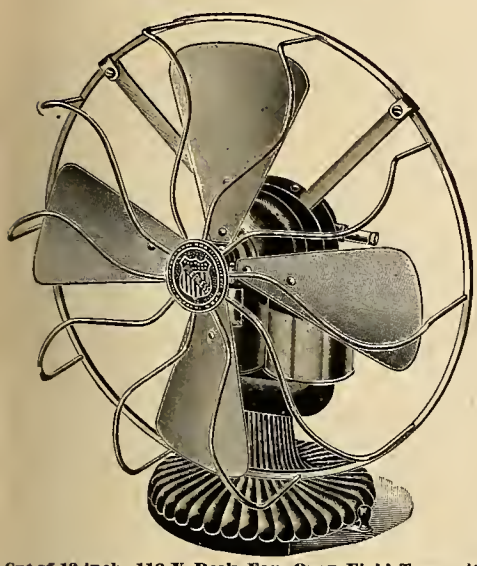
J. W. GODFREY, Manager Sales,
15 Cortlandt Street, NEW YORK.

YONKERS, N. Y.

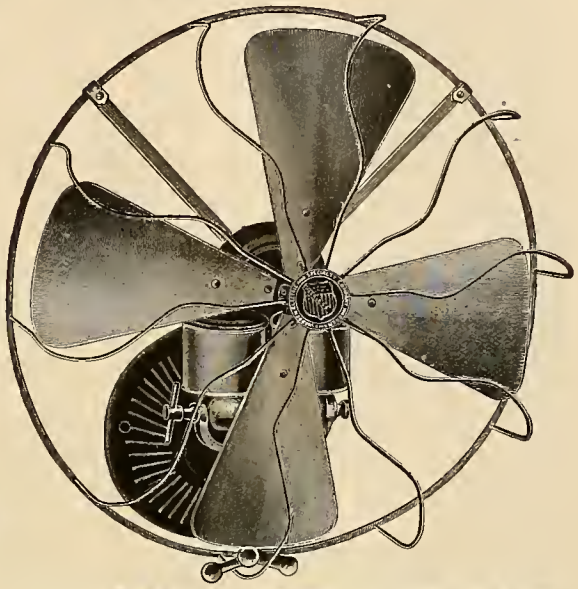
(10923)

PEERLESS

DIRECT-CURRENT DESK AND CEILING FANS.



Cut of 12-inch, 110-V. Desk Fan, Open Field Type with polished brass hoods and field coverings, the handsomest and most efficient Fan on the market.



Cut of 16-inch Wall Fan, same finish as 12-inch and having a swivel joint. By simply turning a handle this Fan can be adjusted to blow air up, down or on either side.

THE FOLLOWING SUPPLY HOUSES ARE AGENTS FOR PEERLESS FANS:

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2. Western Electrical Supply Co., 10-12 North 0th St., St. Louis, Mo.
3. Illinois Electric Co., 239 Madison St., Chicago, Ill.
4. Vallee Bros. & Co., 625 Arch St., Philadelphia, Pa.
5. Frank H. Stewart & Co., 35 North 7th St., Philadelphia, Pa.
6. Electric Supply & Mfg. Co., 62 Public Square, Cleveland, Ohio.
7. The Devere Electric Co., 430 Plum St., Cincinnati, O.
8. Doubleday-Hill Electric Co., 535 Wood St., Pittsburg, Pa.
9. Julius Andrae & Sons Co., 225 W. Water St., Milwaukee, Wis.
10. H. S. Sands El. & Mfg. Co., 1153 Market Street, Wheeling, W. Va.
11. Electric Supply & Const. Co., 80 E. Gay St., Columbus, O.
12. Robert L. McOnat, 125 S. Meridian St., Indianapolis, Ind.
13. W. G. Nagel & Co., 510 Adams St., Toledo, O.
14. Central Electric Co., 124 So. Jefferson St., Peoria, Ill.
15. Elect. Sup. & Eng. Co., 211 Jefferson Ave., Detroit, Mich.
16. Stuart-Howland Co., No. 283-285 Devonshire St., Boston, Mass.

THE WARREN ELECTRIC & SPECIALTY CO., - WARREN, OHIO, U. S. A.

Manufacturers PEERLESS Direct-Current Desk and Ceiling Fan Motors, Transformers, Incandescent Lamps.

Bretheren, I say unto You

WHY

Throw away 85% of your coal when you can sell it for three times its cost by putting in our system of UNDERGROUND EXHAUST STEAM HEATING MAINS.

It is common for electric companies who are now operating EXHAUST STEAM HEATING PLANTS to pay their entire coal and labor bills for the year and 6% on investment for steam mains from sale of exhaust steam. Why cant you do the same? Write for our pamphlet. Mention Western Electrician.

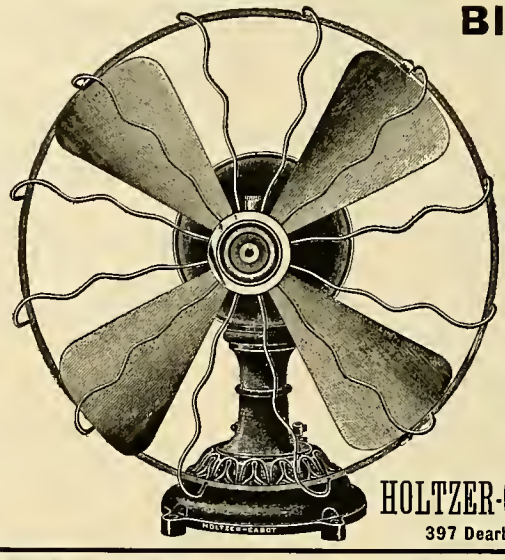
AMERICAN DISTRICT STEAM CO.
LOCKPORT, N. Y.

ALDEN & CO., AGENTS,
MARQUETTE BLDG., CHICAGO.

ENCLOSED ARC LAMPS
FOR ALL CIRCUITS.

One Piece Clutch.
No Sliding Contacts.
Does not feed through Clutch.
Spun Aluminum Case.
10-inch Globe with full size Carbon.
Artistic in design, light in weight, and mechanically perfect.
Catalogue for the asking.

LEA ARC LAMP CO.,
ANDERSON, IND.



BIG STOCK IN CHICAGO!
DIRECT-CURRENT
HOLTZER-CABOT
FANS
110 AND 500 VOLTS,
LAMINATED FIELDS,
CARBON BRUSHES,
SELF-OILING BEARINGS.

THESE FANS MADE IN BOTH
Desk and Bracket Styles.
SEND FOR CATALOG OF FULL LINE OF FANS.

HOLTZER-CABOT ELEC. CO.,
397 Dearborn St., CHICAGO, ILL.

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Smith, Philip.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elec. Supply Co.

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Central Electric Co.
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General Electric Co.
General Inc. Arc Lt. Co.
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Siemens & Halske Electric Co. of America.
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De Dion-Bouton Motorette Co.

Babbitt Met'l and Solder.
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Edison Mfg. Co.
Electric Appliance Co.
Federal Battery Co.
Gilchrist Jar Co,
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National Carbon Co.
Penn Elec. Mfg. Co.
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Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
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Western Electric Co.
Western Elect. Supply Co.

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Cling-Surface Mfg. Co.
Leather Preserver Mfg. Corp.

Belting.
Chicago House Wrecking Co.
Leather Preserver Mfg. Corp.

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Becker Bros.
Central Electric Co.
General Electrical Repair Co.
Robart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.

Burglar Alarms.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Elect. Supply Co.

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Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
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General Electric Co.
New York Ins. Wire Co.
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Manhattan Elec. Supply Co.
National Carbon Co.
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Speer Carbon Co.
United States Carbon Co.
Western Elect. Supply Co.

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Smith Co., S. Morgan.

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Link Belt Machinery Co.

Circuit Breakers.
Cutter Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

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Miller-Knoblock El. Mfg. Co.
Varley Duplex Magnet Co.

Coloring (Inc. Lamp).
Barrett & Co., M. L.
Vitro Chrome Chemical Co.

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Dearborn Drug & Chem. Wks.
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Western Elect. Supply Co.

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McIntire Co., The C.

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General Electrical Repair Co.
Hodge-Walsh Elec. Eng. Co.
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Crocker-Wheeler Company.
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Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Driver-Harris Wire Co.
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Hazard Manufacturing Co.
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Central Mfg. Co.
Independent Tel. Supply Co.
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Kans. City & So. Lum. Co.
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Tennent Insulator Pin Co.
Texas Arm & Pin Co.
Valentine-Clark Co., The.
Western Elect. Supply Co.

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Manhattan Elec. Supply Co.
McQuat, Robert L.
Paiste Co., H. T.
Siemens & Halske Electric Co. of America.
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General Inc. Arc Light Co.
Gregory Electric Co.
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Northern Elec. Mfg. Co.
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Schureman & Hayden.
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Sprague Electric Co.
Stanley Electrical Mfg. Co.
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Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Electric Supply Co.
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Sprague Electric Co.
Westinghouse El. & Mfg. Co.

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Arnold El. Power Station Co.
Bain, Foree.
Hodge-Walsh Elec. Eng. Co.
Humphrey, Henry H.
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Wagner, Herbert A.

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American El. Specialty Co.
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Electric Appliance Co.
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General Electric Co.
General Inc. Arc Light Co.
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Stanley Electrical Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
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Besly & Co., Chas. H.
Crocker-Wheeler Company.
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Western Electric Co.
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Westinghouse El. & Mfg. Co.

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Vulcanized Fibre Co.

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Mooarch Fire Appliance Co.

Flexible Shafts.
Stow Mfg. Co.

Forges.
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Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
Electric Appliance Co.
Maxstadt Mfg. Co., F. W.
McIntire Co., The C.
Western Elect. Supply Co.

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Central Electric Co.
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Electric Appliance Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Manhattan Elec. Supply Co.
McQuat, Robert L.
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Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

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Belophane Glass Co.
Phœnix Glass Co.
Western Elect. Supply Co

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Lombard Water Wheel Gv. Co.

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Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

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Kelley & Son, Benj. F.

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Crescent Mfg. Co.

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Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec Supply Co.
McQuat, Robert L.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Penn Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Driver-Harris Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Razard Manufacturing Co.
Illinois Insulated Wire Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
McDermid Mfg. Co.
Miller-Knoblock El. Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

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General Inc. Arc Light Co.

Lacquers.
Barrett & Co., M. L.

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Central Electric Co.
Chicago Edison Co.
Colonial Electric Co.
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Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
Kentucky Electrical Co.
Manhattan Elec. Supply Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elec. Supply Co,
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Butler-Taylor Co.
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Mechanical Machinery.
Besly & Co., Chas. H.
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Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
Fort Wayne Elec. Wrks, Inc.
General Inc. Arc Light Co.
Siemens & Halske Electric Co. of America.

Mica.
Chicago Mica Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co,
Northern Elec. Mfg. Co.
Siemens & Halske Electric Co. of America.
Stanley Electrical Mfg. Co.
Westinghouse El. & Mfg. Co.

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Packing.
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Robertson & Sons, Jas. L.

Patent Attorneys.
Hamlin, Geo. R.
Johnston, Thomas J.
Page, Chas. G.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

Platinum Bought and Sold.
Baker & Co.
Goldsmith Bros.
Gt. West. Sm. and Refining Co.

Poles.
Berthold & Jennings.
Fowler, John H.
Lindsley Bros. Co.
Naugle, Holcomb & Co.
Perrizo & Sons.
Pittsburg & L. S. Iron Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester & Co., C. H.

Porcelain.
Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Penn Elec. Mfg. Co.

Power Transmission Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Pulleys.
Link Belt Machinery Co.
Reckwood Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Rail Bonds.
American Steel & Wire Co.

Refiners.
Gt. West. Sm. and Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.

Re-Winding—Repairs.
Becker Bros.
Chicago Edison Co.
Cleveland Armature Works.
General Electrical Repair Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
McQuat, Robert L.
Schureman & Rayden.
Stewart Electrical Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Geo'l Inc. Arc Lt. Co.
Iron Clad Resistance Co.
Westinghouse El. & Mfg. Co.

Salt (Battery).
Amer. Battery Compound Co.
Federal Battery Co.

Second-Hand Mach'y.
Chicago House Wrecking Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
Schureman & Hayden.
Stewart Electrical Co.
Walsh's Sons & Co.

Shades.
Amer. Reflector & Ltg. Co.

Soldering Flux.
Cream Flux Co.

Sparking Plugs.
Crest Manufacturing Co.

Speaking Tubes.
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Electric Appliance Co.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elec. Supply Co.

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Queen & Co.
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Barnes Co., The Wallace.
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Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.

Structural Iron Work.
American Bridge Co.

Tapes, Insulating.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The
Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.

Telephones, Telephone Material and Switchboards.
American Elec. Fuse Co.
American El. Telephone Co.
Bruckner Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Central Tel. & Elec. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Coms. Supply Co.
Garl Electric Co.
Holtzer-Cabot Elec. Co.
Independent Tel. Supply Co
Kellogg Switchb. & Sup. Co
Kokomo Tel & El. Mfg. Co.
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Manhattan Elec. Supply Co.
Maxstadt Mfg. Co., F. W.
McDermid Mfg. Co.
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National Tel. Equipm. Co.
North Electric Co.
R. I. Telephone & Elec. Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Swedish-American Tel. Co.
Thomas, Wilcox & Dietz.
Viaduct Mfg. Co.
Warner Electric Co.
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Const. Co.

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Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Siemens & Halske Electric Co. of America.
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Wagner Elec. Mfg. Co.
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Besly & Co., Chas. H.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
Independent Tel. Supply Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co.
Western Electric Co.
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Woodwork, Electrical.
Noblett, E. J.

X-Ray Outfits.
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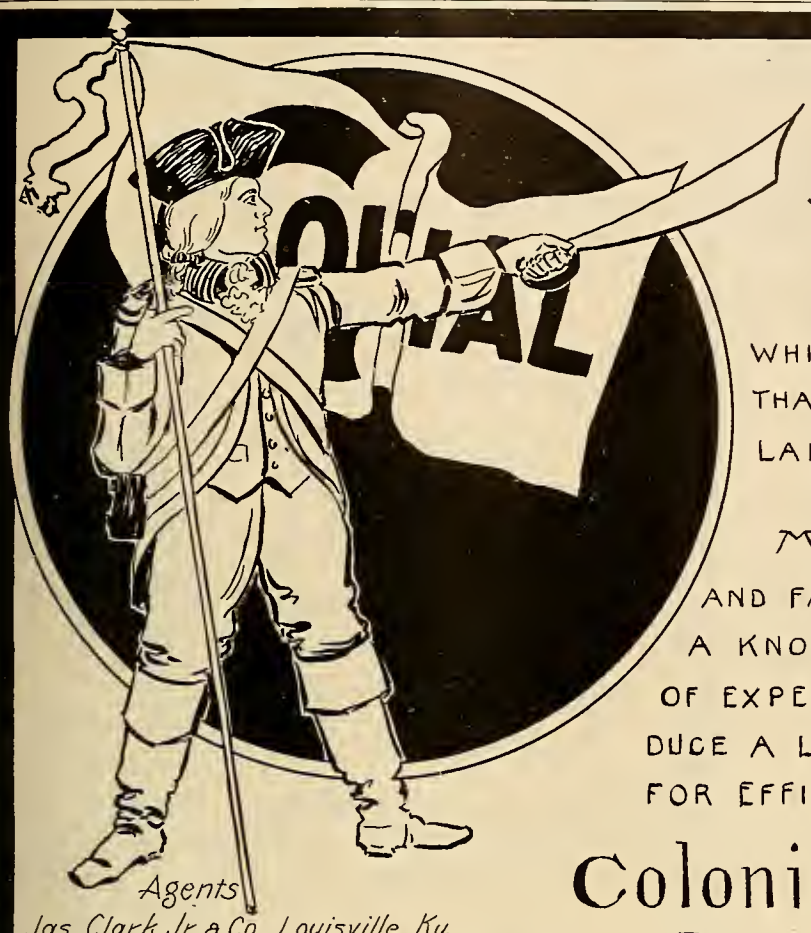
For Alphabetical Index of Advertisements See Page III.



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WHICH STANDS FOR EVERYTHING THAT IS BEST IN INCANDESCENT LAMP MANUFACTURE.

MATERIAL, WORKMANSHIP AND FACILITIES, COMBINED WITH A KNOWLEDGE CULLED FROM YEARS OF EXPERIENCE, ENABLES US TO PRODUCE A LAMP THAT IS GUARANTEED FOR EFFICIENCY AND CANDLE POWER.

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J. H. Bunnel & Co. 20 Park Pl. New York City.

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Co. of America,

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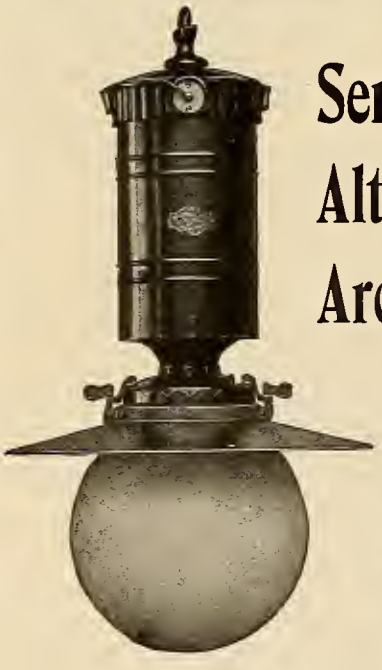

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HAVING A CONSTANT POWER FACTOR WITH ANY NUMBER OF LAMPS IN SERIES. NO REGULATOR REQUIRED.

3 Lamps in Series on 220 to 240 Volts.
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Any Number of Lamps in Series by Using Step-Up or Step-Down Transformer.

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SMALL MOTORS FOR SEWING MACHINES AND SPECIAL PURPOSES.

Highly Efficient.
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Applicable for any purpose where small machines are required.

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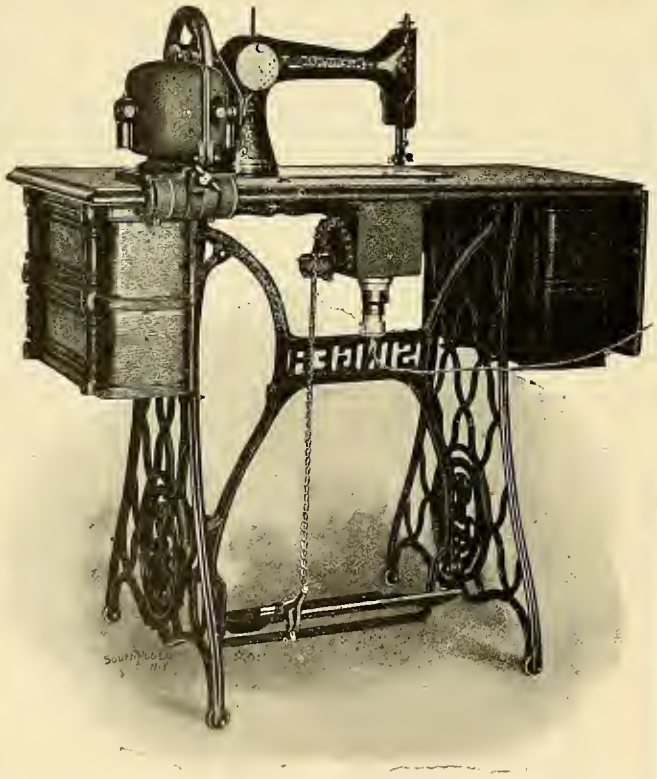

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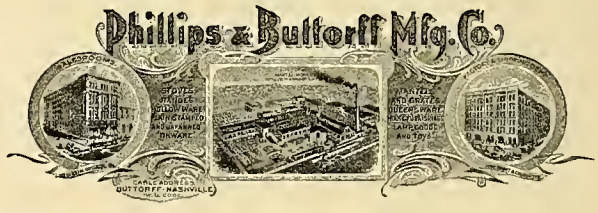

Nashville, Tenn Jan 1, 1900

Mr. Jas Shingleton.
Dear Sir:
The Four Wagner Motors you installed in our Work shop last Summer, have proven satisfactory in every respect, not requiring any attention whatever, and the current consumption has been remarkably low, exceeding our most sanguine expectations.

Yours Truly
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P. J. Buttorff

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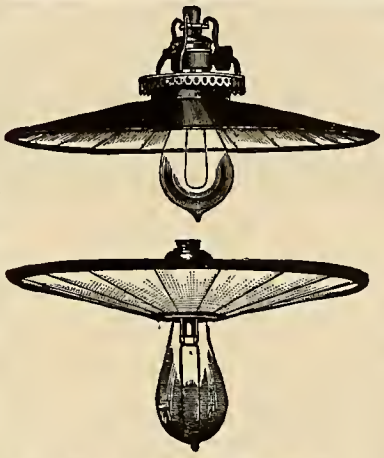

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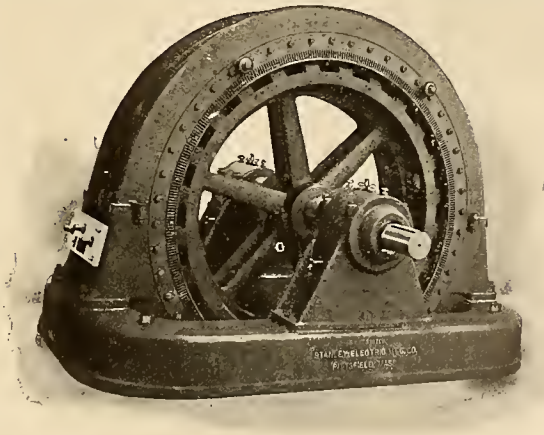

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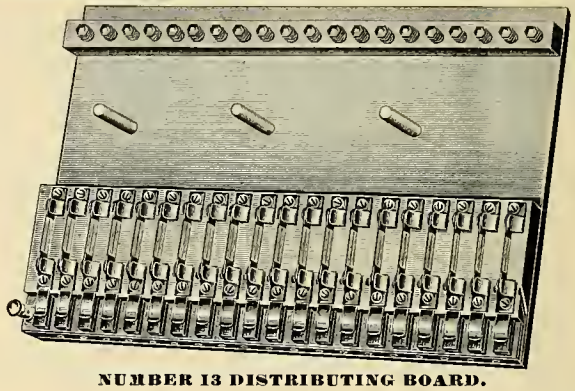

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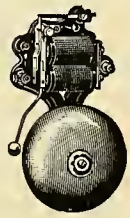

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AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS?

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So EASILY APPLIED that all CAN USE it.
So CHEAP that all SHOULD USE it.
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YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. ***We guarantee it and if not satisfactory money will be refunded.***

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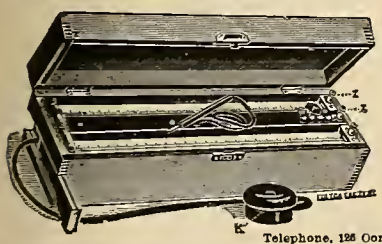

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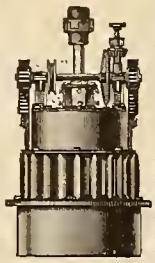

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Electrolysis Proof CONDUITS.

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An absolute non-conductor. Perfect insulation guaranteed
Allows no moisture to accumulate. No scratching of cables. No weak joints. No breakage. No deterioration. Freight charges extremely light. Costs less to lay than other conduits. Made in 7-foot lengths; 3-inch internal diameter; weight 21 lbs to foot. Manufacturers of Electrolysis Proof Insulating materials, Conduits, Laterals, Distributing Box and Post Linings, Moist Proof Manhole Linings, Pipe Covering, Etc.

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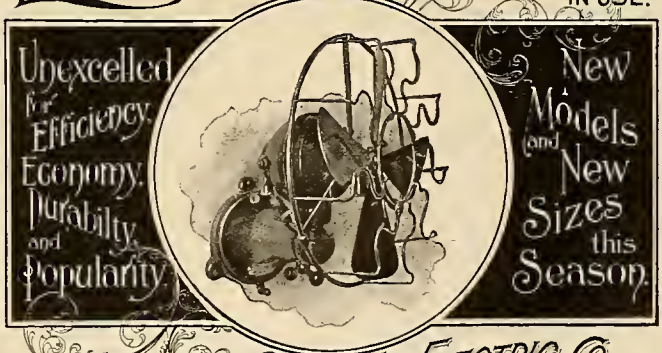
THOUSANDS IN USE.



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CRYSTAL VERY ELASTIC.

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VARNISH. HARD FINISH.

CHAMPION INSULATING PAINTS (Blacks), Four Kinds.
Also Other Insulating Materials.

Our Careful and Persistent Growth is Proof of the Quality of our Insulations. Prices and Quality Guaranteed. Write Us.

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Dynamos and Motors.

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Lot second-hand material. About 7,000 Westinghouse 110-volt lamps, little used; about 400 Doz. West sockets, 500 Doz. genuine K. W. Rosette cut-outs, 300 Doz S. M. cut-outs, plain mostly. Paiste switches and other material. Address

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OFFICE OF THE CITY CLERK.

Kenton, Hardin County, Ohio.
August 2, 1900.

Notice is hereby given that the Council of the City of Kenton, County of Hardin and State of Ohio, will receive bids at the office of the City Clerk of said city, until 12 o'clock noon, on

Monday, September 3d, A. D. 1900,

for lighting the streets, alleys, squares, other public places and public buildings within the corporate limits of said city with not less than One Hundred and Ten (110) Electric Lights of Two Thousand (2,000) Candlepower properly placed and adjusted under supervision of the City Council. Said bids shall be for the term of five years. Said bids shall contain the name of the system of lighting proposed and shall state the amount per annum for which each light which is required will be erected and maintained during the hours of darkness, all night and every night.

Each bid must be accompanied by a good and sufficient guaranty that if the bid be accepted the bidder will enter into a contract and secure its performance by two disinterested sureties within thirty days after the acceptance of said bid.

Council reserves the right to reject any or all bids.

By order of the Council.

JOHN P. DUGAN,
City Clerk.

WANTED FOR SPOT CASH

BURNED OUT INCANDESCENT LAMPS AND BASES.
Freight Paid and Highest Prices Guaranteed.

GEO. F. SCHWALM CO., - HARRISON, N. J.

WE DO REPAIRING.

The satisfactory kind that brings your second order.

Armatures, transformers and fields rewound. Commutators refilled. Machines rebuilt. All work guaranteed. Low prices. Write us.

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For Everything Electrical, including **NATIONAL ELECTRIC CO.'S MACHINES.**

Manufacturers of the Celebrated "Perfection" Brushes for Dynamos and Motors.

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DYNAMOS, MOTORS, ARC LAMPS, INSTRUMENTS, TRANSFORMERS, TELEPHONES.
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110-Volt Incandescent Dynamos.

1 12-light Hartley, self-oiler, multipolar.
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1 50-light Hawkeye.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 50-light C. & C., self-oiler.
1 55-light Edison, 3 K. W., self-oiler, comp.
1 50-light Mather.
1 60-light Thomson-Houston, 75 v., comp. with extra armature.
1 75-light Thomson-Houston, D. 5.
1 75-light Wood, self-oiler.
1 90-light Westinghouse.
1 100-light Cutten.
1 100-light Jenney, comp.
1 210-light Triumph, self-oiler.
1 225-light United States.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp. self-oiler.
1 270-light T.-H., comp. self-oiler, D. 15.
3 270-light Westinghouse, M. P., slow speed, 15 K. W., October delivery.
1 300-light Columbian, multipolar, comp., self-oiler.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp., wound.
1 350-light National, self-oiler, compound.
3 350-light Edison, 20 K. W., self-oilers.
1 360-light Duplex multipolar, self-oiler, compound, slow speed.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Eickmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
4 800-light Edison, 45 K. W., self-oilers.
1 1050-light Waddell-Entz, 80 K. W., M. P., for direct connection.

220-Volt Generators.

1 7½ K. W. General Electric, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 15 K. W. Edison, compound, self-oiler.
1 25 K. W. Edison, self-oiler.
1 40 K. W. E. & C., multipolar, slow speed.
1 200 K. W. Crocker-Wheeler multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.

500-Volt Generators—Continued.

1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
3 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x24x14, all complete, fine.
1 150 K. W. Detroit (Rae) multipolar, compound, self-oiler, new armature.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp. wound.
1 600-light Bain, 30 K. W., self-oiler, new toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed arm't.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
1 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.

Arc Dynamos—Continued.

1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7, Steuben-rausch commutator.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westingh'se, self-oiler.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 3 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Eickmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

1 30 H. P. Edison, 25 K. W., self-oiler.
1 50 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 75 H. P. Sprague, self-oiler, new arm't.
1 225 H. P. Crocker-Wheeler, M. P.

500-Volt Motors.

1 ¼ H. P. Detroit, series wound.
1 1 H. P. Jenney, self-oiler.
1 1 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jenney, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. C. & C.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
1 40 H. P. Jenney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

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1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oilers, single-phase.
1 2½ H. P. Ft. Wayne, 100 volts, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

Alternating Current Motors.

MULTIPHASE.

1 1 H. P. Westinghouse, self-oiler, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 3-phase, type, 8-10-900, Form A, 60-cycle, 110 volts.

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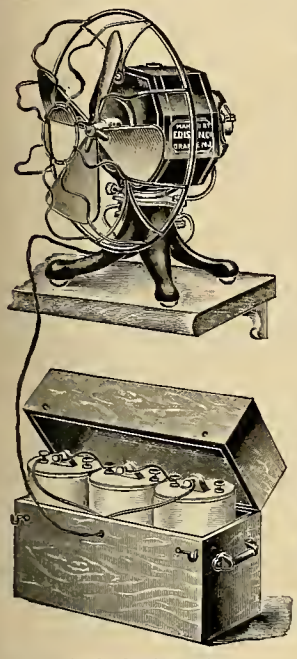

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No. S2 1 pair 17¾x24 Williams automatic engines, coupled together.
No. S3 2 generators, type U. S. Westinghouse, bi-polar, size, 80 K. W.
No. S4 2 60x16 horizontal tubular boilers.
No. S5 1 450 H. P. Hazleton water tube boiler, 2 Rooney furnaces with stokers.
No. S6 1 Worthington duplex pump, 6x4 x6.
No. S7 1 Koerschell heater, 2x9 feet.
No. S8 1 Hancock inspirator, 1¼ inches.
No. S9 38 feet 6⅜-inch shafting.
No. S10 39 feet 8-inch shafting.
No. S11 8 feet 4⅞-inch shafting.
No. S12 15 feet 10-inch shafting.
No. S13 2 6⅜-inch flanged couplings.
No. S14 1 8-inch flanged coupling.
No. S15 1 6⅜x4⅞ flanged couplings.
No. S16 1 60x38x6⅜ in. double arm drive pulley.
No. S17 4 60x16x6⅜ in. Hill friction clutch pulleys.
No. S18 1 60x28x6⅜ in. iron pulley, leather covered face.
No. S19 1 60x16x4⅞ in. iron pulley.
No. S20 1 14x43x8 in. iron pulley.
No. S21 2 6⅜x20 chain oiling pillow blocks.
No. S22 5 6⅜x15 chain oiling pillow blocks.
No. S23 1 4⅞x15 chain oiling pillow blocks.
No. S24 1 72x26x8 in. Dodge wood pulley.
No. S25 2 14 ft. x 16 in. cable drums; 6 grooves for 1¼-inch cable.
No. S26 1 12 ft. x 17 in. x 15 in. spur gear.
No. S27 10 8x18 in. pillow blocks.
No. S28 2 double ply dynamo belts, 16-inch width, 57 feet long.
No. S29 1 double ply dynamo belt, 14½-inch width; 71 feet long.
No. S30 1 double ply dynamo belt, 14½-inch width; 48 feet long.

WE PUPCHASED FROM P. D. ARMOUR & CO., Union Stock Yards, their entire boiler outfit. Armour & Co. changed their motive power from steam to electricity at a cost of over $2,000,000, as a result of which they sold to us all their fine horizontal tubular boilers, consisting of 48—60x16, 12—54x16, 12—60x18.

They are all in excellent condition and have been thoroughly overhauled, all weak parts replaced.

We also purchased the HASTINGS, NEB., ELECTRIC PLANT, consisting of the following:

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No. S64 12x20x12 Westinghouse automatic compound.
No. S65 12x20x14 Ball automatic compound.
No. S66 12x24 Zeahm Bros.
No. S67 12x20 horizontal slide valve.
No. S205 13x16 Twin engines, tandem bed.
No. S70 13x16 horizontal side crank.
No. S71 13x18 four valve Russell automatic.
No. S72 13x20x15 Armington & Sims cross compound condensing.
No. S73 13x16 Erie horizontal.
No. S74 14x14 automatic Ideal.
No. S75 14x24 Richards horizontal.
No. S76 14x24 box bed.
No. S77 14x20 Atlas automatic.
No. S78 14x24 Bay State.
No. S78 14x30 Cumner.
No. S79 14½x13 Armington & Sims automatic.
No. S80 15x14 automatic Ideal.
No. S81 16x14 Smith, Beggs & Rankin automatic.
No. S207 16x36 Woodruff & Beach.
No. S208 17¾x24 pr. auto. Williams, coupled.
No. S82 18x30 250 H. P.
No. S83 20x22 Corliss.
No. S84 20x36 Corliss.
No. S85 20x42 Corliss.
No. S86 26x48 Corliss.
No. S87 20x24 horizontal, box bed.
No. S209 66x20 Chandler & Taylor.
No. S210 40 H. P. Rice automatic.
No. S211 35 H. P. Chandler & Taylor.
No. S88 22x42x48 Allis tandem condensing.
No. S89 14x20 Russell automatic.
No. S90 10 H. P. Davis & Rankin.
No. S91 10 H. P. slide valve.
No. S92 40 H. P. slide valve.
No. S93 60 H. P. slide valve.
No. S94 20 H. P. Milburn.
No. S95 No. 874 Racine automatic, 9-inch stroke.
No. S96 80 H. P. Farquhar.
No. S97 No. 1 Russell high-speed automatic.
No. S98 12 H. P. Giant.
No. S99 14 H. P. Giant.
No. S100 6 H. P. automatic Westinghouse.
No. S101 10 H. P. gas engine.
No. S102 13 H. P. Dayton gasoline.
No. S103 35 H. P. upright.
No. S104 40 H. P. Otto gas.
No. S105 50 H. P. Otto gas.
No. S106 19 H. P. Lewis gasoline.
No. S107 50 H. P. Raymond gasoline.
No. S172 68 H. P. Atlas.
No. S173 10x20 side crank.
No. S174 Otis furnace hoist engine, 2 cyl., 8x10.
No. S177 13x16 Twin engines, tandeu bed.
No. S179 7x14 Ames cylinder.
No. S273 16x30 balance wheel, 14 feet diam.
No. S274 1 H. P. gasoline.
No. S275 16½x30 Buckeye.
No. S276 6x12 horizontal slide valve.
No. S277 14x28 horizontal slide valve.
No. S278 12x24 marine oscillating.
No. S279 30x30 slide valve.
No. S280 36x42 slide valve.
No. S281 24x30 slide valve.
No. S282 10x15 center crank.
No. S283 6x8 box bed, side crank.
No. S284 16x36 Sinker & Davis.
No. S285 9x9 upright, center crank.
No. S286 9x14 horizontal, side crank
No. S287 9x12 Nagel.
No. S288 7x7 side crank.

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No. SM151 1 150-light Eddy dynamo.
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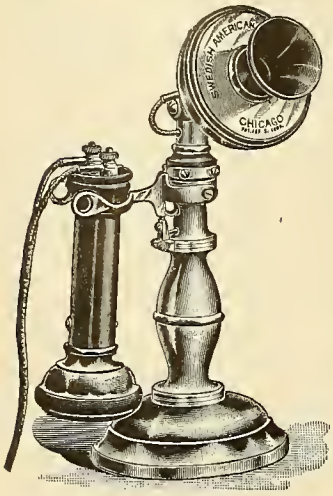

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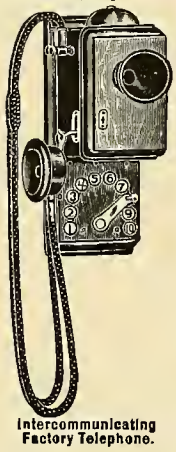

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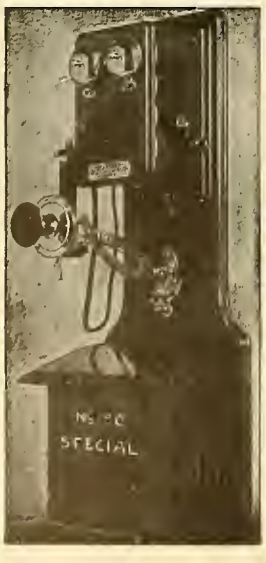

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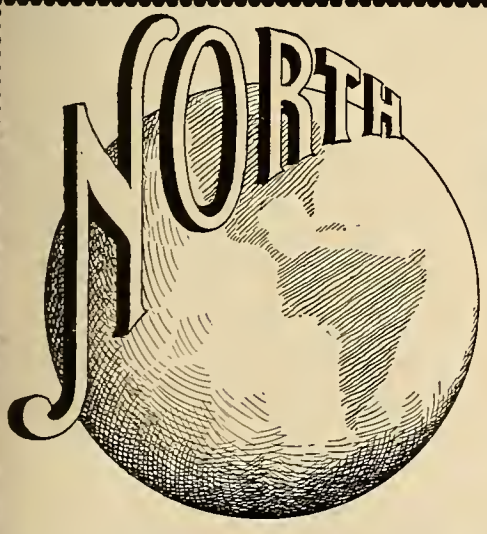

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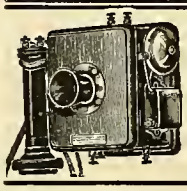

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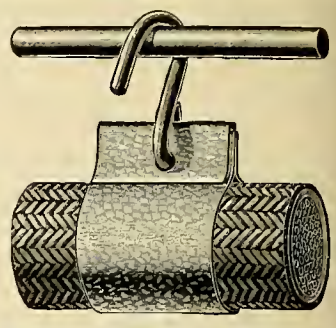

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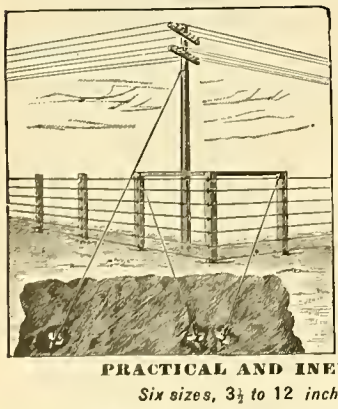

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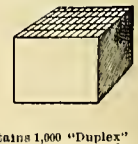

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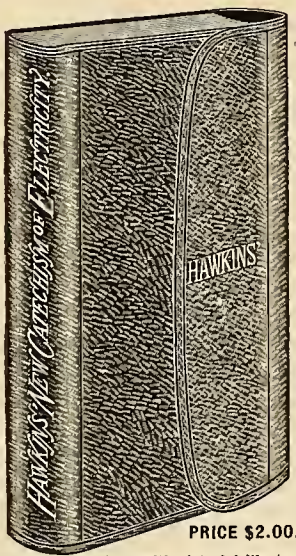

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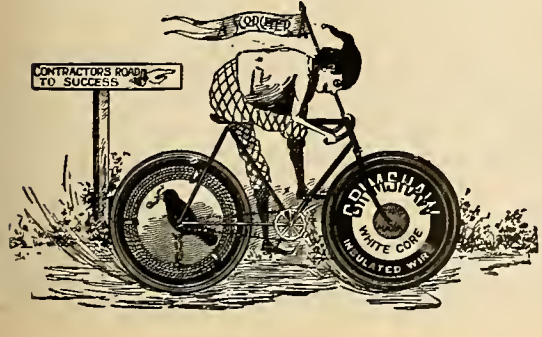

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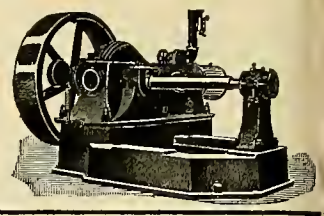

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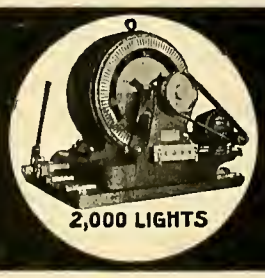

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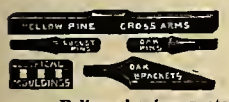

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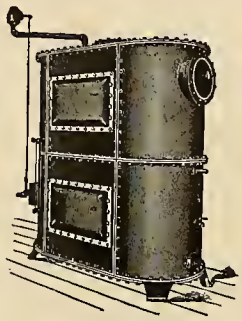

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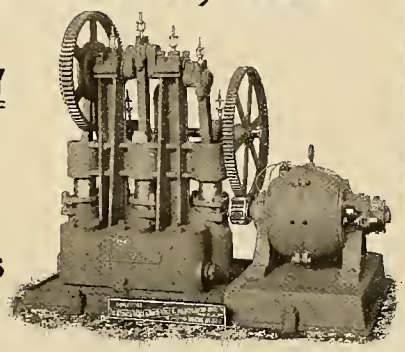

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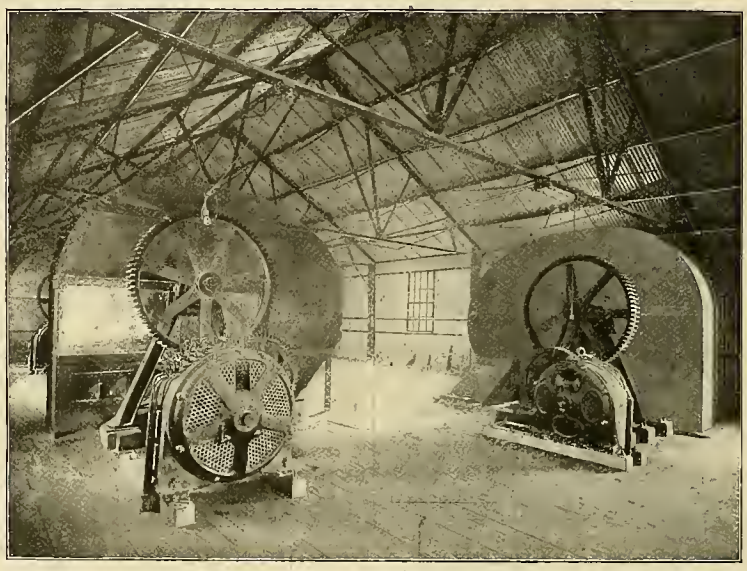

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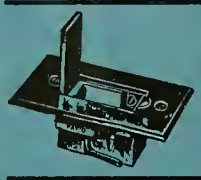

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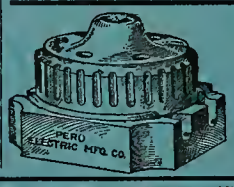

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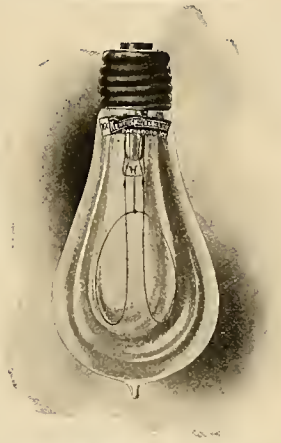

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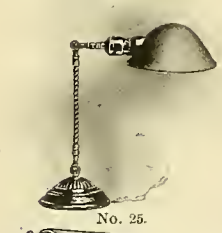
CHICAGO EDISON COMPANY, 139 ADAMS ST., CHICAGO.

FAN MOTORS

No. 1.

No. 22.


No. 25.

No. 9.

Prepare for Artificial Lights

And do not forget we manufacture over

35

STYLES OF SHADE LAMPS,

All adjustable and made especially to protect the eyes. Manufactured to suit the purchaser and for all kinds of people.

LOWEST IN PRICE.
MANY NEW DESIGNS.

Send for Our Catalogue.

Pacific Electric Co.,

LA CROSSE, WIS.

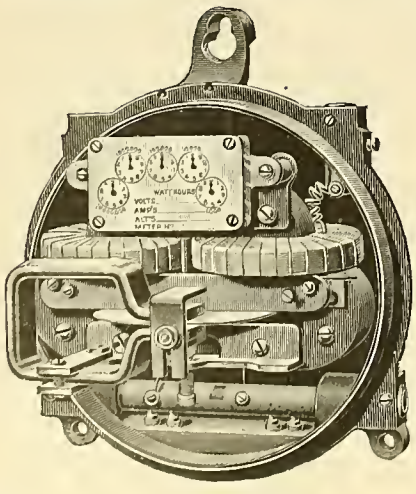
See

that the OKONITE TRADE MARK. trade-mark is stamped in the bottom of the TIN box, and take no substitute for OKONITE TRADE MARK. and Manson tapes.

CENTRAL ELECTRIC COMPANY

264-266-268-270 Fifth Avenue

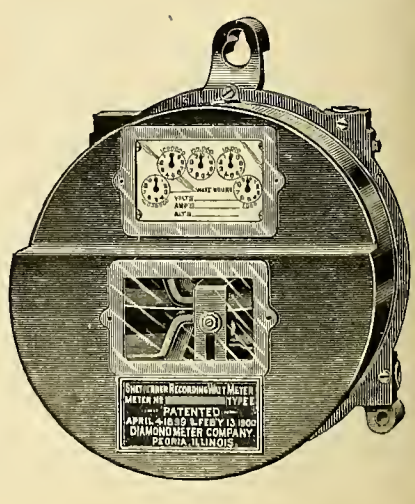
CHICAGO



Scheeffer Recording Wattmeter.

ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.



DIAMOND METER CO.

PEORIA, ILL., U. S. A.

THE EDISON LAMP

Embodies

20 Years

Of Experience, Growth and Development.

It Stands To-day Absolutely Unequaled—the Standard of the World.

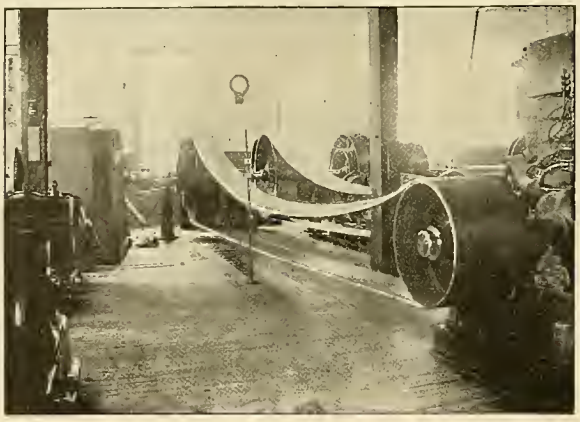
TRIED AND PROVEN BY TWENTY YEARS' UNEXCELLED SERVICE.

Commands the highest price—is the cheapest to use. By the experience of customers buying twelve million lamps a year.

15,000,000 lamps—yearly production. 5,000,000 lamps in stock. Prompt shipments, all kinds, any quantity.

THE GENERAL ELECTRIC COMPANY,

HARRISON, N. J.



CLING-SURFACE.

We guarantee these results from Cling-Surface:

Slipping stopped.

Belts made pliable and elastic.

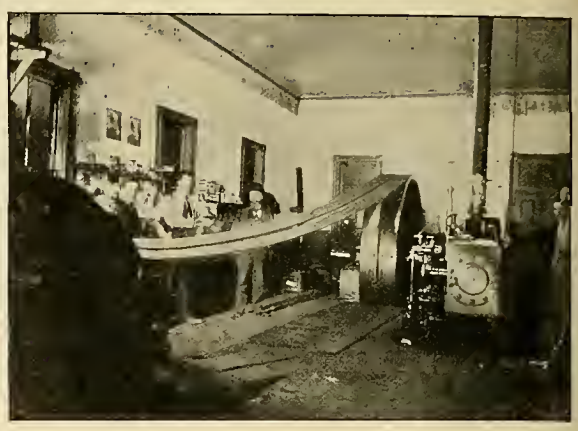
Power increased at least 15%.

Belts will run easy or slack.

ASK US FOR THE ONLY BOOKLET OF SLACK BELTS YOU EVER SAW.

CLING-SURFACE MFG. CO.,
177-182 Virginia St., BUFFALO, N.Y.

Chicago, St. Louis, New York, Boston, New Orleans.



ROCKLAND, ME., February 22, 1900.

Cling-Surface Mfg. Co., New England Branch, Boston.

GENTLEMEN:—These two 16-in. belts have been treated with Cling-Surface for some time. They run this way all the time. The load sometimes jumps from zero to full load, yet there is no slip.

ROCKLAND, THOMASTON & CAMDEN ST. RY. CO.

MOUND CITY, Mo., March 5, 1900.

Cling-Surface Mfg. Co.

GENTLEMEN:—Have used Cling-Surface four months. It has stopped all slipping. Belts 10 in., 30-ft. centers, run with 22-in. sag, yet carry full load, are pliable and in fine condition. Used to run very tight. We highly recommend Cling-Surface.

MOUND CITY ELEC. LT. & TELEPHONE CO.

CLASSIFIED INDEX OF ADVERTISEMENTS.

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Smith, Philip.

Annunciators.
Central Electric Co.
Electric Appliance Co.
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Western Electric Co.
Western Elec. Supply Co.

Arc Lamps.
Belden-Larwill El. & Mf. Co.
Central Electric Co
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Les Arc Lamp Co.
Siemens & Halske Electric Co. of America.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Automobiles.
DeDion-Bouton Motorette Co.

Babbitt Met'l and Solder.
Gr. Western Sm. and Refg. Co.

Batteries and Jars.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Federal Battery Co.
Gilchrist Jar Ce,
Gordon Battery Co.
Leclanche Battery Co., The.
Manhattan Elec. Supply Co.
National Carbon Co.
Peru Elec. Mfg. Co.
Roche, William.
Western Electric Co.
Western Elect. Supply Co.

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Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Belt Dressing.
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Belting.
Chicago House Wrecking Co.
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Electrician Publishing Co.

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General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
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Carbons, Points & Plates
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Chicago Edison Co.
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National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
United States Carbon Co.
Western Elect. Supply Co.

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Chains.
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Link Belt Machinery Co.

Circuit Breakers.
Cutler Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Coils and Magnets.
Miller-Knoblock El. Mfg. Co.
Varley Duplex Magnet Co.

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Amer. Battery Compound Co.
Dearborn Drug & Chem. Wks.
McLennan & Co., K.
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Electrolysis Proof Conduit Mfg. Co.
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Richmond Conduit Co.
Sprague Electric Co.
Western Elect. Supply Co.

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McIntire Co., The C.

Construction & Repairs.
Becker Bros.
Chicago Edison Co.
General Electrical Repair Co.
Hodge-Walsh Elec. Eng. Co.
Western Electric Co.

Contractors and Electric Light Plants.
Arnold El. Power Station Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Stanley Electrical Mfg. Co.
Star Dynamo Works.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
Central Electric Co.
Driver-Harris Wire Co.
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General Electric Co.
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Simplex Electrical Co.
Standard Underground C. Co.

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Elec. Engineer Corr. Inst.
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Cross-Arms, Pins and Brackets.
Blue Ridge Locust Pin Co.
Brady, T. H.
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Central Mfg. Co.
Independent Tel. Supply Co.
Indpls. Arm, Brack. & Pin Co.
Kans. City & So. Lum. Co.
Leavitt, R. H.
Tennent Insulator Pin Co.
Texas Arm & Pin Co.
Valentine-Clark Co., The.
Western Elect. Supply Co.

Cut-Outs and Switches.
Bossert Elec. Const. Co.
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Chicago Edison Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
General Elec. Co.
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Hill, W. S., Electric Co.
Manhattan Elec. Supply Co.
McQuat, Robert L.
Paiste Co., H. T.
Siemens & Halske Electric Co. of America.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Cuts.
Franklin Eng. & Electro Co.

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Iron Clad Resistance Co.

Dynamos and Motors.
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Chicago Motor and Dyn. Co.
Chicago House Wrecking Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
Schureman & Hayden.
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Sprague Electric Co.
Stanley Electrical Mfg. Co.
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Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Electric Railways.
Arnold El. Power Station Co.
Crocker-Wheeler Company.
General Electric Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold El. Power Station Co.
Bain, Foree.
Bodge-Walsh Elec. Eng. Co.
Humphrey, Henry H.
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Electrical Instruments.
American El. Specialty Co.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
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Queen & Co.
Siemens & Halske Electric Co. of America.
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Western Electric Co.
Western Elect. Supply Co.
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Electro-Plating Mach'y.
Besly & Co., Chas. H.
Crocker-Wheeler Company.
General Electric Co.

Elevators-Conveyors.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Engines, Steam.
Ball Engine Co.
Camp Engineering Co.
Chicago House Wrecking Co.
Sturtevant Co., B. F.

Exh'st Steam Apparatus.
American District Steam Co.

Fan Outfits.
Central Electric Co.
Crocker-Wheeler Company.
Edison Mfg. Co.
Emerson El. Mfg. Co.
Fuller Co., The.
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General Inc. Arc Light Co.
Holtzer-Cabot Elec. Co.
Roth Bros. & Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Fire Extinguishers.
Monarch Fire Appliance Co.

Flexible Shafts.
Stow Mfg. Co.

Forges.
Sturtevant Co., B. F.

Fuses and Fuse Wire.
American Elec. Fuse Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
Electric Appliance Co.
McIntire Co., The C.
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Gears.
Besly & Co., Chas. H.

General Elec. Supplies.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Manhattan Elec. Supply Co.
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Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Holophane Glass Co.
Phœnix Glass Co.
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Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heaters (Feed Water).
Kelley & Son, Benj. F.

Heating and Ventilating Apparatus.
Sturtevant Co., B. F.

Holders, Inc. Lamp.
Crescent Mfg. Co.

Insulators and Insulating Materials.
Akron Smoking Pipe Co.
Central Electric Co.
Chicago Edison Co.
Chicago Mica Co.
Eagle Paint & Varnish Wks.
Electric Appliance Co.
General Inc. Arc Light Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Elec. Fuse Co.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Driver-Harris Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
McDermid Mfg. Co.
Miller-Knoblock El. Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lacquers.
Barrett & Co., M. L.

Lamps, Incandescent.
Central Electric Co.
Chicago Edison Co.
Colonial Electric Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
Kentucky Electrical Co.
Manhattan Elec. Supply Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lightning Arresters.
American Elec. Fuse Co.
Butler-Taylor Co.
Central Electric Co.
Electric Appliance Co.
Eureka Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Klein & Son, Mathias.

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Mechanical Machinery.
Besly & Co., Chas. H.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Valle.

Meters.
Diamond Meter Co.
Fort Wayne Elec. Wrks, Inc.
General Inc. Arc Light Co.
Siemens & Halske Electric Co. of America.

Mica.
Chicago Mica Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Siemens & Halske Electric Co. of America.
Stanley Electrical Mfg. Co.
Westinghouse El. & Mfg. Co.

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Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Hamlin, Geo. R.
Johnston, Thomas J.
Page, Chas. G.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

Platinum Bought and Sold.
Baker & Co.
Goldsmith Bros.
Gt. West. Sm. and Refining Co.

Poles.
Berthold & Jennings.
Davis & Stitt Co.
Fowler, John H.
Lindsley Bros. Co.
Naugle, Holcomb & Co.
Perrizo & Sons.
Pittsburg & L. S. Iron Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester & Co., C. H.

Porcelain.
Akron Smoking Pipe Co.
Peru Elec. Mfg. Co.

Power Transmission Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Pulleys.
Link Belt Machinery Co.
Rockwood Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Rail Bonds.
American Steel & Wire Co.

Refiners.
Gt. West. Sm. and Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.

Re-Winding—Repairs.
Becker Bros.
Chicago Edison Co.
Cleveland Armature Works.
General Electrical Repair Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
McQuat, Robert L.
Schureman & Hayden.
Stewart Electrical Co.

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Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Iron Clad Resistance Co.
Westinghouse El. & Mfg. Co.

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Amer. Battery Compound Co.
Federal Battery Co.

Second-Hand Mach'y.
Chicago House Wrecking Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
Schureman & Hayden.
Stewart Electrical Co.
Walsh's Sons & Co.

Shades.
Amer. Reflector & Ltg. Co.
Pacific Electric Co.

Soldering Flux.
Cream Flux Co.

Sparking Plugs.
Crest Manufacturing Co.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elec. Supply Co.

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Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Westen Electrical Inst. Co.

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Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
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American Bridge Co.

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American Steel & Wire Co.
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Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The
Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.

Telephones, Telephone Material and Switchboards.
American Elec. Fuse Co.
American El. Telephone Co.
Bruckner Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Central Tel. & Elec. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Gerl Electric Co.
Holtzer-Cabot Elec. Co.
Independent Tel. Supply Co
Kellogg Switchb. & Sup Co
Kokomo Tel & El. Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co.
Manhattan Elec. Supply Co.
McDermid Mfg. Co.
Mianus Electric Co.
National Tel. Equipm. Co.
North Electric Co.
R. I. Telephone & Elec. Co.
Standard Tel. & El. Co.
Star Dynamo Works.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Swedish-American Tel. Co.
Thomas, Wilcox & Dietz.
Viaduct Mfg. Co.
Warner Electric Co.
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Const. Co.

Tools.
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Ft. Wayne Elec. Works, Inc.
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Siemens & Halske Electric Co. of America.
Stanley Electrical Mfg. Co.
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Westinghouse El. & Mfg. Co.

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Universities.
Pratt Institute.
University of Notre Dame.

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

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Western Electrical Sup. Co.

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Noblett, E. J.

X-Ray Outfits.
Queen & Co.

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"FEDERAL SALT"

FOR CARBON CYLINDER AND CARBON-MANGANESE BATTERIES.

GIVES MORE CURRENT, LONGER LIFE, ABSOLUTELY NO CRYSTALS.

5c.

Package in case lots of 150 packages F. O. B. Bound Brook, N. J.

Both salts have a depolarizer in the mixture. Federal Salt No. 1 has more depolarizer than Federalite, and so will last longer. That's the only difference.

It's the DEPOLARIZER that INCREASES the STRENGTH, GIVES LONGER LIFE, and DOES AWAY ABSOLUTELY with CRYSTALIZATION and CREEPING SALTS.

MADE BY

FEDERAL BATTERY Co.,

11 PINE STREET, N. Y.

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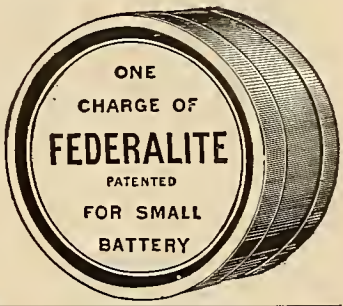

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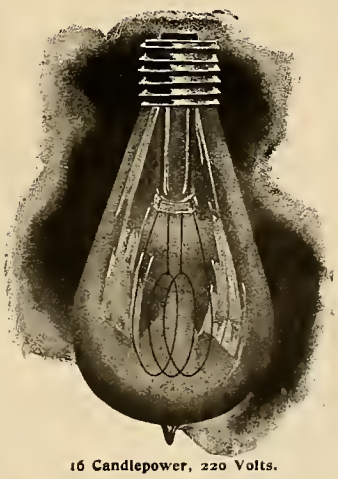

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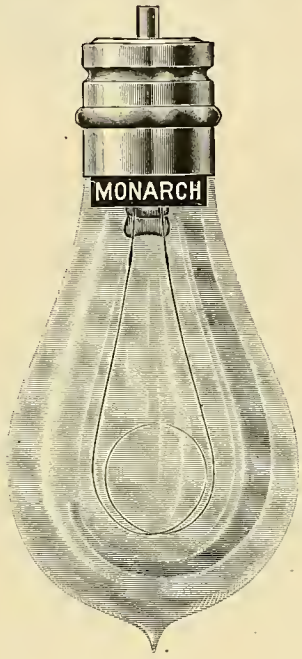

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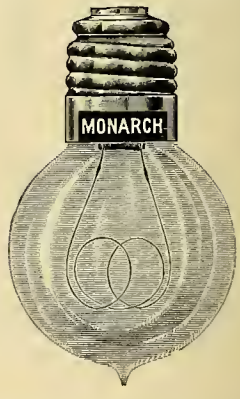

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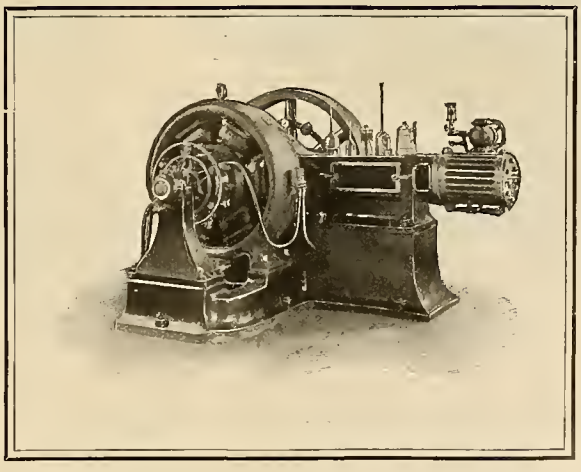

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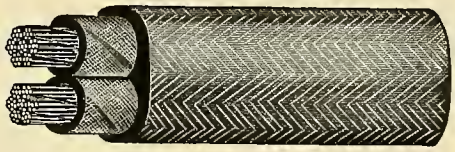

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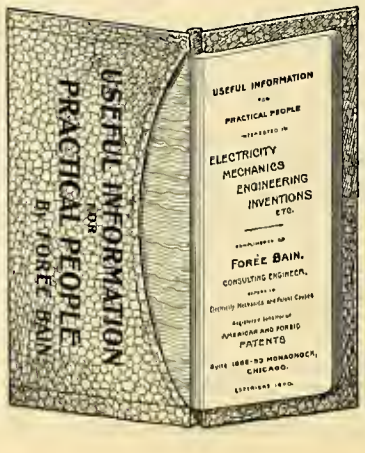

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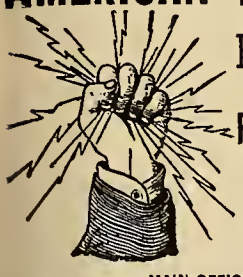

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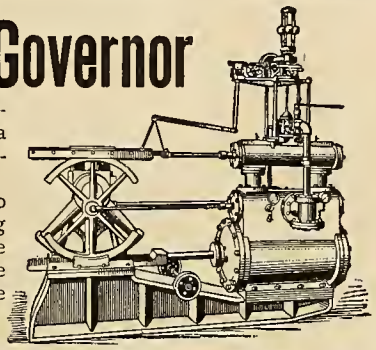

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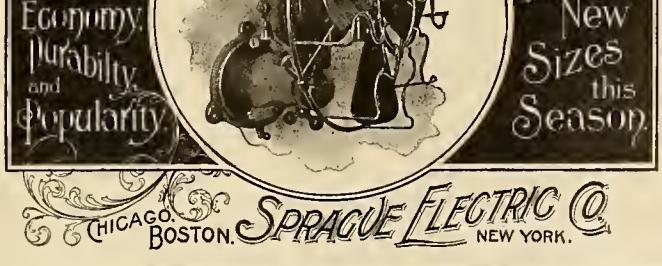

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One No. 6 390-light, 110-volt Edison machine in good condition with rheostat, sliding base, pulley, ammeter and voltmeter; also about 2,500 lbs. of bare copper Nos. 000, 00, 2, 4 and 6 B. W. G., all suitable for some small town. Address "N.," P. O. Box 135, Anna, Ill.

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AUCTION SALE.——BANKRUPT SALE.

Entire Property of The Suburban Electric Co., Covington, Ky., Offered For Sale.

Notice is hereby given that pursuant to an order in bankruptcy, in the matter of the Suburban Electric Company, a corporation organized under the laws of the state of Kentucky, bankrupt, No. 276, in the District Court of the United States for the District of Kentucky, I will, on the 25th day of September, 1900, at 10 o'clock a. m., at the Scott street entrance of the United States Court in Covington, Ky., sell at public auction to the highest bidder, all the property, real and personal, of every kind and description belonging to the Suburban Electric Company, bankrupt, including all the rights, privileges and franchises, except the franchise to be a corporation, and also its electric lighting plant, power station, machinery, engines, boilers, dynamos, electric machines, electric lamps and other appliances and appurtenances, poles, lines, wires and all contracts, claims and demands, and all other property of every kind and description, also the following described real estate belonging to the said bankrupt, situated in the city of Covington, Kenton County, Kentucky, and bounded as follows:

1. Beginning at a point on the east line of Madison avenue at the northeast corner of Madison avenue and an alley running parallel to and between Fourth and Fifth streets; thence northwardly along the east line of said Madison avenue towards Fourth street ninety (90) feet; thence at right angles to Madison avenue one hundred and ninety (190) feet to another alley; thence with said other alley and at right angles to said first-named alley ninety (90) feet to said first-named alley; thence westwardly along the same one hundred and ninety (190) feet to the place of beginning.

And also the following described piece of real estate belonging to said bankrupt, situated in the city of Newport, Campbell County, Kentucky, to wit:

2. Lot No. 260 in the Cotes Brilliant Lot & Home Company's subdivision, fronting thirty (30) feet on the west side of Park avenue, and extending back one hundred and twenty (120) feet to an alley.

The first tract of real estate above described will be sold subject to such lien as Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, or either of them, may have upon said real estate, which lien is as yet undetermined in amount.

The property above described will be sold free from any and all liens or encumbrances, except the lien or encumbrance in favor of Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, upon the said first described real estate aforesaid.

The second piece of real estate described aforesaid will be sold separately.

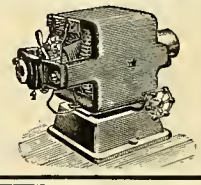
All the balance of the real estate, and all the other property and assets of every kind, and the rights, privileges and franchises of the Suburban Electric Company will be sold as an entirety and as a going concern.

The terms of the sale will be one-third (⅓) cash, to be paid upon the confirmation of the sale, the balance in equal installments of six and twelve months from date of sale, deferred payments to draw six (6%) per cent interest and to be secured by lien upon the property sold and also by bond with sureties satisfactory to the referee in bankruptcy herein; or purchaser may pay cash for said property upon the confirmation of the sale. No bid for said property will be received from any bidder who shall not place in the hands of the undersigned at the time of making said bid, as a pledge that said bidder will make good his bid if the sale is confirmed, the sum of fifteen thousand ($15,000) dollars, which sum of fifteen thousand dollars will be credited upon the first payment of the purchase money for said sale.

Inspection of property invited. Full information given upon application at the office of the bankrupt in Covington, Ky.

CHARLES H. SHAW,
Trustee in Bankruptcy of the Suburban Electric Company.

SIMRALL & GALVIN,
Attorneys for Trustee in Bankruptcy.



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1 50-light C. & C., self-oiler.
1 55-light Edison, 3 K. W., self-oiler, comp.
1 50-light Mather.
1 60-light Thomson-Houston, 75 v., comp. with extra armature.
1 75-light Thomson-Houston, D. 5.
1 75-light Wood, self-oiler.
1 90-light Westinghouse.
1 100-light Cutten.
1 100-light Jenney, comp.
1 210-light Triumph, self-oiler.
1 225-light United States.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp. self-oiler.
1 270-light T.-H., comp. self-oiler, D. 15.
3 270-light Westinghouse, M. P., slow speed, 15 K. W., October delivery.
1 300-light Columbian, multipolar, comp., self-oiler.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp., wound.
1 350-light National, self-oiler, compound.
3 350-light Edison, 20 K. W., self-oilers.
1 360-light Duplex multipolar, self-oiler, compound, slow speed.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elckmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., for direct connection.

220-Volt Generators.

1 7½ K. W. General Electric, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 15 K. W. Edison, compound, self-oiler.
1 25 K. W. Edison, self-oiler.
1 40 K. W. E. & C., multipolar, slow speed.
1 200 K. W. Crocker-Wheeler multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.

500-Volt Generators—Continued.

1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
3 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x24x14, all complete, fine.
1 150 K. W. Detroit (Rae) multipolar, compound, self-oiler, new armature.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp. wound.
1 600-light Bain, 30 K. W., self-oiler, new toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed arm't.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
1 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.

Arc Dynamos—Continued.

1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westingh'se, self-oiler.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 ⅜ H. P. Crocker - Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Elckmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

1 30 H. P. Edison, 25 K. W., self-oiler.
1 50 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 75 H. P. Sprague, self-oiler, new arm't.
1 225 H. P. Crocker-Wheeler, M. P.

500-Volt Motors.

1 ¼ H. P. Detroit, series wound.
1 1 H. P. Jenney, self-oiler.
1 1 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jenney, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. C. & C.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
1 40 H. P. Jenney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

Alternating-Current Motors.

SINGLE PHASE.

1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oilers, single-phase.
1 2½ H. P. Ft. Wayne, 100 volts, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

Alternating Current Motors.

MULTIPHASE.

1 1 H. P. Westinghouse, self-oiler, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 3-phase, type, 8-10-900, Form A, 60-cycle, 110 volts.

Automobiles.

1 Wood's electric runabout, with top, carries 2 persons, practically new.
1 Electric open phaeton, seats 3 persons, fine condition.
1 Electric "trap," carries 4 persons, new.

TRANSFORMERS, METERS AND ARC LAMPS.

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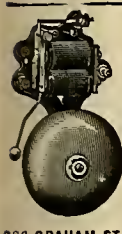

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Box 1002, Scranton, Penna.

NOTICE OF BIDS.

OFFICE OF THE CITY CLERK.

Kenton, Hardin County, Ohio.
August 2, 1900.

Notice is hereby given that the Council of the City of Kenton, County of Hardin and State of Ohio, will receive bids at the office of the City Clerk of said city, until 12 o'clock noon, on

Monday, September 3d, A. D. 1900,

for lighting the streets, alleys, squares, other public places and public buildings within the corporate limits of said city with not less than One Hundred and Ten (110) Electric Lights of Two Thousand (2,000) Candlepower properly placed and adjusted under supervision of the City Council. Said bids shall be for the term of five years. Said bids shall contain the name of the system of lighting proposed and shall state the amount per annum for which each light which is required will be erected and maintained during the hours of darkness, all night and every night.

Each bid must be accompanied by a good and sufficient guaranty that if the bid be accepted the bidder will enter into a contract and secure its performance by two disinterested sureties within thirty days after the acceptance of said bid.

Council reserves the right to reject any or all bids.

By order of the Council.

JOHN P. DUGAN,
City Clerk.

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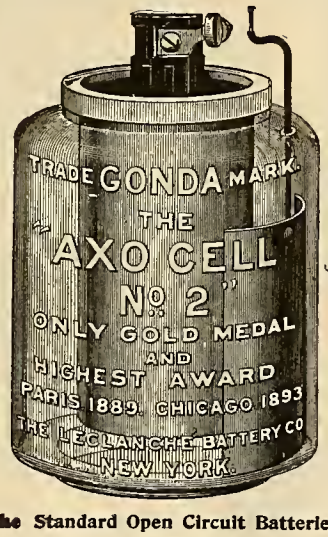

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The following list of thoroughly overhauled machines are in stock and ready for prompt delivery.

DYNAMOS—

110-Volt Incandescent.

One 12-light Elbridge.
One 50-light Nowotny, new.
One 100-light Daft.
One 250-light U. S.
One 350-light Davis.
One 800-light G. E.
One 1,800-light Ft. Wayne, new.

DYNAMOS—ARC.

One Brush, 1-light, 3,000 c. p.
One Brush, 3-light, 2,000 c. p.
One Amer. Wood, 20-light, 2,000 c. p.
One West. Elec., 30-light, 2,000 c. p.
One Ft. Wayne Wood, 35-light, 1,200 c. p.
One T. H. L. D., 35-light, 2,000 c. p.

ALTERNATORS.

One 3A Slattery.
One A60 G. E.

STEWART ELECTRICAL CO.,
S. E. Cor. Fifth and Sycamore,
CINCINNATI, O.

GENERATORS.

One Wood b. p., 500 v., 45 k. w.
One T.-H. m. p. 75,500 v., 75 k. w.
One Edison b. p., 500 v., 100 k. w.

110-VOLT MOTORS.

One Diehl, ½ h. p.
One Edison, ¾ h. p.
One Elbridge, ¾ h. p.
One Card, 1 h. p.
One Sprague, 1 h. p.
One Nowotny, 3 h. p.
One Daft, 10 h. p.
One U. S., 20 h. p.
One Q. C., 28 h. p.

220-VOLT MOTORS.

One Nowotny, 1 h. p., new.
One Nowotny, 1 h. p.
One Davis, 5 h. p.
One Daft, 10 h. p.
One E. R. & C. C., 10 h. p.
One Edison b. p., 15 h. p.

500-VOLT MOTORS.

One Davis, 20 h. p.
One Brush, 25 h. p.
One Wood h. p., 60 h. p.
One T.-H. m. p., 15, 90 h. p.
One Edison, 100 k. w., 120 h. p.

MACHINERY AND SUPPLIES

AT BARGAIN PRICES.

FOR SALE.

We are constantly purchasing entire factories and plants. We bought from the Sioux City Traction Co. the following:

No. S1 2 13x22x12 Westinghouse compound engines.
No. S2 1 pair 17¾x24 Williams automatic engines, coupled together.
No. S3 2 generators, type U. S. Westinghouse, bi-polar, size, 80 K. W.
No. S4 2 60x16 horizontal tubular boilers.
No. S5 1 450 H. P. Hazleton water tube boiler, 2 Roney furnaces with stokers.
No. S6 1 Worthington duplex pump, 6x4 x6.
No. S7 1 Koerschell heater, 2x9 feet.
No. S8 1 Hancock inspirator, 1¼ inches.
No. S9 38 feet 6⅝-inch shafting.
No. S10 39 feet 8-inch shafting.
No. S11 8 feet 4⅞-inch shafting.
No. S12 15 feet 10-inch shafting.
No. S13 2 6⅝-inch flanged couplings.
No. S14 1 8-inch flanged coupling.
No. S15 1 6⅜x4⅞ flanged couplings.
No. S16 1 60x38x6⅜ in. double arm drive pulley.
No. S17 4 60x16x6⅜ in. Hill friction clutch pulleys.
No. S18 1 60x28x6⅜ in. iron pulley, leather covered face.
No. S19 1 60x16x4⅞ in. iron pulley.
No. S20 1 14x42x8 in. iron pulley.
No. S21 2 6⅜x20 chain oiling pillow blocks.
No. S22 5 6⅜x15 chain oiling pillow blocks.
No. S23 1 4⅞x15 chain oiling pillow blocks.
No. S24 1 72x26x8 in. Dodge wood pulley.
No. S25 2 14 ft. x 16 in. cable drums; 6 grooves for 1¼-inch cable.
No. S26 1 12 ft. x 17 in. x 15 in. spur gear.
No. S27 10 8x18 in. pillow blocks.
No. S28 2 double ply dynamo belts, 16-inch width, 57 feet long.
No. S29 1 double ply dynamo belt, 14½-inch width; 71 feet long.
No. S30 1 double ply dynamo belt, 14½-inch width; 48 feet long.

WE PURCHASED FROM P. D. ARMOUR & CO., Union Stock Yards, their entire boiler outfit. Armour & Co. changed their motive power from steam to electricity at a cost of over $2,000,000, as a result of which they sold to us all their fine horizontal tubular boilers, consisting of 48—60x16. 12—54x16, 12—60x18.

They are all in excellent condition and have been thoroughly overhauled, all weak parts replaced.

We also purchased the HASTINGS, NEB., ELECTRIC PLANT, consisting of the following:

No. S326 1 9½x12 Armington & Sims engine.
No. S327 2 650-light incandescent dynamos.
No. S328 2 25-light Ball arc dynamos.
No. S329 2 60x16 horizontal tubular boilers.
No. S330 2 66x16 horizontal tubular boilers.
Shafting, hangers, couplings, etc.

ENGINES.

No. S64 12x20x12 Westinghouse automatic compound.
No. S65 12x20x14 Ball automatic compound.
No. S66 12x24 Zeabm Bros.
No. S67 12x20 horizontal slide valve.
No. S205 13x16 Twin engines, tandem bed.
No. S70 13x16 horizontal side crank.
No. S71 13x18 four valve Russell automatic.
No. S72 13x20x15 Armington & Sims cross compound condensing.
No. S73 13x16 Erie horizontal.
No. S74 14x14 automatic Ideal.
No. S75 14x24 Richards horizontal.
No. S76 14x24 box bed.
No. S77 14x20 Atlas automatic.
No. S78 14x24 Bay State.
No. S78 14x30 Cumner.
No. S79 14½x13 Armington & Sims automatic.
No. S80 15x14 automatic Ideal.
No. S81 16x14 Smith, Beggs & Rankin automatic.
No. S207 16x36 Woodruff & Beach.
No. S208 17¾x24 pr. auto. Williams, coupled.
No. S82 18x30 250 H. P.
No. S83 20x22 Corliss.
No. S84 20x36 Corliss.
No. S85 20x42 Corliss.
No. S86 26x48 Corliss.
No. S87 20x24 horizontal, box bed.
No. S209 66x20 Chandler & Taylor.
No. S210 40 H. P. Rice automatic.
No. S211 35 H. P. Chandler & Taylor.
No. S88 22x42x48 Allis tandem condensing.
No. S89 14x20 Russell automatic.
No. S90 10 H. P. Davis & Rankin.
No. S91 10 H. P. slide valve.
No. S92 40 H. P. slide valve.
No. S93 60 H. P. slide valve.
No. S94 20 H. P. Milburn.
No. S95 No. 874 Racine automatic, 9-inch stroke.
No. S96 80 H. P. Farquhar.
No. S97 No. 1 Russell high-speed automatic.
No. S98 12 H. P. Giant.
No. S99 14 H. P. Giant.
No. S100 6 H. P. automatic Westinghouse.
No. S101 10 H. P. gas engine.
No. S102 13 H. P. Dayton gasoline.
No. S103 35 H. P. upright.
No. S104 40 H. P. Otto gas.
No. S105 50 H. P. Otto gas.
No. S106 13 H. P. Lewis gasoline.
No. S107 50 H. P. Raymond gasoline.
No. S172 68 H. P. Atlas.
No. S173 10x20 side crank.
No. S174 Otis furnace hoist engine, 2 cyl., 8x10.
No. S177 13x16 Twin engines, tandem bed.
No. S179 7x14 Ames cylinder.
No. S273 16x30 balance wheel, 14 feet diam.
No. S274 1 H. P. gasoline.
No. S275 16½x30 Buckeye.
No. S276 6x12 horizontal slide valve.
No. S277 14x28 horizontal slide valve.
No. S278 12x24 marine oscillating.
No. S279 30x30 slide valve.
No. S280 36x42 slide valve.
No. S281 24x30 slide valve.
No. S282 10x15 center crank.
No. S283 6x8 box bed, side crank.
No. S284 16x36 Sinker & Davis.
No. S285 9x9 upright, center crank.
No. S286 9x14 horizontal, side crank
No. S287 9x12 Nagel.
No. S288 7x7 side crank.

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110-VOLT INCANDESCENT DYNAMOS.

No. SM145 2 T.-H. 500-light, 110-volt, direct connected.
No. SM146 1 50-light Edison dynamo.
No. SM147 1 25-light C. & C. dynamo.
No. SM148 1 250-light Edison dynamo.
No. SM149 1 100-light Rockford dynamo.
No. SM150 3 500-light T.-H. dynamos.
No. SM151 1 150-light Eddy dynamo.
No. SM152 1 100-light, 110-volt, Weston dynamo.
No. SM153 1 250-light Hawkeye dynamo.

500-VOLT GENERATORS.

No. SM154 1 No. 8 T.-H., 75 K. W., 500-volt.

550-VOLT GENERATORS.

No. SM155 2 type U. S. Westinghouse bi-polar; 80 K. W.; 350 revolutions, 550-volt.

ALTERNATORS.

No. SM156 1 50 K. W.; 1,000-volt; Westinghouse; complete with switchboard, exciter, one extra brand new armature for exciter, two field coils.
No. SM157 1 500-light National; exciter on shaft.
No. SM158 1 500-light T.-H. alternator; 1,000-volt.
No. SM159 1 600-light T.-H.; 2,040-volt.
No. SM160 2 25 K. W. Westinghouse Alternators; 1,150-volt; 16,000 alternations; switchboard and instruments.

ARC DYNAMOS.

No. SM161 25-light; 2,000 c. p. low tension; one extra armature for same.
No. SM162 3 50-light; 2,000 c. p.; T.-H.
No. SM163 1 No. 8; 60-light; arc; 2,000 c. p.; Wood.
No. SM164 1 80-light Western Electric dynamo.
No. SM165 20-light, 2,000 c. p. Sperry; switchboard and instruments.

MOTORS.

No. SM166 1 20 H. P., 500-volt, Ft. Wayne.
No. SM167 1 3 H. P., 500-volt., T.-H.
No. S168 1 McGowan condenser, steam cyl., 8-inch.
No. S169 1 hoisting engine and boiler, 6x 12, made by Kendall & Bro.

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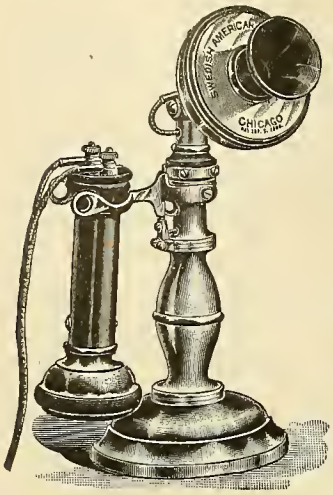

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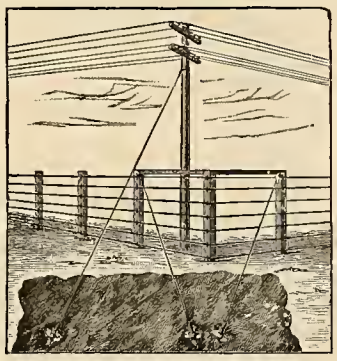

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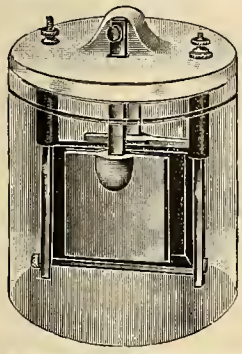

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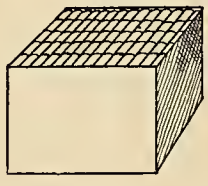

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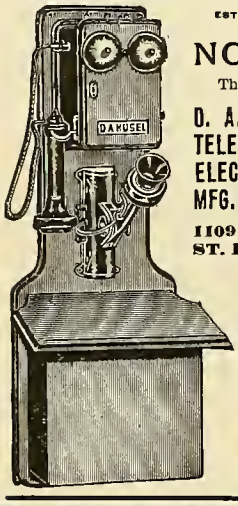

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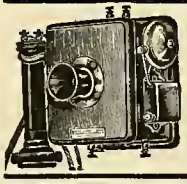

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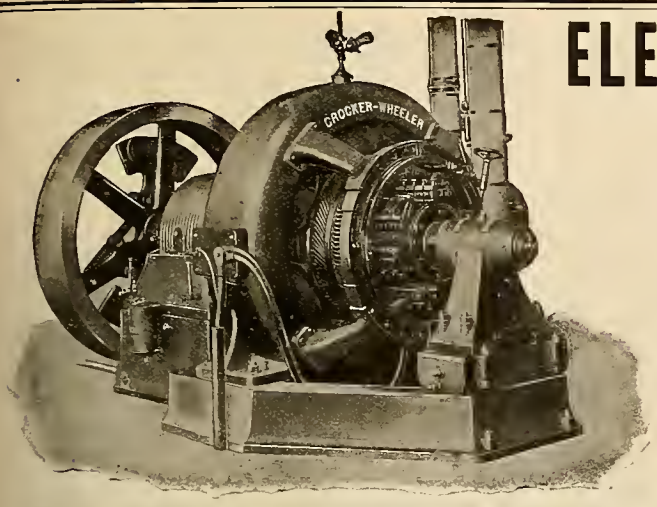

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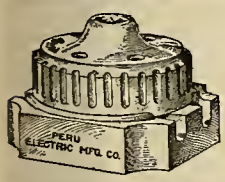

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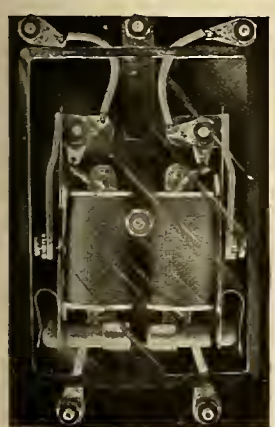

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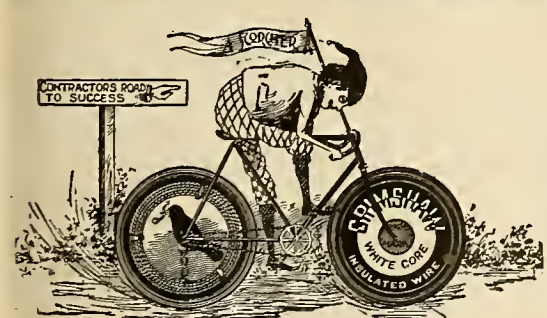

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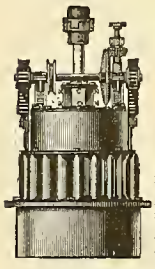

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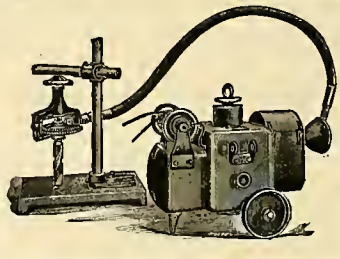

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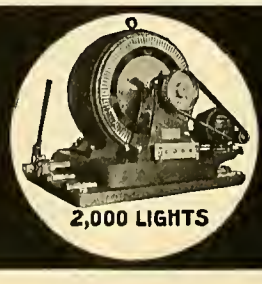

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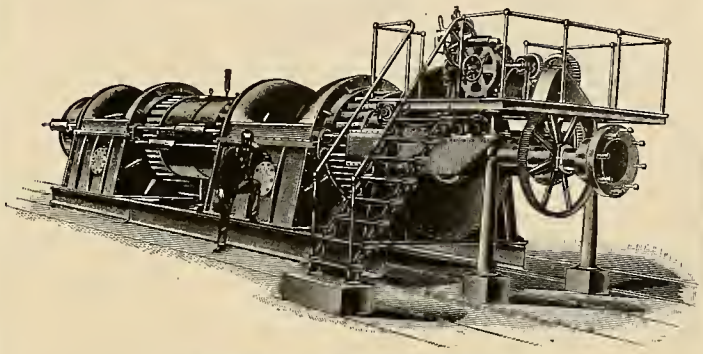

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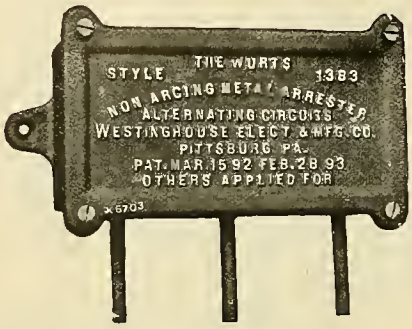

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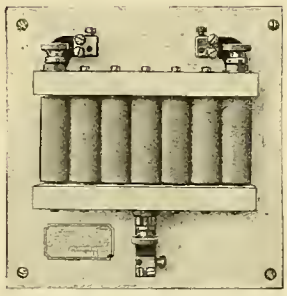

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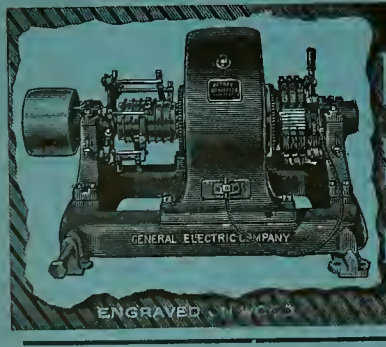

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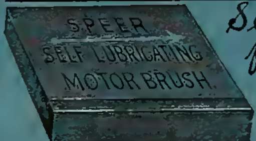

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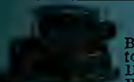
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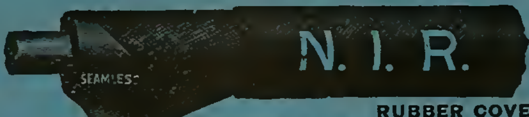

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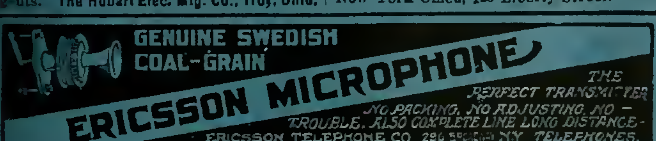

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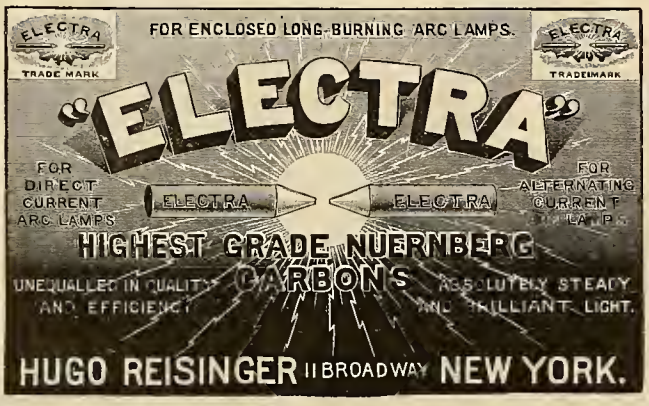

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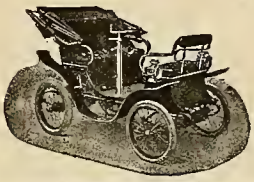

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CHICAGO EDISON COMPANY,

FAN MOTORS

139 ADAMS ST., CHICAGO.

OUR SELF-STARTING SINGLE-PHASE A. C. MOTORS AND WHAT A CUSTOMER THINKS OF THEM.

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Nashville Tenn June 1, 1900

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Yours Truly

Phillips & Buttorff Mfg Co

P. H. Buttorff

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SAN FRANCISCO, 120 Sutter St. NEW ORLEANS, 610 Gravier St.

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FOREIGN DEPARTMENT, Havemeyer Bldg., New York City.
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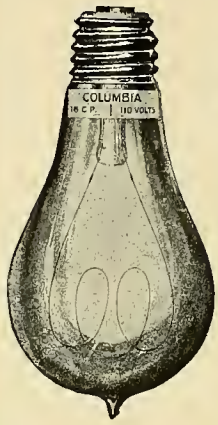
LONDON, ENG., 47 Victoria St., C. R. Heap, Agent. YOKOHAMA, JAPAN, Bagnall & Hilles, Agents.
PARIS, FRANCE, 12 Rue St. Georges, E. H. Cadiot & Cie, Agents.



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The India-Rubber and Gutta-Percha Insulating Co.,

MAIN OFFICE, Glenwood Works,

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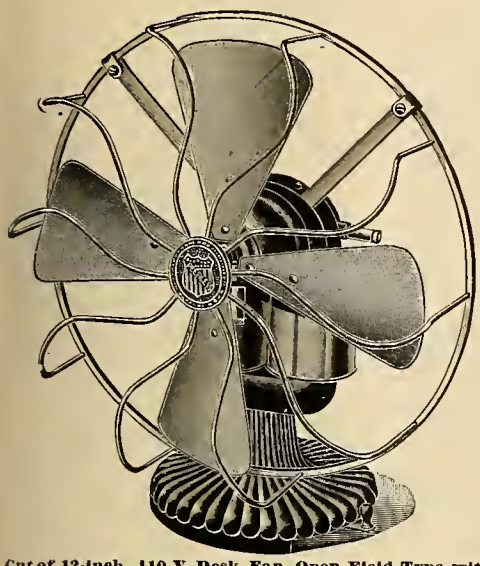
YONKERS, N. Y.

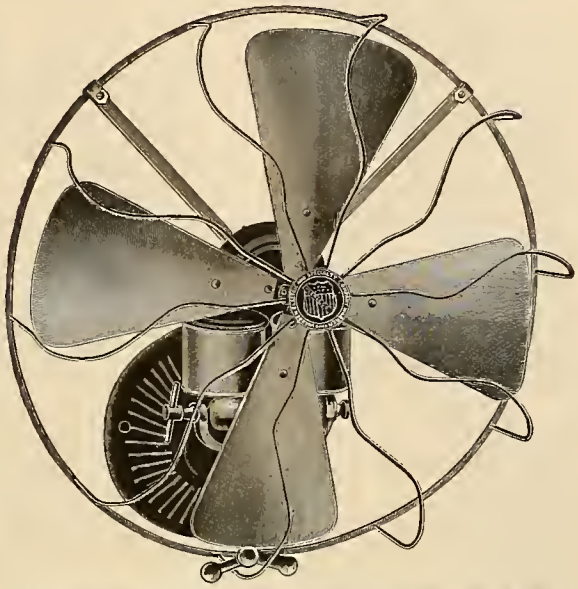
(10923)

PEERLESS

DIRECT-CURRENT DESK AND CEILING FANS.



Cut of 12-inch, 110-V, Desk Fan, Open Field Type with polished brass hoods and field coverings, the handsomest and most efficient Fan on the market.



Cut of 16-inch Wall Fan, same finish as 12-inch and having a swivel joint. By simply turning a handle this Fan can be adjusted to blow air up, down or on either side.

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11. Electric Supply & Const. Co., 80 E. Gay St., Columbus, O.
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Munsell & Co., Eugene.
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New York Insulated Wire Co.
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Paiste Co., H. T.
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Sterling Varnish Co.
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American Electrical Works.
American Steel & Wire Co.
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General Electric Co.
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Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
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Johnston, Thomas J.
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Jeffrey Mfg. Co.
Link Belt Machinery Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

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Refiners.
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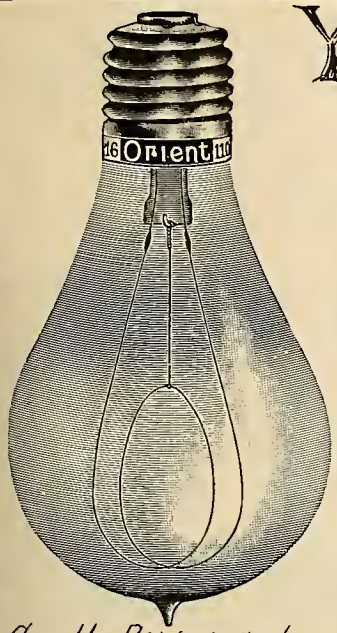

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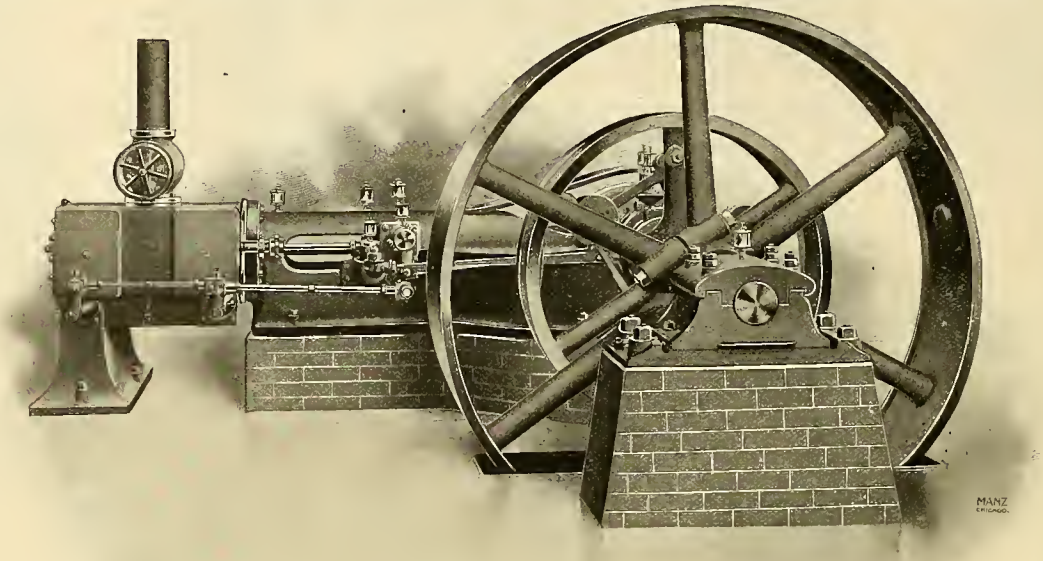

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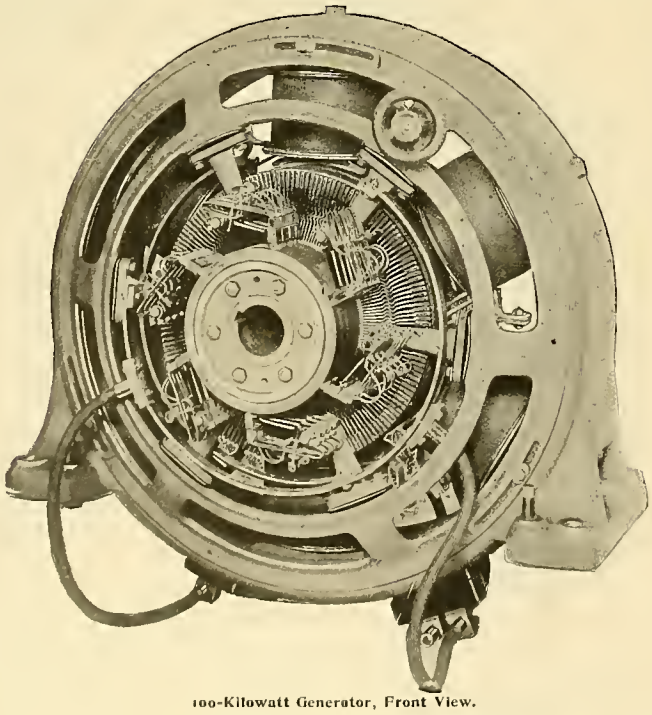

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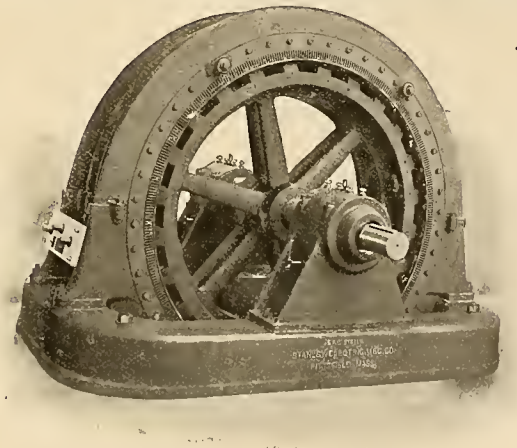

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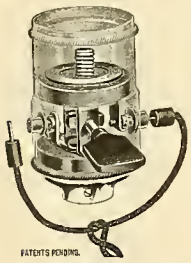

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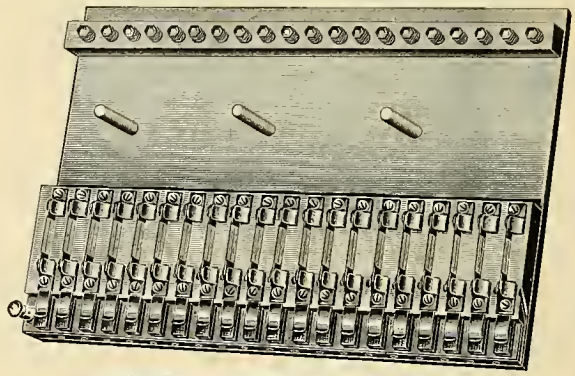

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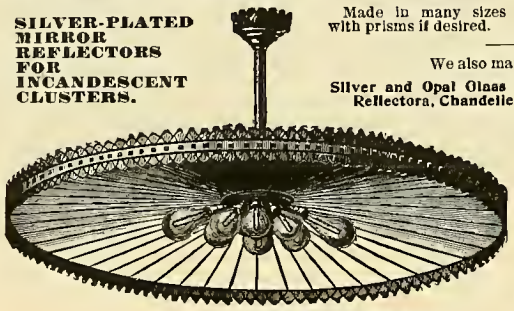

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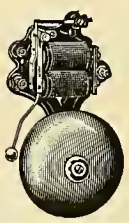

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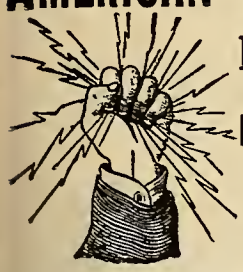

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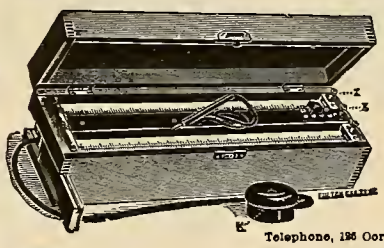

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Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

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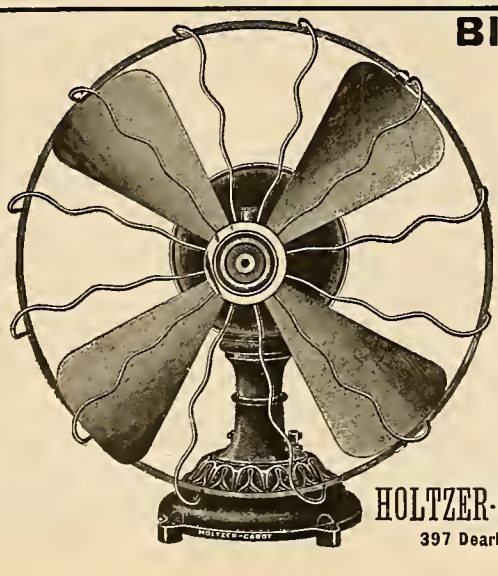

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PER LIGHT 30c.

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Position, by a practical electrician of eight years' experience, to look after light plant and do the necessary wiring and construction work and capable of doing the wiring of the plant. Prefer day work, or will work ½ day and ½ night. Best of reference furnished. Strictly temperate. Address "TEMPERATE," care Western Electrician, 510 Marquette Bldg., Chicago.

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One 18x42-inch Hamilton Corliss Engine, 180 H. P., good as new; counter-shafting and belt. Terms cash. Address ARTHUR FRANTZEN CO., 225 Dearborn St., Chicago.

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The satisfactory kind that brings your second order.

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Manfrs. of the well known

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--FOR SALE--

110-Volt Incandescent Dynamos.

1 12-light Hartley, self-oiler, multipolar.
2 12-light Edison, ¾ K. W.
1 26-light Perrett.
1 50-light Hawkeye.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 50-light C. & C., self-oiler.
1 55-light Edison, 3 K. W., self-oiler, comp.
1 50-light Mather.
1 60-light Thomson-Houston, 75 v., comp. with extra armature.
1 75-light Thomson-Houston, D. 5.
1 75-light Wood, self-oiler.
1 80-light Westinghouse.
1 100-light Cutten.
1 100-light Jenney, comp.
1 210-light Triumph, self-oiler.
1 225-light United States.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp. self-oiler.
1 270-light T.-H., comp. self-oiler, D. 15.
3 270-light Westinghouse, M. P., slow speed, 15 K. W., October delivery.
1 300-light Columbian, multipolar, comp., self-oiler.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp., wound.
1 350-light National, self-oiler, compound.
3 350-light Edison, 20 K. W., self-oilers.
1 360-light Duplex multipolar, self-oiler, compound, slow speed.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Eickmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Enz, 80 K. W., M. P., for direct connection.

220-Volt Generators.

1 7½ K. W. General Electric, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 15 K. W. Edison, compound, self-oiler.
1 25 K. W. Edison, self-oiler.
1 40 K. W. E. & C., multipolar, slow speed.
1 200 K. W. Crocker-Wheeler multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.

500-Volt Generators—Continued.

1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
3 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x24x14, all complete, fine.
1 150 K. W. Detroit (Rae) multipolar, compound, self-oiler, new armature.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp. wound.
1 600-light Bain, 30 K. W., self-oiler, new toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 500-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed arm't.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
1 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.

Arc Dynamos—Continued.

1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, half arm.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westingh'se, self-oiler.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 3 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Eickmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

1 30 H. P. Edison, 25 K. W., self-oiler.
1 50 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 75 H. P. Sprague, self-oiler, new arm't.
1 225 H. P. Crocker-Wheeler, M. P.

500-Volt Motors.

1 ¼ H. P. Detroit, series wound.
1 1 H. P. Jenney, self-oiler.
1 1 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jenney, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. C. & C.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
1 40 H. P. Jenney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

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SINGLE PHASE.

1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oilers, single-phase.
1 2½ H. P. Ft. Wayne, 100 volts, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

Alternating Current Motors.

MULTIPHASE.

1 1 H. P. Westinghouse, self-oiler, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 3-phase, type, 8-10-900, Form A, 60-cycle, 110 volts.

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1 Wood's electric runabout, with top, carries 2 persons, practically new.
1 Electric open phaeton, seats 3 persons, fine condition.
1 Electric "trap," carries 4 persons, new.

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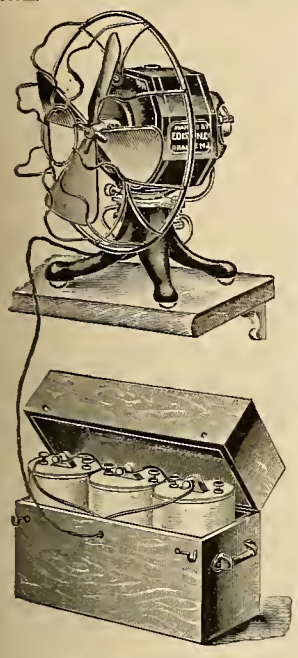

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MACHINERY AND SUPPLIES

AT BARGAIN PRICES.

FOR SALE.

We are constantly purchasing entire factories and plants. We bought from the Sioux City Traction Co. the following:

No. S1 2 13x22x12 Westinghouse compound engines.
No. S2 1 pair 17¾x24 Williams automatic engines, coupled together.
No. S3 2 generators, type U. S. Westinghouse, bi-polar, size, 80 K. W.
No. S4 2 60x16 horizontal tubular boilers.
No. S5 1 450 H. P. Hazleton water tube boiler, 2 Roney furnaces with stokers.
No. S6 1 Worthington duplex pump, 6x4 x6.
No. S7 1 Koerschell heater, 2x9 feet.
No. S8 1 Hancock inspirator, 1¼ inches.
No. S9 38 feet 6⅞-inch shafting.
No. S10 39 feet 8-inch shafting.
No. S11 8 feet 4⅞-inch shafting.
No. S12 15 feet 10-inch shafting.
No. S13 2 6⅞-inch flanged couplings.
No. S14 1 8-inch flanged coupling.
No. S15 1 6⅝x4⅞ flanged couplings.
No. S16 1 60x33x6⅜ in. double arm drive pulley.
No. S17 4 60x16x6⅜ in. Hill friction clutch pulleys.
No. S18 1 60x28x6⅜ in. iron pulley, leather covered face.
No. S19 1 60x16x4⅞ in. iron pulley.
No. S20 1 14x43x8 in. iron pulley.
No. S21 2 6⅜x20 chain oiling pillow blocks.
No. S22 5 6⅜x15 chain oiling pillow blocks.
No. S23 1 4⅜x15 chain oiling pillow blocks.
No. S24 1 72x26x8 in. Dodge wood pulley.
No. S25 2 14 ft. x 16 in. cable drums; 6 grooves for 1¼-inch cable.
No. S26 1 12 ft. x 17 in. x 15 in. spur gear.
No. S27 10 8x18 in. pillow blocks.
No. S28 2 double ply dynamo belts, 16-inch width, 57 feet long.
No. S29 1 double ply dynamo belt, 14½-inch width; 71 feet long.
No. S30 1 double ply dynamo belt, 14½-inch width; 48 feet long.

WE PURCHASED FROM P. D. ARMOUR & CO., Union Stock Yards, their entire boiler outfit. Armour & Co. changed their motive power from steam to electricity at a cost of over $2,000,000, as a result of which they sold to us all their fine horizontal tubular boilers, consisting of 48—60x16 12—54x16, 12—60x18.

They are all in excellent condition and have been thoroughly overhauled, all weak parts replaced.

We also purchased the HASTINGS, NEB., ELECTRIC PLANT, consisting of the following:

No. S326 1 9½x12 Armington & Sims engine.
No. S327 2 650-light incandescent dynamos.
No. S328 2 25-light Ball arc dynamos.
No. S329 2 60x16 horizontal tubular boilers.
No. S330 2 66x16 horizontal tubular boilers.
Shafting, hangers, couplings, etc.

ENGINES.

No. S64 12x20x12 Westinghouse automatic compound.
No. S65 12x20x14 Ball automatic compound.
No. S66 12x24 Zeahm Bros.
No. S67 12x20 horizontal slide valve.
No. S265 13x16 Twin engines, tandem bed.
No. S70 13x16 horizontal side crank.
No. S71 13x18 four valve Russell automatic.
No. S72 13x20x15 Armington & Sims cross compound condensing.
No. S73 13x16 Erie horizontal.
No. S74 14x14 automatic Ideal.
No. S75 14x24 Richards horizontal.
No. S76 14x24 box bed.
No. S77 14x20 Atlas automatic.
No. S78 14x24 Bay State.
No. S78 14x30 Cumner.
No. S79 14½x13 Armington & Sims automatic.
No. S80 15x14 automatic Ideal.
No. S81 16x14 Smith, Beggs & Rankin automatic.
No. S207 16x36 Woodruff & Beach.
No. S208 17¾x24 pr. auto. Williams, coupled.
No. S82 18x30 250 H. P.
No. S83 20x22 Corliss.
No. S84 20x36 Corliss.
No. S85 20x42 Corliss.
No. S86 26x48 Corliss.
No. S87 20x24 horizontal, box bed.
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No. S88 22x42x48 Allis tandem condensing.
No. S89 14x20 Russell automatic.
No. S90 10 H. P. Davis & Rankin.
No. S91 10 H. P. slide valve.
No. S92 40 H. P. slide valve.
No. S93 60 H. P. slide valve.
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No. S95 No. 874 Racine automatic, 9-inch stroke.
No. S96 80 H. P. Farquhar.
No. S97 No. 1 Russell high-speed automatic.
No. S98 12 H. P. Giant.
No. S99 14 H. P. Giant.
No. S100 6 H. P. automatic Westinghouse.
No. S101 10 H. P. gas engine.
No. S102 13 H. P. Dayton gasoline.
No. S103 35 H. P. upright.
No. S104 40 H. P. Otto gas.
No. S105 50 H. P. Otto gas.
No. S106 19 H. P. Lewis gasoline.
No. S107 50 H. P. Raymond gasoline.
No. S172 68 H. P. Atlas.
No. S173 10x20 side crank.
No. S174 Otis furnace hoist engine, 2 cyl., 8x10.
No. S177 13x16 Twin engines, tandem bed.
No. S179 7x14 Ames cylinder.
No. S273 16x30 balance wheel, 14 feet diam.
No. S274 1 H. P. gasoline.
No. S275 16½x30 Buckeye.
No. S276 6x12 horizontal slide valve.
No. S277 14x28 horizontal slide valve.
No. S278 12x24 marine oscillating.
No. S279 30x30 slide valve.
No. S280 36x42 slide valve.
No. S281 24x30 slide valve.
No. S282 10x15 center crank.
No. S283 6x8 box bed, side crank.
No. S284 16x36 Sinker & Davis.
No. S285 9x9 upright, center crank.
No. S286 9x14 horizontal, side crank
No. S287 9x12 Nagel.
No. S288 7x7 side crank.

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110-VOLT INCANDESCENT DYNAMOS.

No. SM145 2 T.-H. 500-light, 110-volt, direct connected.
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No. SM147 1 25-light C. & C. dynamo.
No. SM148 1 250-light Edison dynamo.
No. SM149 1 100-light Rockford dynamo.
No. SM150 2 500-light T.-H. dynamos.
No. SM151 1 150-light Eddy dynamo.
No. SM152 1 100-light, 110-volt, Weston dynamo.
No. SM153 1 250-light Haykeye dynamo.

500-VOLT GENERATORS.

No. SM154 1 No. 8 T.-H., 75 K. W., 500-volt.

550-VOLT GENERATORS.

No. SM155 2 type U. S. Westinghouse bi-polar; 80 K. W.; 350 revolutions, 550-volt.

ALTERNATORS.

No. SM156 1 50 K. W.; 1,000-volt; Westinghouse; complete with switchboard, exciter, one extra brand new armature for exciter, two field coils.
No. SM157 1 500-light National; exciter on shaft.
No. SM158 1 500-light T.-H. alternator; 1,000-volt.
No. SM159 1 600-light T.-H.; 2,040-volt.
No. SM160 2 25 K. W. Westinghouse Alternators; 1,150-volt; 16,000 alternations; switchboard and instruments.

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No. SM161 25-light; 2,000 c. p. low tension; one extra armature for same.
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No. SM163 1 No. 8; 60-light; arc; 2,000 c. p.; Wood.
No. SM164 1 80-light Western Electric dynamo.
No. SM165 20-light, 2,000 c. p. Sperry; switchboard and instruments.

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No. SM167 1 3 H. P., 500-volt., T.-H.
No. S168 1 McGowan condenser, steam cyl., 8-inch.
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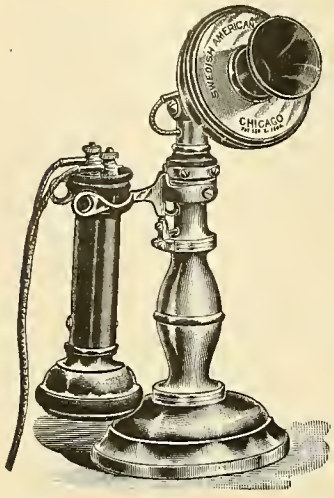

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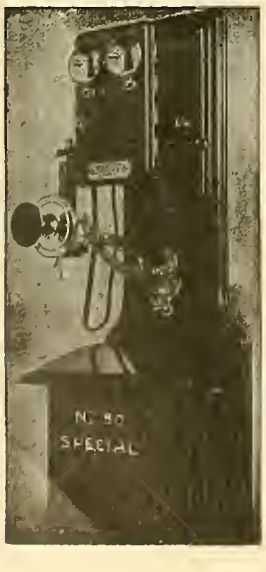

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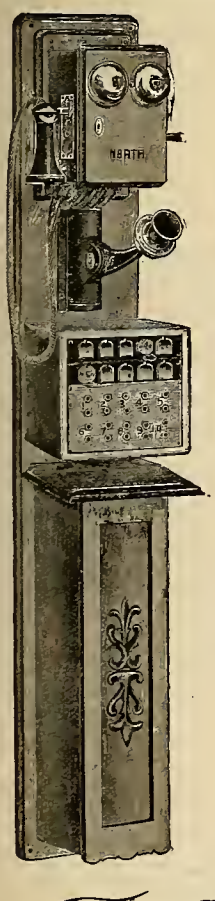

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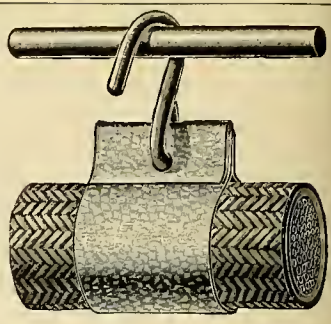

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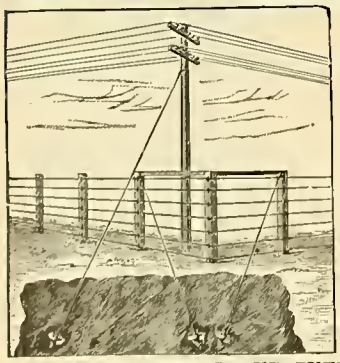

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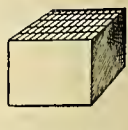

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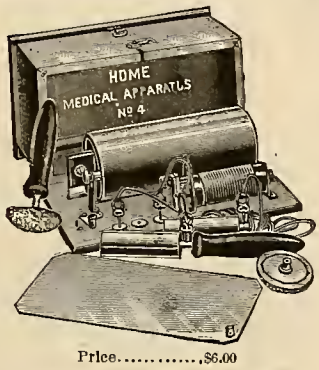

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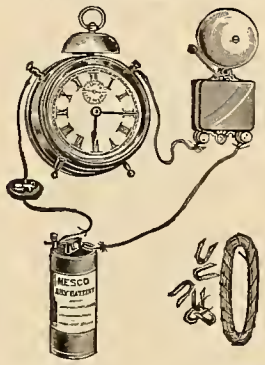

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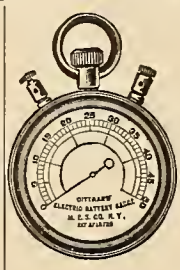

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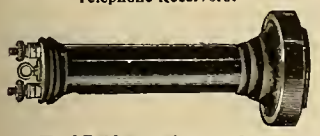

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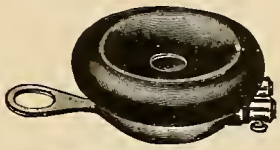

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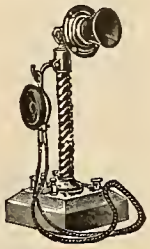

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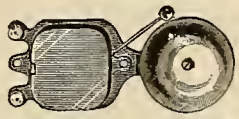

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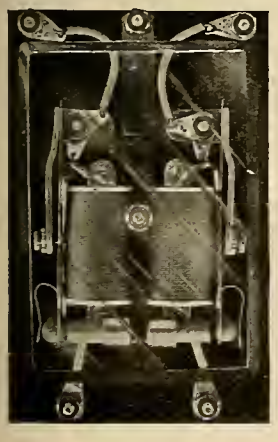

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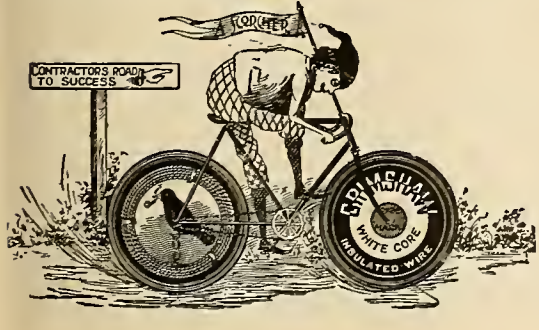

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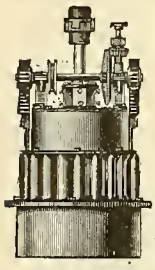

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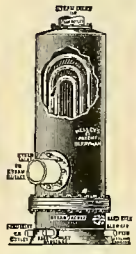

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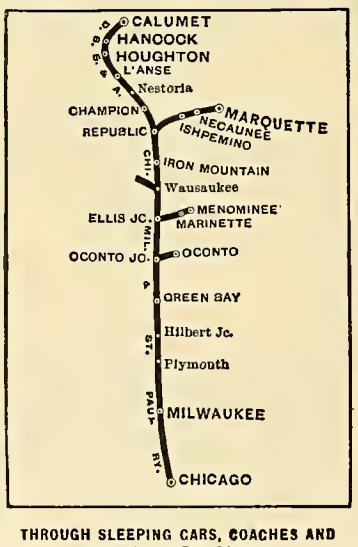

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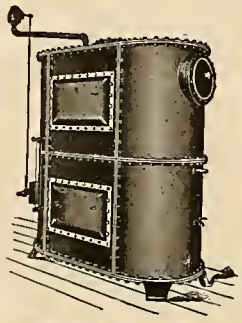

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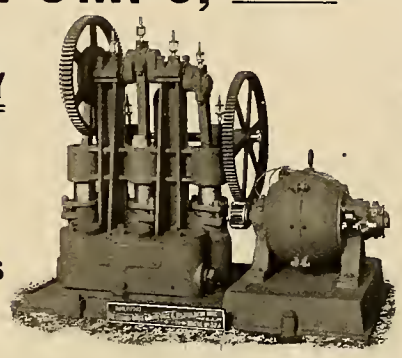

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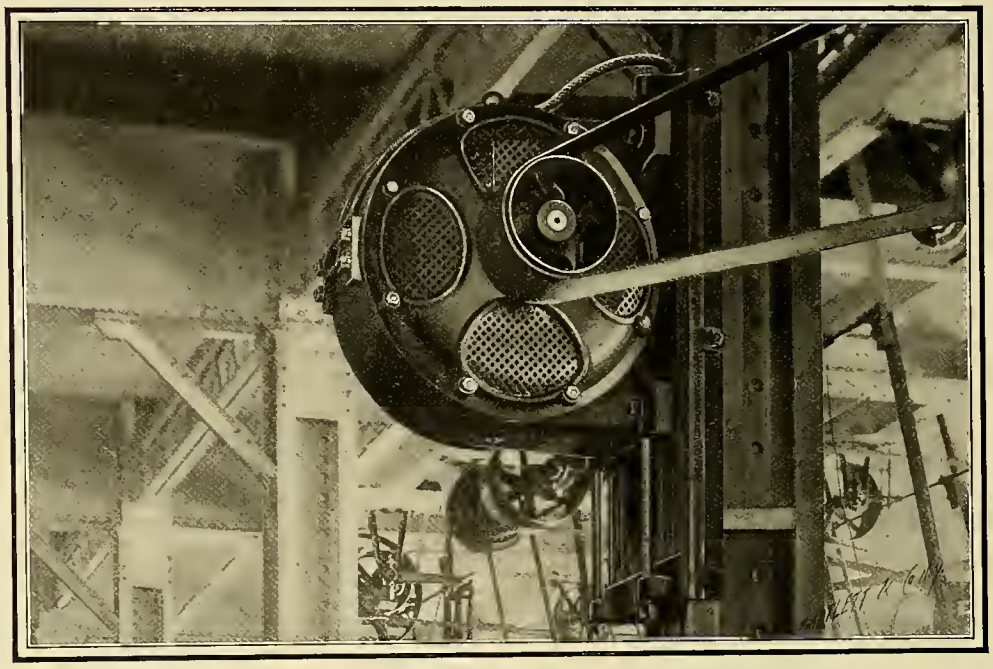

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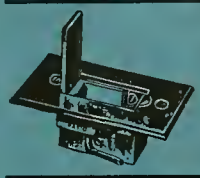

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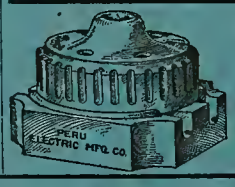

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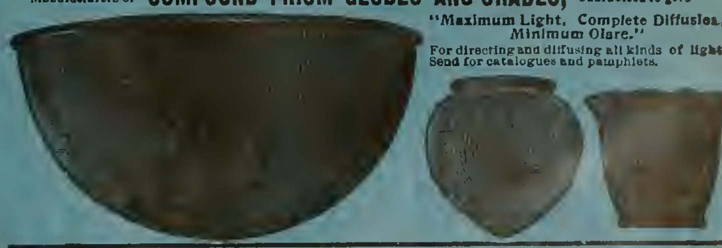

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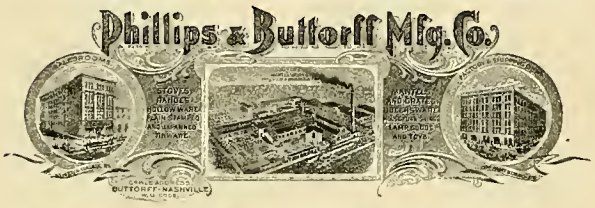
PARAGON

CHICAGO EDISON COMPANY, 139 ADAMS ST., CHICAGO.

FAN MOTORS

OUR SELF-STARTING SINGLE-PHASE A. C. MOTORS AND WHAT A CUSTOMER THINKS OF THEM.



Nashville, Tenn. June 1, 1900

Mr. Jas Shingleton.

Dear Sir—

The Four Wagner Motors you installed in our Work Shop last Summer, have proven satisfactory in every respect, not requiring any attention whatever, and the current consumption has been remarkably low, exceeding our most sanguine expectations.

Yours Truly

Phillips & Buttorff Mfg. Co.

P. P. Buttorff

WRITE FOR BULLETINS "Z 24, 35, 37 and 39."

WAGNER ELECTRIC MFG. CO.,

GENERAL OFFICES AND FACTORY, ST. LOUIS, MO., U. S. A.

BRANCH OFFICES:

NEW YORK, 220 Havemeyer Bldg. PHILADELPHIA, 1000 Betz Bldg. BOSTON, 620 Atlantic Ave.
CHICAGO, 1624 Marquette Bldg. BALTIMORE, 204 East Lexington St
SAN FRANCISCO, 120 Sutter St. NEW ORLEANS, 510 Gravier St.

FOREIGN AGENCIES:

FOREIGN DEPARTMENT, Havemeyer Bldg., New York City.
CITY OF MEXICO, MEX., American Engineering Co. of Mexico, Agents.
LONDON, ENG., 47 Victoria St., C. R. Heap, Agent. YOKOHAMA, JAPAN, Bagnall & Hilles, Agents.
PARIS, FRANCE, 12 Rue St. Georges, E. H. Cadiot & Cie, Agents.

Columbia Lamps.

Unequaled in Quality.

BEFORE placing your orders for fall and early winter requirements in Incandescent Lamps we respectfully invite the attention of Central Stations and Isolated Plants to the high quality of the Columbia. We guarantee the highest uniformity in initial readings as well as the highest maintenance of candlepower.

Special prices to consumers on future delivery orders for 1,000 or more covering full annual requirements.

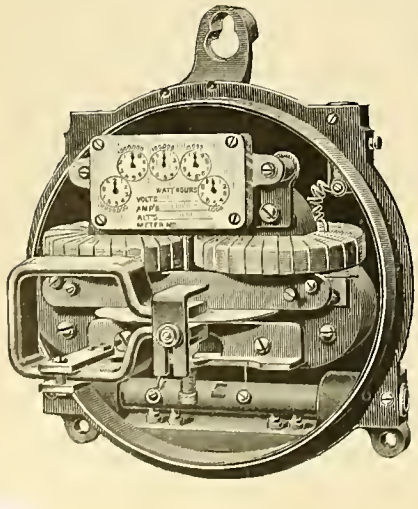
Trial order solicited.

CENTRAL ELECTRIC COMPANY,

GENERAL SALES AGENTS,

264-266-268-270 Fifth Avenue,

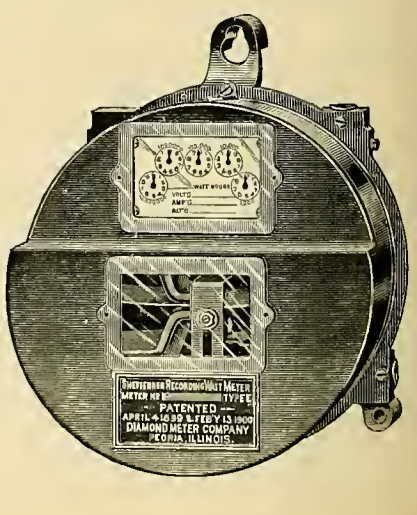
CHICAGO.



Scheeffer Recording Wattmeter.

ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.



DIAMOND METER CO.

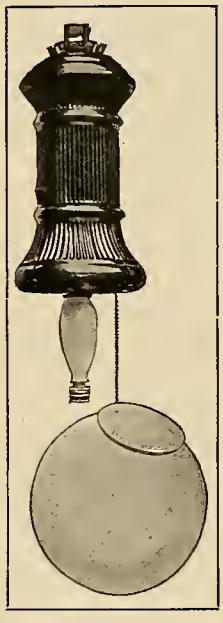
PEORIA, ILL., U. S. A.

SEASON AND REASON.

At this particular time the lighting question is interesting central station managers, manufacturers, and all who require artificial light.

And with it arises that ever-perplexing question of

WHAT LAMP TO BUY?



DON'T BUY

Any lamp before investigating the merits of

THE BELDEN SYSTEM,

Because it possesses features superior to anything on the market. A trial has convinced others and will do the same for you.

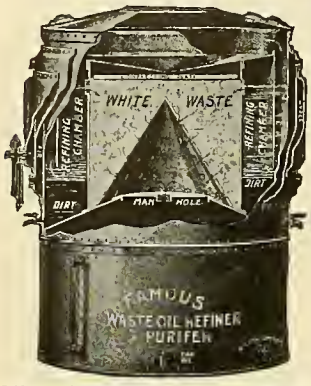
BELDEN-LARWILL ELECTRIC & MFG. CO.,

FORT WAYNE, IND.

Chicago Agents, M. B. Austin & Co., 56 W. Van Buren Street.

IS YOUR FILTER A FRAUD?

FAMOUS OIL FILTER.



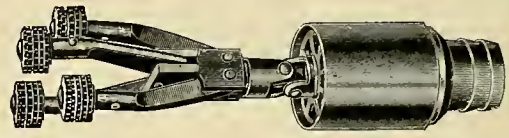
DETERMINE..... FOR YOURSELF

Whether it has any real filtering capacity or other substantial merit by examining the filtered oil with our Clean Oil Indicator. This microscopic device reveals the injurious grit and carbon found in most reused or filtered oils. Sent prepaid on receipt of 50 cents. Our FAMOUS FILTERS are continually replacing those of every other make, because they are the only ones designed upon correct principles, which you will note from the interior arrangement shown in the cut and fully described in the catalogue. They will, moreover, deliver an absolutely pure quality of oil, which it is impossible for any other filter to do.

Sent on approval to any responsible firm. Write for new booklet on Modern Engineering Practice as applied to Oil Filtration and Lubrication. It contains facts which may interest and surprise you.

CHICAGO BOILER CLEANER COMPANY, 321 Dearborn St., Chicago, Ill.

A WONDERFUL MACHINE.



A prominent bank in Kansas City made over 1,000 per cent. by investing in one of our TURBINE CLEANERS. It reduced its fuel bill from $450 to $200 per month.

New evidence of the superiority of this machine accumulates daily. We have just finished cleaning some water tube boilers where more than half of the tubes were totally filled with scale. This work required special drills which were inserted in place of the flexible head, but it easily did the work of a $1,500 power cleaner at only a fraction of the cost to buy, adjust, operate and maintain. It is not only the most rapid, economical and satisfactory apparatus for cleaning water tube boilers, but is practically the only one which will perform the work in most cases. Sent on approval. Boilers cleaned by contract.

CHICAGO BOILER CLEANER COMPANY,

321 DEARBORN STREET, CHICAGO, ILL.

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Anchors (Tel. & Tel. Pole).
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Western Elec. Supply Co.

Arc Lamps.
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General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
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Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Gr. Western Sm. and Refg. Co.

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Edison Mfg. Co.
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Gilchrist Jar Co.
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Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Belt Dressing.
Cling-Surface Mfg. Co.
Leather Preserver Mfg. Corp.

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Leather Preserver Mfg. Corp.

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Sturtevant Co., B. F.

Books, Electrical.
Electrician Publishing Co.

Bridges and Buildings (Steel).
American Bridge Co.

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Central Electric Co.
General Electrical Repair Co.
Bobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.

Burglar Alarms.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Elect. Supply Co.

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Carbons, Points & Plates
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Speer Carbon Co.
United States Carbon Co.
Western Elect. Supply Co.

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Link Belt Machinery Co

Circuit Breakers.
Cutter Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Coils and Magnets.
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Varley Duplex Magnet Co.

Coloring (Inc. Lamp).
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Vitro Chrome Chemical Co.

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Amer. Battery Compound Co.
Dearborn Drug & Chem. Wks.
McLennan & Co., K.
Western Electric Co.
Western Elect. Supply Co.

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Electric Appliance Co.
Electrolysis Proof Conduit Mfg. Co.
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Richmondt Conduit Co.
Sprague Electric Co.
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McIntire Co., The C.

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Becker Bros.
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General Electrical Repair Co.
Hodge-Walsh Elec. Eng. Co.
Western Electric Co.

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Arnold El. Power Station Co.
Bullock Electric Mfg. Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
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Sprague Electric Co.
Stanley Electrical Mfg. Co.
Star Dynamo Works
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
Central Electric Co.
Driver-Harris Wire Co.
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General Electric Co.
Hazard Manufacturing Co.
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Simplex Electrical Co.
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Kans. City & So. Lum. Co.
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Texas Arm & Pin Co.
Valentine-Clark Co., The.
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Bossert Elec. Const. Co.
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General Elec. Co.
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Hill, W. S., Electric Co.
Manhattan Elec. Supply Co.
McOuat, Robert L.
Palste Co., H. T.
Siemens & Halske Electric Co. of America.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Cuts.
Franklin Eng. & Electro Co.

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Iron Clad Resistance Co.

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Chicago Motor and Dyn. Co.
Chicago House Wrecking Co.
Crocker-Wheeler Company.
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General Electric Co.
General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
Schureman & Hayden.
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Sprague Electric Co.
Stanley Electrical Mfg. Co.
Star Dynamo Works.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Electric Supply Co.
Westinghouse El. & Mfg. Co.

Electric Railways.
Arnold El. Power Station Co.
Crocker-Wheeler Company.
General Electric Co.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold El. Power Station Co.
Bain, Foree.
Hodge-Walsh Elec. Eng. Co.
Humphrey, Henry B.
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Electrical Instruments.
American El. Specialty Co.
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Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Manhattan Elec. Supply Co.
Queen & Co.
Siemens & Halske Electric Co. of America.
Stanley Electrical Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

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Besly & Co., Chas. H.
Crocker-Wheeler Company.
General Electric Co.

Elevators-Conveyors.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Engines, Steam.
Ball Engine Co.
Camp Engineering Co.
Chicago House Wrecking Co.
Sturtevant Co., B. F.

Exh'st Steam Apparatus.
American District Steam Co.

Fan Outfits.
Central Electric Co.
Crocker-Wheeler Company.
Edison Mfg. Co.
Emerson El. Mfg. Co.
Fuller Co., The.
General Electric Co.
General Inc. Arc Light Co.
Holtzer-Cabot Elec. Co.
Roth Bros. & Co.
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Sprague Electric Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Filters, Oil.
Chicago Boiler Cleaner Co.

Fire Extinguishers.
Monarch Fire Appliance Co.

Fixtures and Fittings.
White Mfg. Co., J. H.

Flexible Shafts.
Stow Mfg. Co.

Forges.
Sturtevant Co., B. F.

Fuses and Fuse Wire.
American Elec. Fuse Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Co.
Electric Appliance Co.
McIntire Co., The C.
Western Elect. Supply Co.

Gears.
Besly & Co., Chas. H.

General Elec. Supplies.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Manhattan Elec. Supply Co.
McOuat, Robert L.
Mianus Electric Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Holophane Glass Co.
Phœnix Glass Co.
Western Elect. Supply Co

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. B.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heaters (Feed Water).
Kelley & Son, Benj. F.

Heating and Ventilating Apparatus.
Sturtevant Co., B. F.

Holders, Inc. Lamp.
Crescent Mfg. Co.

Insp. & Insurance Boiler.
Hartford Steam Boiler Insp. & Insurance Co.

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Central Electric Co.
Chicago Edison Co.
Chicago Mica Co.
Eagle Paint & Varnish Wks.
Electric Appliance Co.
General Inc. Arc Light Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
McOuat, Robert L.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Palste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Elec. Fuse Co.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Driver-Harris Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
McDermid Mfg. Co.
Miller-Knoblock El. Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lacquers.
Barrett & Co., M. L.

Lamps, Incandescent.
Central Electric Co.
Chicago Edison Co.
Colonial Electric Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
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Manhattan Elec. Supply Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Warren Elec. & Specialty Co.
Western Electric Co.
Western Elec. Supply Co.
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Lightning Arresters.
American Elec. Fuse Co.
Butler-Taylor Co.
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Eureka Electric Co.
Ft. Wayne Elec. Wks., Inc.
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Linemen's Climbers.
Klein & Son, Mathias.

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Mechanical Machinery.
Besly & Co., Chas. H.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
Fort Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.
Siemens & Halske Electric Co. of America.

Mica.
Chicago Mica Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Siemens & Halske Electric Co. of America.
Stanley Electrical Mfg. Co.
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Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

Platinum Bought and Sold.
Baker & Co.
Goldsmith Bros.
Gt. West. Sm. and Refining Co.

Poles.
Berthold & Jennings.
Davis & Stitt Co.
Fowler, John H.
Lindsley Bros. Co.
Naugle, Holcomb & Co.
Perrizo & Sons.
Pittsburg & L. S. Iron Co.
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Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester & Co., C. H.

Porcelain.
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Peru Elec. Mfg. Co.

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Link Belt Machinery Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

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American Steel & Wire Co.

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Gt. West. Sm. and Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.

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Becker Bros.
Chicago Edison Co.
Cleveland Armature Works.
General Electrical Repair Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
McOuat, Robert L.
Schureman & Hayden.
Stewart Electrical Co.

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Stewart Electrical Co.
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Crest Manufacturing Co.

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Electric Appliance Co.
Manhattan Elec. Supply Co.
Western Electric Co.
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Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

Springs.
American Steel & Wire Co.
Barnes Co., The Wallace.
Manross, F. N.

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Bossert Elec. Const. Co.

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American Battery Co.
Electric Storage Battery Co.

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American Bridge Co.

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American Electrical Works.
American Steel & Wire Co.
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Okonite Co., The
Simplex Electrical Co.
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Bruckner Electric Co.
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Independent Tel. Supply Co
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Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
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Roebling's Sons Co., J. A.
Standard Underground C. Co.
Western Electric Co.
Western Electrical Sup. Co.

Woodwork, Electrical.
Noblett, E. J.

X-Ray Outfits.
Queen & Co.

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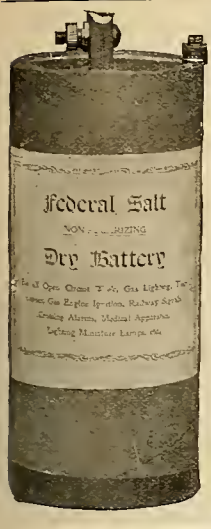


Wonderful Recuperation.

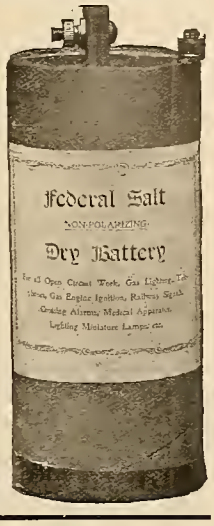
Higher Voltage and Amperage.

Will do more Hard Work than any Dry Battery on the Market.

No more Running Down on the Shell.

FEDERAL SALT NON-POLARIZING DRY BATTERIES.

If you are not satisfied with the dry battery you are getting, we can guarantee the Federal Dry Battery will meet all requirements. Made in all standard sizes.



FEDERAL BATTERY CO.,

Manufacturers of Federal Salt and Federalite.

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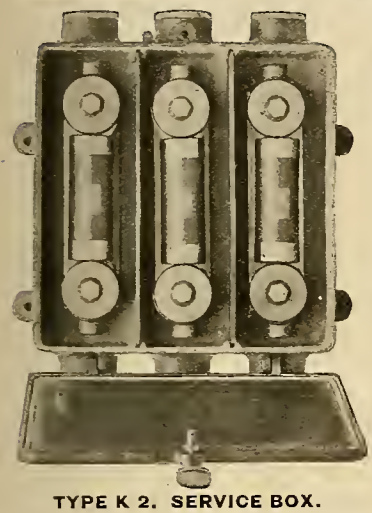

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THE D. & W. FUSE CO.

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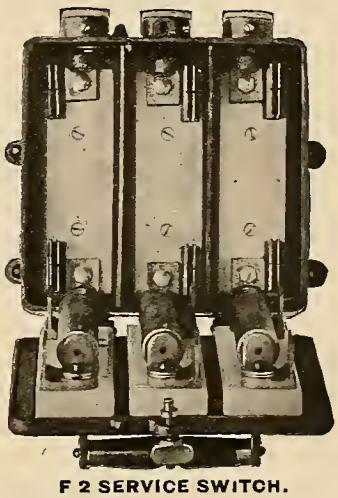
SERVICE SWITCHES

FOR TWO AND THREE WIRE SYSTEMS.

May be used on outside of buildings and in wet cellars, as they are water-tight.

FITTED WITH D. & W. FUSES.

D. & W. FUSE CO., Providence, R. I.



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Series Enclosed Alternating Arc System,

HAVING A CONSTANT POWER FACTOR WITH ANY NUMBER OF LAMPS IN SERIES.

NO REGULATOR REQUIRED

IN THE OPERATION OF THESE LAMPS.

Lamps are provided with a choke coil which is automatically cut into circuit when a lamp cuts out, maintaining current constant.

3 Lamps in series on 220 to 240 volts. 7 Lamps in series on 500 to 550 volts.
13 Lamps in series on 1,000 volts.

Any number of lamps in series by using step-up or step-down Transformer.
Write for Our Bulletin No. 7007.

Highest Efficiency. Electrical and Mechanical Simplicity.

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Horizontal Edgewise Ammeters, Voltmeters, Wattmeters.

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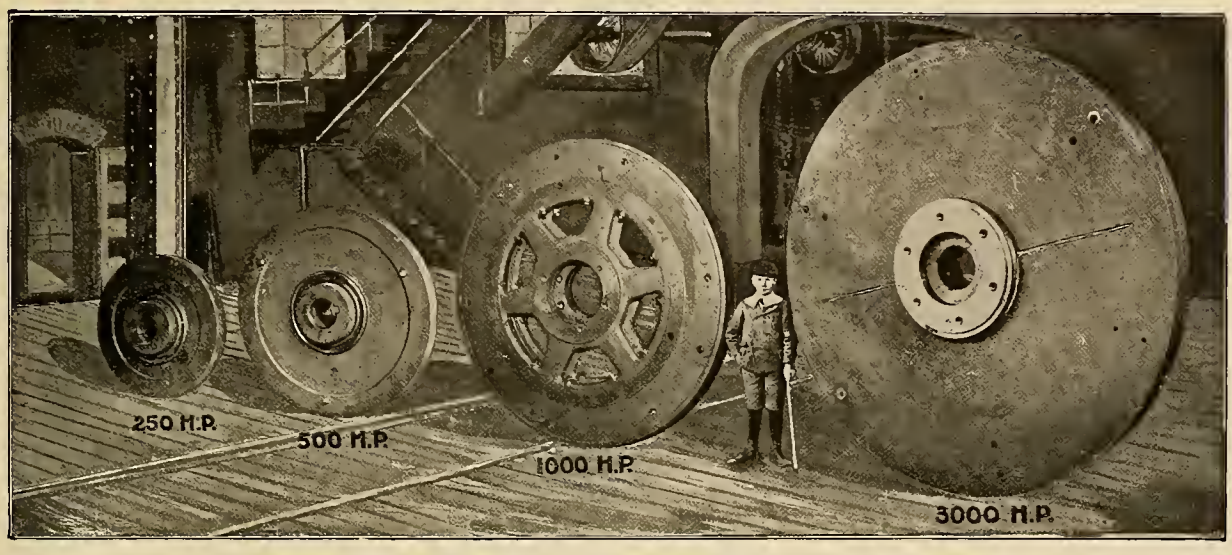
Ad. No. S—164

ANOTHER STEP IN ADVANCE

THE ARNOLD MAGNETIC CLUTCH.

(PATENTED.)



OF ANY SIZE. FOR ANY PURPOSE.

These clutches were designed by us for use in connection with the "Arnold System" of Power Station Construction but we have received so many inquiries in regard to their application in various places where it is desired to transmit power from one shaft to another that we have arranged for their manufacture.

THEY CAN BE USED on line shafting, so that different sections of the shaft can be thrown in or out of service by means of a switch.

To directly connect a generator to an engine so that it can be started or stopped without stopping the engine.

To connect a dynamo to a line shaft which may extend through the hollow quill upon which the generator armature is mounted.

To connect a motor to a machine in such a way that the motor may be disconnected at once in case of accident to the machine.

AND IN MANY OTHER WAYS.

A FEW POINTS:
ABOUT MAGNETIC CLUTCHES.

They can be operated by means of a conveniently placed electric switch.

Can be energized by a direct current of any voltage.

Require a small amount of energy. The 3,000 h. p. clutch used 200 watts or less than $\frac{1}{100}$ of 1 per cent of the power transmitted.

Are simpler and present a neater appearance than friction clutches.

Are easy to install, to operate and to keep in order.

We believe that engineers will appreciate at once the advantages of a successful magnetic clutch.

We would be pleased to correspond in regard to their application in connection with any power transmitting problem.

ARNOLD ELECTRIC POWER STATION CO.,

Department "M," 1540 Marquette Building,

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SIEMENS & HALSKE ELECTRIC CO.

OF AMERICA.

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ELECTRICAL APPARATUS,

Railway, Lighting, Power Transmission.

IMPROVED DUNCAN INTEGRATING WATTMETERS.

Many thousands of these Wattmeters are in daily use. Our sales are increasing. All electrical instruments should be perfect and register accurately. The large use of and increasing demand for our meters indicate that they meet these important requirements.

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Boston. Chicago. Cincinnati. Denver.
New York. Philadelphia. St. Louis. San Francisco.

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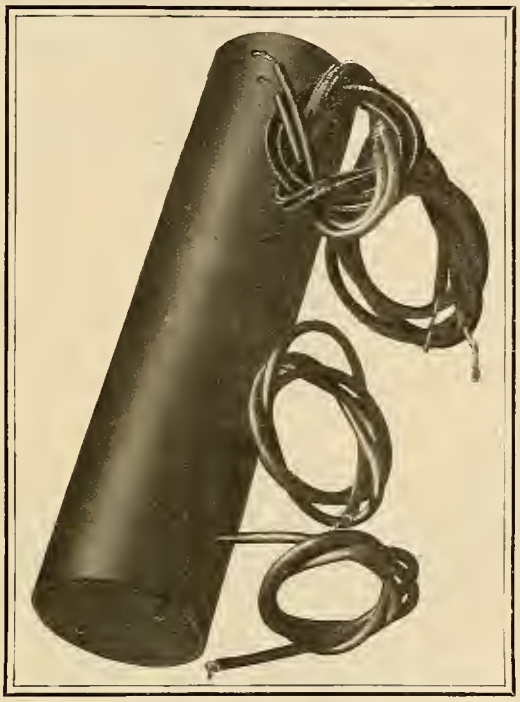
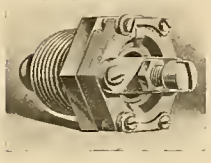


RUHMKORFF COILS OF EVERY DESCRIPTION.



Ignition Plugs (Something New) Both Wires Insulated.

VARLEY DUPLEX MAGNET CO.,

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NOXALL ANNUNCIATORS

Nox Them All

IN...

Price, Quality, Durability and Efficiency.

◆◆

The Best and Cheapest Annunciator on the Market.

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You Can't Beat Them.

◆◆

We Have Them.

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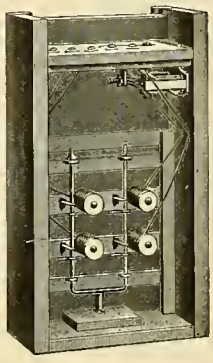
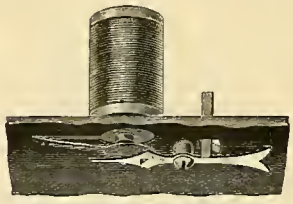
Send Us Your Orders.

A Six-Drop Noxall
As It Appears Ready for Installation. Neat and Efficient.



Cut Showing Absence of any Internal Mechanism back of the Face-Plate except Set-Back Rod.



Sectional View of Drop.
Note Its Extreme Simplicity; Nothing to Get Out of Order.

Front View of Drop.
Armature and Hole Do Not Show in Completed Instrument.

No Part of the Indicating Mechanism Back of the Face-Plate.

◆◆

A Two-Piece Annunciator Composed of Simply a Magnet and Needle.

◆◆

No Intermediate Mechanism Between Needle and Armature.

◆◆

A Needle for Every Number, Therefore No Lost Calls.

◆◆

For Elevator Service Unexcelled, as it will not Shake Down.

◆◆

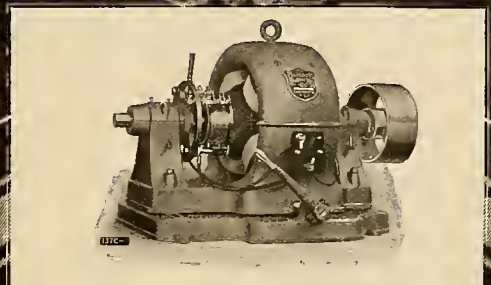
Bell Adjusted Without Removing the Case From the Wall.

WESTERN ELECTRICAL SUPPLY CO.,

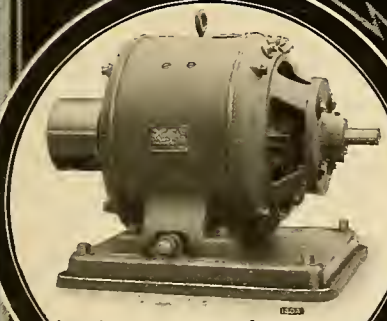
"Everything Electrical." ST. LOUIS, MO.

BULLOCK

MOTORS GENERATORS

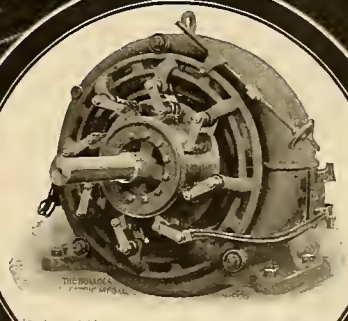


75 K.W. TYPE "H" GENERATOR,
DESCRIBED IN BULLETIN 32-A.

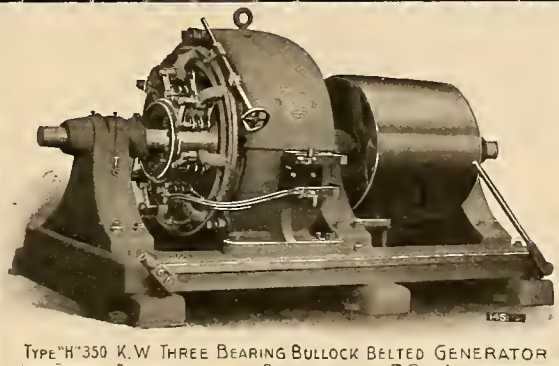


25 H.P. TYPE "N" BULLOCK MOTOR, BELTED, OPEN ENDS
DESCRIBED IN BULLETIN No. 35.

Bullock
ELECTRIC MFG CO
CINCINNATI O.
U.S.A.
TRADE MARK



200 K.W. BULLOCK ENGINE TYPE GENERATOR
DESCRIBED IN BULLETIN No. 34 A.



TYPE "H" 350 K.W. THREE BEARING BULLOCK BELTED GENERATOR
DESCRIBED IN BULLETIN 32-A.

MADE IN THE MOST MODERN WORKS IN THE WORLD

SEND FOR DESCRIPTIVE BULLETINS GIVING DETAILS OF CONSTRUCTION & TABLES OF SIZES

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COLUMBIA CARBONS

FOR ENCLOSED ARCS

Guaranteed superior to any imported Carbon in uniformity of size and straightness, or subject to return at our expense. Try us and be convinced.

NATIONAL CARBON COMPANY,

1198 West Madison Avenue, Cleveland, Ohio.

ALDEN & CO., AGENTS,
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ENCLOSED ARC LAMPS

FOR ALL CIRCUITS.

One Piece Clutch.
No Sliding Contacts.
Does not feed through Clutch.
Spun Aluminum Case.
10-inch Globe with full size Carbon.
Artistic in design, light in weight, and mechanically perfect.
Catalogue for the asking.

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A. C. Enclosed Arc Lamp System.

Enclosed Arc Lamps for all Circuits.

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SALES OFFICE,
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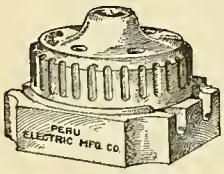
NEWARK, N. J.



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"PEMCO," the new style Creole rosette. Insulation perfect, long fuse, superior in every detail.

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Electric Hack Saw

For **ALTERNATING OR DIRECT CURRENT.**

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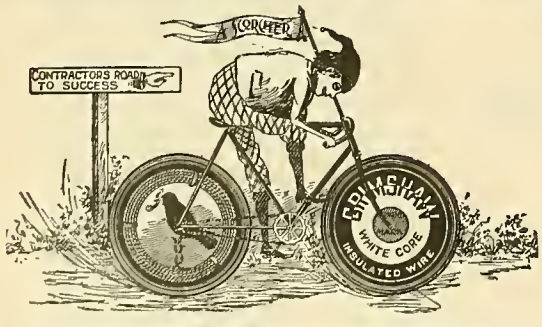

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RAVEN WHITE CORE, RAVEN BLACK CORE, COMPETITION LINE WIRE, GRIMSHAW AND COMPETITION TAPES AND SPLICING COMPOUNDS.

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ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

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Leading manufacturers in the U. S. of

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Write for Estimates. Send for Catalogue.

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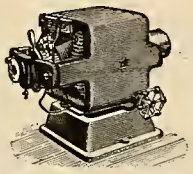

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DYNAMOS and MOTORS

Open and Enclosed for All Purposes.

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Jefferson City, Mo.

NOTE OUR PRICES ON DYNAMOS

COPPER COMMUTATORS GUARANTEED 3 YEARS.

10 LIGHT, $30 30 LIGHT, $65 75 LIGHT, $115

20 " 50 50 " 85 100 " 145

Warranted free from mechanical and electrical defects. Armatures rewound, commutators refilled, machines repaired. All work guaranteed. Send for catalogue.

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IS PACKED IN OILED PAPER IN AIR TIGHT TIN BOXES.

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REASONABLE PRICE.

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Both-Alternating and Direct Current Apparatus, S. K. C. and Northern Systems.

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POWER PLANTS for LONGEST DISTANCES.

LIGHTING AND RAILWAY MACHINERY.

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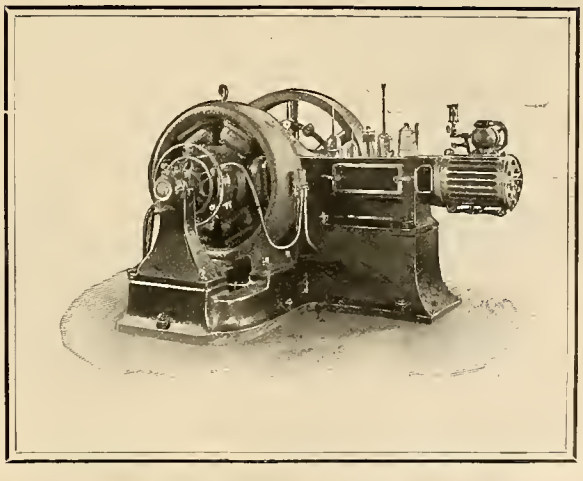

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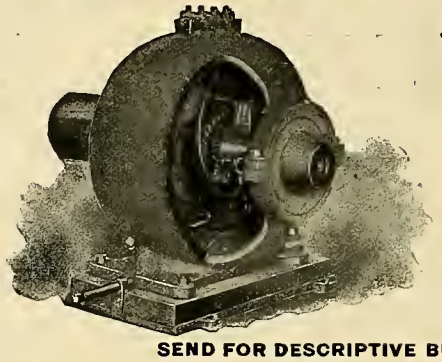
ROTH MOTORS AND GENERATORS.



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Strongly Built,
High Commercial Efficiency,
Open and Closed Types,
For Floor, Wall or Ceiling.

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PERFECT MICANITE INSULATOR REGISTERED.

RECOGNIZED STANDARD OF INSULATORS.

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Railway Lighting and Power Plants,
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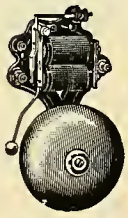

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Gale's Commutator Compound.

The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

50c. per stick. $5.00 per dozen Send 50c. for trial stick.

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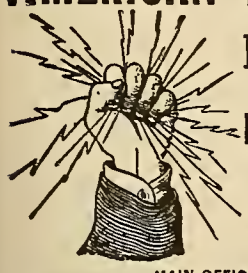

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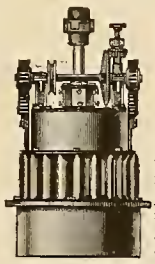

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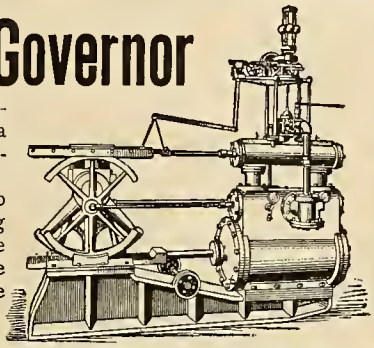

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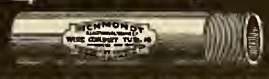

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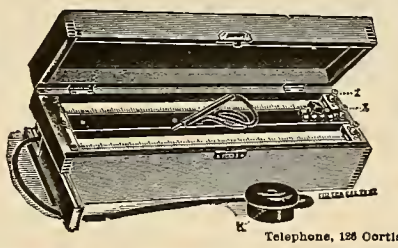

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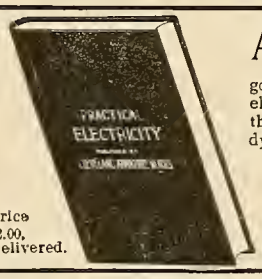

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Dr. J. S. Romine of Chadron, Neb., will sell $10,000 stock of Chadron Electric Light and Power Co. for $3,000 cash; balance stock, $4,000, held by J. D. Bacon of Chadron, a retired banker, he will sell on account of my selling, for $2,000 cash or on time, or keep his stock. Plant cost over $16,000; no bonds, mortgages or debts; no other light plant; city contract. Coal, $2.95 per ton. Pure city spring water. City of 3,000, healthy, good school, academy, six churches. Business can be greatly increased. Reason for selling, age and business keep me away all the time.

SECOND-HAND
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We invite correspondence with those wishing to buy or sell.

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NEW SLATTERY TRANSFORMERS...
PER LIGHT 30c.

We have about 200 brand new Slattery Transformers in 25 and 50 lighters, all 1000 volt to 50 volt, 16,000 alternations, for sale at the above figure, or will rent them or trade them for other goods.

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PROPOSALS FOR ELECTRIC LIGHT.

NOTICE IS HEREBY GIVEN that bids will be received by the City Council of the City of Billings, State of Montana, until 6 p. m. on Tuesday, October 2, 1900 at the office of the City Clerk, for the furnishing of fifty or more electric street lights in the City of Billings for a period extending from July 1, 1901, to March 1, 1907, according to specifications on file in the office of the City Clerk of said City, copies of which can be had upon application to the City Clerk. A certified check for $1,000 must accompany each bid, to be returned to the parties whose bids are rejected, and to the party receiving the contract on the furnishing of required bonds. The city reserves the right to reject any and all bids, and the successful bidder acquires the right under the City Ordinances to carry on a general electric lighting business in the City of Billings:

Dated August 28, 1900.

J. B. HERFORD, City Clerk,
Billings, Montana.

To Represent Manufacturers.

A gentleman of several years' experience in the electrical business and large acquaintance with the supply trade of the country, desiring to make a change, would like to represent several manufacturers in New York and the Eastern States. Good reference can be furnished. Address "H. M.," care Electrical Review, New York, N. Y.

WANTED.

Position as chief engineer in an electric light or power plant by experienced engineer. Age thirty-seven, strictly temperate, first-class references. Address "BOX 14," Midland, Mich.

WANTED.

Man experienced in the assembling and testing of direct-current dynamos and motors. Answer, giving experience and salary expected, addressing "MOTOR," care Western Electrician, 510 Marquette Building, Chicago.

POSITION WANTED.

Telephone electrician desires position as manager or superintendent of telephone exchange. Seven years' experience as foreman, switchboard electrician, superintendent and manager. First-class references as to ability and character. Address "M. M.," care Western Electrician, 510 Marquette Building, Chicago.

NOTICE TO CONTRACTORS.

Sealed proposals will be received by the Light Committee of the City of Sidney, Ohio, for the lighting of the streets of Sidney with arc lights of 2000 candle power, with a minimun of seventy-five lights, for the terms of ten, fifteen and twenty years, commencing August 1, 1901. Proposals will be received until 12 o'clock noon, September 22, 1900.

The right is reserved to reject any or all bids.

FRANKLIN MUMFORD,
Chairman Light Committee,
City of Sidney, Ohio.

WANTED.

Electrician of several years' experience, both practical and technical, with city lighting and power plants, wishes position as electrician or foreman. Is acquainted with the principal lighting and power systems. Can furnish references from past employers. Address F. A. DARST, 530 Highland Ave., Kansas City, Mo.

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One Ball engine in first-class operative condition, size 15x16, pulleys 80 inches in diameter, 15-inch face. One Hill clutch pulley, 64 inches diameter, 15½ face. One Hill clutch pulley, 50 inches diameter, 12 face. One Hill belt tightener pulley, 24 inches diameter, 15½ face. This apparatus was recently replaced with larger units and will be sold at a bargain. ATCHISON RY., LIGHT & POWER CO., Atchison, Kansas.

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1 12-light Hartley, self-oiler, multipolar.
2 12-light Edison, ¾ K. W.
1 26-light Perrett.
1 50-light Hawkeye.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 50-light C. & C., self-oiler.
1 55-light Edison, 3 K. W., self-oiler, comp.
1 50-light Mather.
1 60-light Thomson-Houston, 75 v., comp. with extra armature.
1 75-light Thomson-Houston, D. 5.
1 75-light Wood, self-oiler.
1 90-light Westinghouse.
1 100-light Cutten.
1 100-light Jenney, comp.
1 210-light Triumph, self-oiler.
1 225-light United States.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp. self-oiler.
1 270-light T.-H., comp. self-oiler, D. 15.
3 270-light Westinghouse, M. P., slow speed, 15 K. W., October delivery.
1 300-light Columbian, multipolar, comp., self-oiler.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp., wound.
1 350-light National, self-oiler, compound.
3 350-light Edison, 20 K. W., self-oilers.
1 360-light Duplex multipolar, self-oiler, compound, slow speed.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elckmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., for direct connection.

220-Volt Generators.

1 7½ K. W. General Electric, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 15 K. W. Edison, compound, self-oiler.
1 25 K. W. Edison, self-oiler.
1 40 K. W. E. & C., multipolar, slow speed.
1 200 K. W. Crocker-Wheeler multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.

500-Volt Generators—Continued.

1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
3 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x24x14, all complete, fine.
1 150 K. W. Detroit (Rae) multipolar, compound, self-oiler, new armature.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp. wound.
1 600-light Bain, 30 K. W., self-oiler, new toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed arm't.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
1 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.

Arc Dynamos—Continued.

1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, hall arm.
2 45-light 1200 C. P. Brush, No. 7, Steuhenrousch commutator.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westingh'se, self-oiler.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 3 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Elckmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

1 30 H. P. Edison, 25 K. W., self-oiler.
1 50 H. P. E. & C., multipolar, slow speed.
1 60 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 75 H. P. Sprague, self-oiler, new arm't.
1 225 H. P. Crocker-Wheeler, M. P.

500-Volt Motors.

1 ¼ H. P. Detroit, series wound.
1 1 H. P. Jenney, self-oiler.
1 1 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jenney, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. C. & C.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
1 40 H. P. Jenney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

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1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oilers, single-phase.
1 2½ H. P. Ft. Wayne, 100 volts, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

Alternating Current Motors.

MULTIPHASE.

1 1 H. P. Westinghouse, self-oiler, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 3-phase, type, 8-10-900, Form A, 60-cycle, 110 volts.

Automobiles.

1 Wood's electric runabout, with top, carries 2 persons, practically new.
1 Electric open phaeton, seats 3 persons, fine condition.
1 Electric "trap," carries 4 persons, new.

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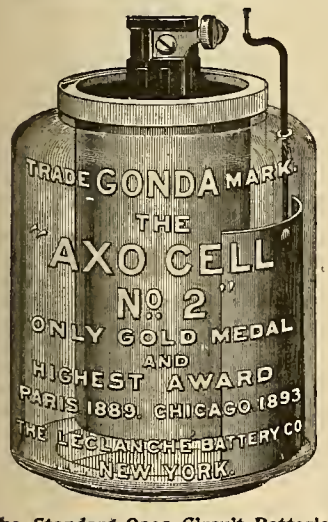

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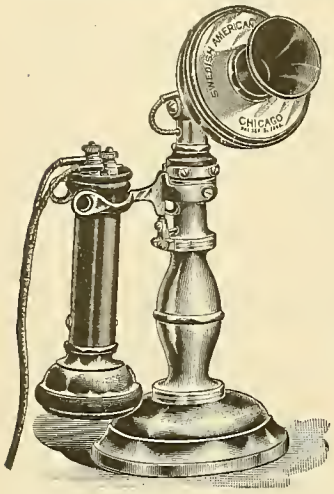

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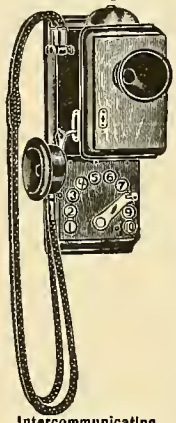

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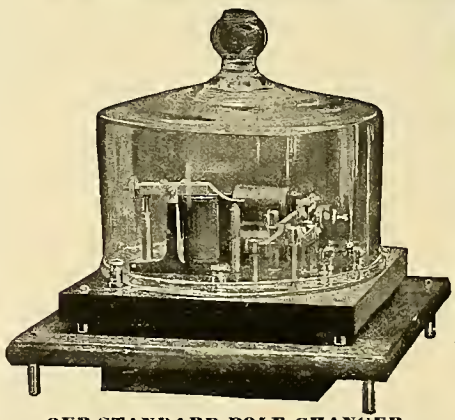

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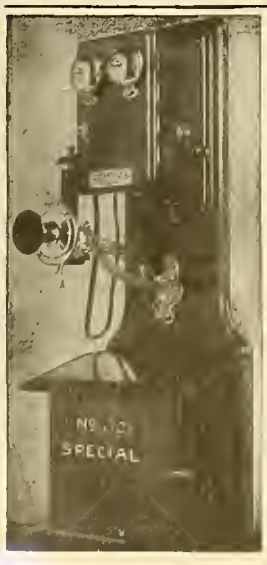

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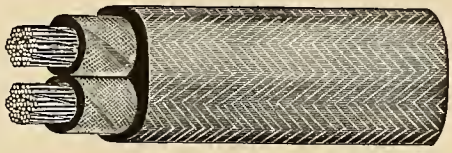

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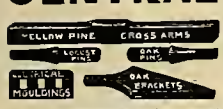

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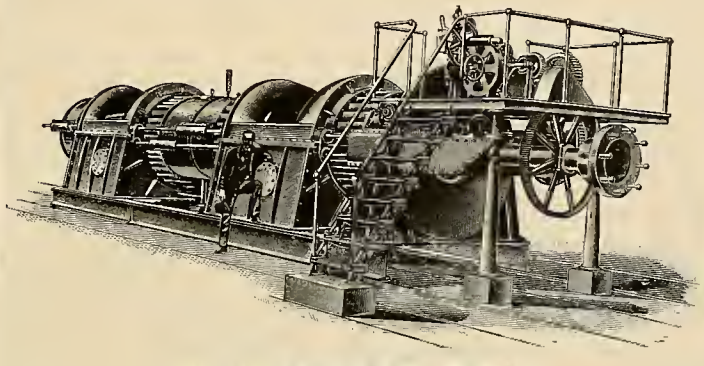

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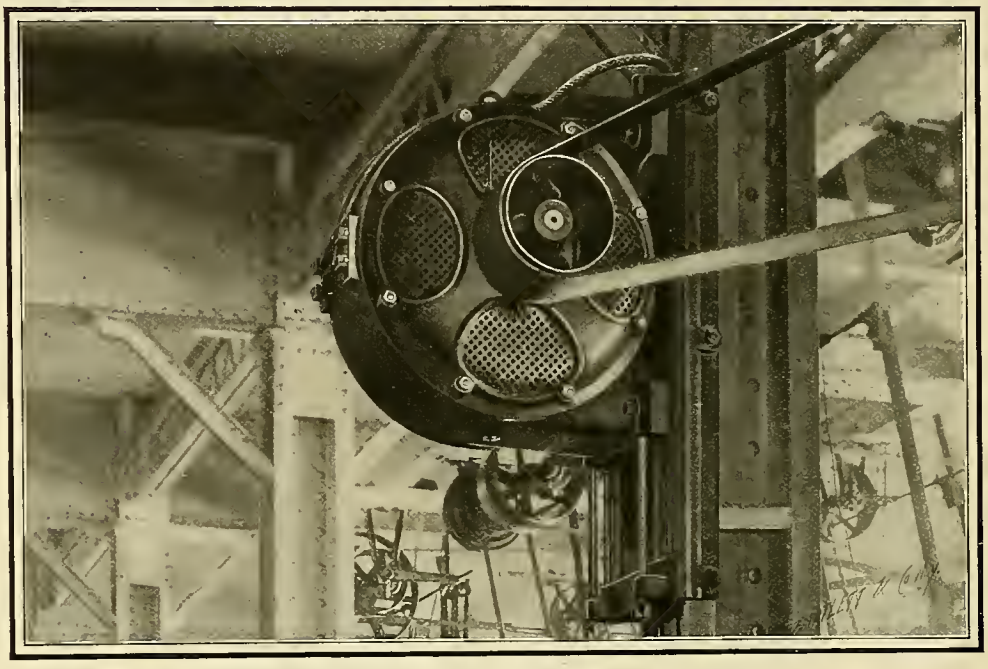

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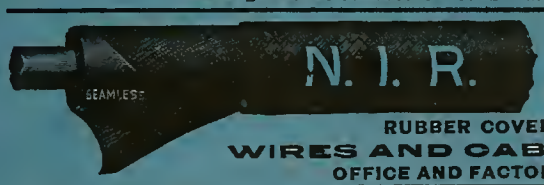

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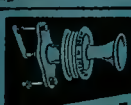

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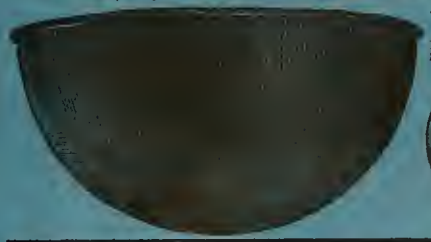

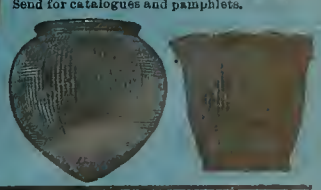

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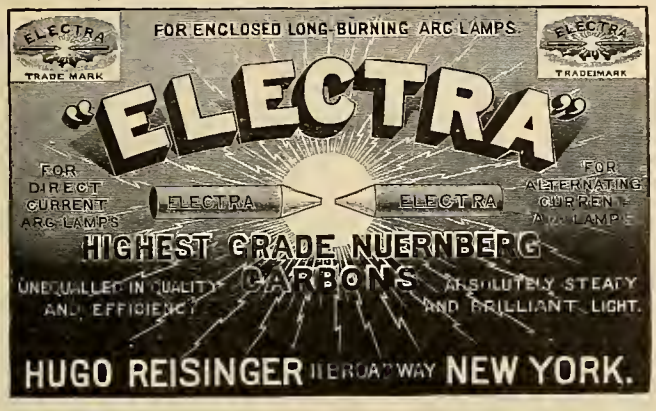

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PARAGON

CHICAGO EDISON COMPANY, **FAN MOTORS**

139 ADAMS ST., CHICAGO.

Columbia Lamps.

Unequaled in Quality.

BEFORE placing your orders for fall and early winter requirements in Incandescent Lamps we respectfully invite the attention of Central Stations and Isolated Plants to the high quality of the Columbia. We guarantee the highest uniformity in initial readings as well as the highest maintenance of candlepower.

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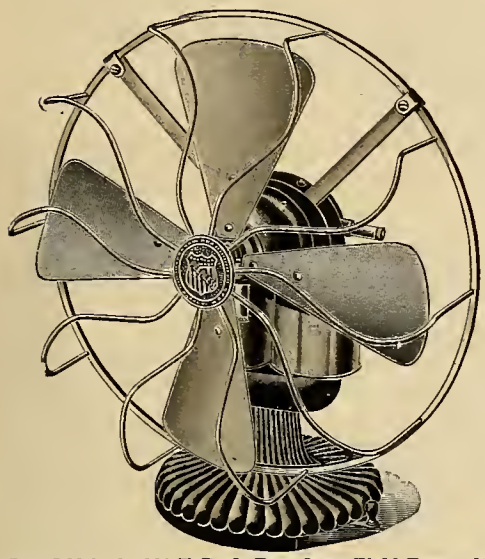
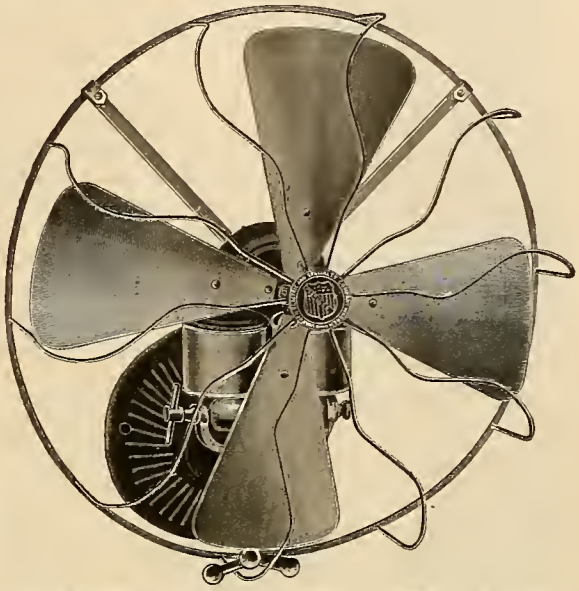
DIRECT-CURRENT DESK AND CEILING FANS.



Cut of 12-inch, 110-V, Desk Fan, Open Field Type with polished brass hoods and field coverings, the handsomest and most efficient Fan on the market.



Cut of 16-inch Wall Fan, same finish as 12-inch and having a swivel joint. By simply turning a handle this Fan can be adjusted to blow air up, down or on either side.

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Does not feed through Clutch.
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Noblett, E. J.

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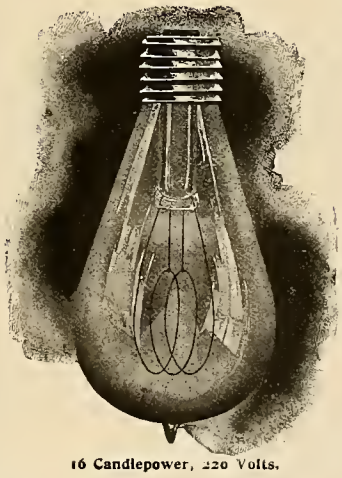

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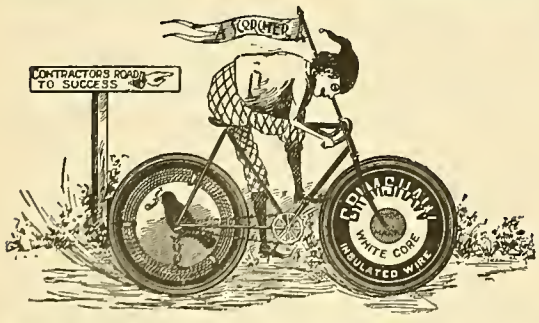

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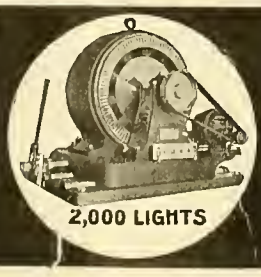

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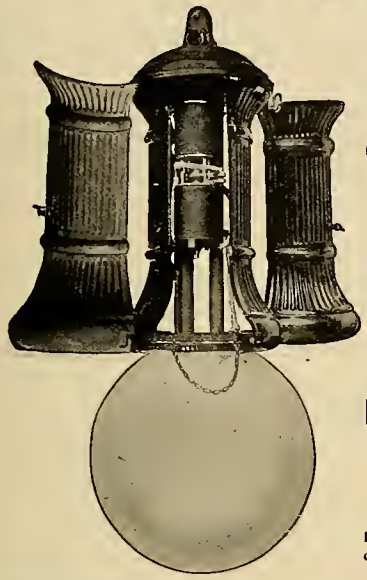

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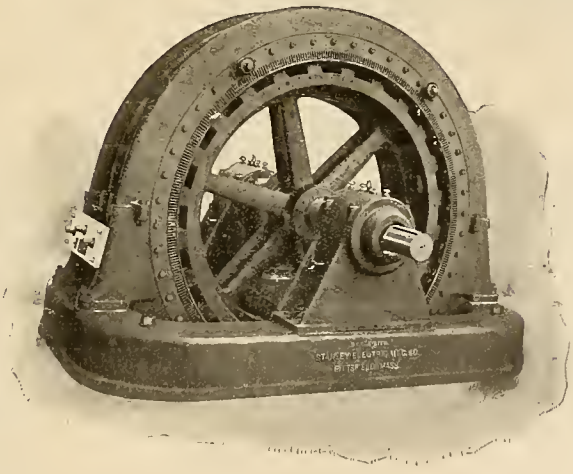

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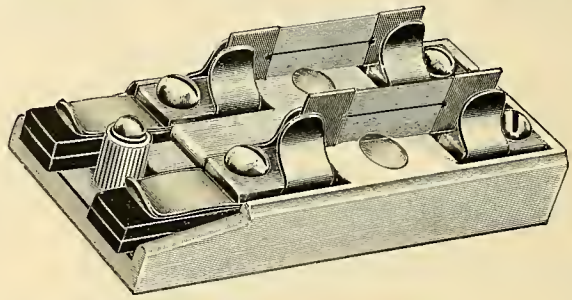

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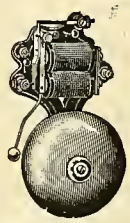

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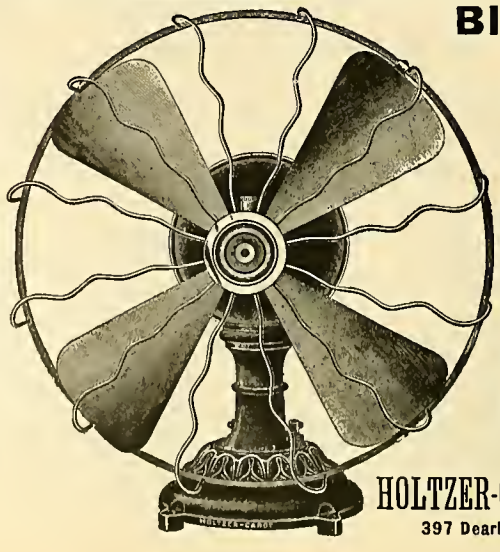

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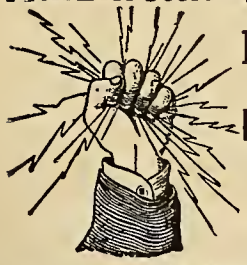

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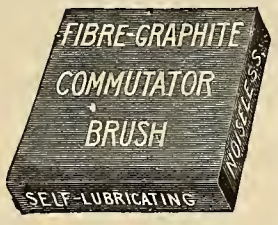

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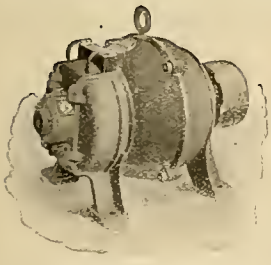

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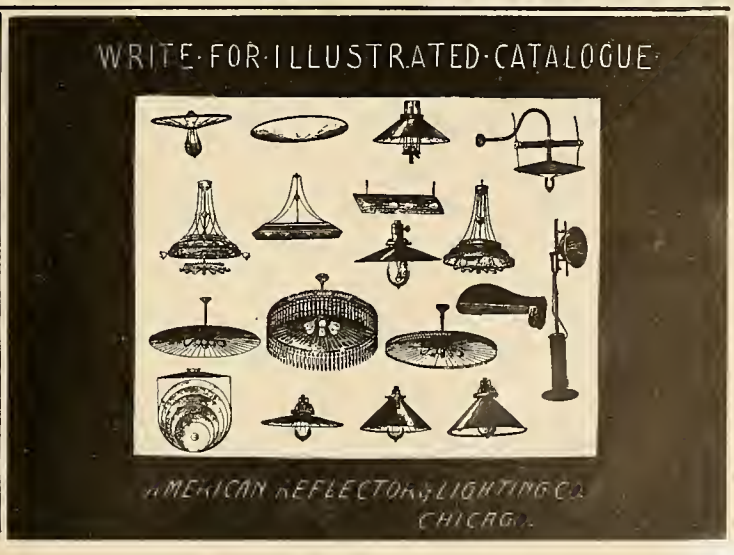

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Dealers in electric supplies everywhere to handle our superior grade automatic interior telephones for hotel and factory use. Write for catalogue and prices. Liberal inducements. CHICAGO HOTEL TELEPHONE CO., 334 Dearborn Street, Chicago, Ill.

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We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

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Dr. J. S. Romine of Chadron, Neb., will sell $10,000 stock of Chadron Electric Light and Power Co. for $3,000 cash; balance stock, $4,000, held by J. D. Bacon of Chadron, a retired banker, he will sell on account of my selling, for $2,000 cash or on time, or keep his stock. Plant cost over $16,000; no bonds, mortgages or debts; no other light plant; city contract. Coal, $2.95 per ton. Pure city spring water. City of 3,000, healthy, good school, academy, six churches. Business can be greatly increased. Reason for selling, age and business keep me away all the time.

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PROPOSALS FOR ELECTRIC LIGHT.

NOTICE IS HEREBY GIVEN that bids will be received by the City Council of the City of Billings, State of Montana, until 6 p. m. on Tuesday, October 2, 1900 at the office of the City Clerk, for the furnishing of fifty or more electric street lights in the City of Billings for a period extending from July 1, 1901, to March 1, 1907, according to specifications on file in the office of the City Clerk of said City, copies of which can be had upon application to the City Clerk. A certified check for $1,000 must accompany each bid, to be returned to the parties whose bids are rejected, and to the party receiving the contract on the furnishing of required bonds. The city reserves the right to reject any and all bids, and the successful bidder acquires the right under the City Ordinances to carry on a general electric lighting business in the City of Billings.

Dated August 28, 1900.

J. B. HERFORD, City Clerk,
Billings, Montana.

To Represent Manufacturers.

A gentleman of several years' experience in the electrical business and large acquaintance with the supply trade of the country, desiring to make a change, would like to represent several manufacturers in New York and the Eastern States. Good reference can be furnished. Address **"H. M.,"** care Electrical Review, New York, N. Y.

WANTED.

Electrical engineer competent to design small, efficient motors for automobiles. One with experience in this line or in street car work preferred. Applicants will please state experience in full and salary expected. Address "ELECAUTO," care Western Electrician, 510 Marquette Bldg., Chicago.

NOTICE TO CONTRACTORS.

Sealed proposals will be received by the Light Committee of the City of Sidney, Ohio, for the lighting of the streets of Sidney with arc lights of 2000 candle power, with a minimun of seventy-five lights, for the terms of ten, fifteen and twenty years, commencing August 1, 1901. Proposals will be received until 12 o'clock noon, September 22, 1900.

The right is reserved to reject any or all bids.

FRANKLIN MUMFORD,
Chairman Light Committee,
City of Sidney, Ohio.

FOR SALE.

An electric-light plant in a growing Indian Territory town of 4,500 population; perpetual franchise; plant has just been installed and is paying 10 per cent.; there is large demand for lights, and by Jan. 1st plant will be paying 20 per cent. Will take part cash and give time on balance, or will sell a part interest; good reason for selling. Address L. M. L., care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Man experienced in the assembling and testing of direct-current dynamos and motors. Answer, giving experience and salary expected, addressing "MOTOR," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Competent and practical man desires position as chief engineer or superintendent of central station. At liberty after October 1. Address "ENGINEER," care Western Electrician, 510 Marquette Bldg., Chicago.

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1 12-light Hartley, self-oiler, multipolar.
2 12-light Edison, ¾ K. W.
1 26-light Perrett.
1 50-light Hawkeye.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 50-light C. & C., self-oiler.
1 55-light Edison, 3 K. W., self-oiler, comp.
1 50-light Mather.
1 60-light Thomson-Houston, 75 v., comp. with extra armature.
1 75-light Thomson-Houston, D. 5.
1 75-light Wood, self-oiler.
1 90-light Westinghouse.
1 100-light Cutten.
1 100-light Jeuney, comp.
1 210-light Triumph, self-oiler.
1 225-light United States.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp. self-oiler.
1 270-light T.-H., comp. self-oiler, D. 15.
3 270-light Westinghouse, M. P., slow speed, 15 K. W., October delivery.
1 300-light Columbian, multipolar, comp., self-oiler.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp., wound.
1 350-light National, self-oiler, compound.
3 350-light Edison, 20 K. W., self-oilers.
1 360-light Duplex multipolar, self-oiler, compound, slow speed.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elckmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., for direct connection

220-Volt Generators.

1 7½ K. W. General Electric, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 15 K. W. Edison, compound, self-oiler.
1 25 K. W. Edison, self-oiler.
1 40 K. W. E. & C., multipolar, slow speed.
1 200 K. W. Crocker-Wheeler multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.

500-Volt Generators—Continued.

1 30 K. W. Jeuney, self-oiler.
1 35 K. W. Jeuney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
3 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x24x 14, all complete, fine.
1 150 K. W. Detroit (Rae) multipolar, compound, self-oiler, new armature.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp. wound.
1 600-light Bain, 30 K. W., self-oiler, new toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed arm't.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1200-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
1 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.

Arc Dynamos—Continued.

1 35-light 2000 C. P. T.-H., rlog armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, a. c.
1 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7, Steuhenrausch commutator.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, rlog armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westingh'se, self-oiler.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 3 H. P. Crocker Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 6 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Elekmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

1 30 H. P. Edison, 25 K. W., self-oiler.
1 50 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 75 H. P. Sprague, self-oiler, new arm't.
1 225 H. P. Crocker-Wheeler, M. P.

500-Volt Motors.

1 ¼ H. P. Detroit, series wound.
1 1 H. P. Jeuney, self-oiler.
1 1 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jeuney, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. C. & C.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 20 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jeuney, self-oiler.
1 40 H. P. Jeuney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

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1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oilers, single-phase.
1 2½ H. P. Ft. Wayne, 100 volts, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

Alternating Current Motors.

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1 1 H. P. Westinghouse, self-oiler, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 2-phase, type, 8-10-900, Form A, 60-cycle, 110 volts.

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1 Wood's electric runabout, with top, carries 2 persons, practically new.
1 Electric open phaeton, seats 3 persons, fine condition.
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FOR SALE.

We are constantly purchasing entire factories and plants. We bought from the Sioux City Traction Co. the following:

No. S1 2 13x22x12 Westinghouse compound engines.
No. S2 1 pair 17¾x24 Williams automatic engines, coupled together.
No. S3 2 generators, type U. S. Westinghouse, bi-polar, size, 80 K. W.
No. S4 2 60x16 horizontal tubular boilers.
No. S5 1 450 H. P. Hazleton water tube boiler, 2 Roney furnaces with stokers.
No. S6 1 Worthington duplex pump, 6x4 x6.
No. S7 1 Koerschell heater, 2x9 feet.
No. S8 1 Hancock inspirator, 1¼ inches.
No. S9 38 feet 6⅞-inch shafting.
No. S10 39 feet 8-inch shafting.
No. S11 8 feet 4⅞-inch shafting.
No. S12 15 feet 10-inch shafting.
No. S13 2 6¾-inch flanged couplings.
No. S14 1 8-inch flanged coupling.
No. S15 1 6⅝x4⅞ flanged couplings.
No. S16 1 60x38x6⅝ in. double arm drive pulley.
No. S17 4 60x16x6⅝ in. Hill friction clutch pulleys.
No. S18 1 60x28x6⅝ in. iron pulley, leather covered face.
No. S19 1 60x16x4⅞ in. iron pulley.
No. S20 1 14x42x8 in. iron pulley.
No. S21 2 6⅝x20 chain oiling pillow blocks.
No. S22 5 6⅝x15 chain oiling pillow blocks.
No. S23 1 4⅞x15 chain oiling pillow blocks.
No. S24 1 72x26x8 in. Dodge wood pulley.
No. S25 2 14 ft. x 16 in. cable drums; 6 grooves for 1¼-inch cable.
No. S26 1 12 ft. x 17 in. x 15 in. spur gear.
No. S27 10 8x18 in. pillow blocks.
No. S28 2 double ply dynamo belts, 16-inch width, 57 feet long.
No. S29 1 double ply dynamo belt, 14½-inch width; 71 feet long.
No. S30 1 double ply dynamo belt, 14½-inch width; 48 feet long.

WE PURCHASED FROM P. D. ARMOUR & CO., Union Stock Yards, their entire boiler outfit. Armour & Co. changed their motive power from steam to electricity at a cost of over $2,000,000, as a result of which they sold to us all their fine horizontal tubular boilers, consisting of 48—60x16. 12—54x16, 12—60x18.

They are all in excellent condition and have been thoroughly overhauled, all weak parts replaced.

We also purchased the HASTINGS, NEB., ELECTRIC PLANT, consisting of the following:

No. S326 1 9½x12 Armington & Sims engine.
No. S327 2 650-light incandescent dynamos.
No. S328 2 25-light Ball arc dynamos.
No. S329 2 60x16 horizontal tubular boilers.
No. S330 2 66x16 horizontal tubular boilers.
Shafting, hangers, couplings, etc.

ENGINES.

No. S64 12x20x12 Westinghouse automatic compound.
No. S65 12x20x14 Ball automatic compound.
No. S66 12x24 Zeahm Bros.
No. S67 12x20 horizontal slide valve.
No. S205 13x16 Twin engines, tandem bed.
No. S70 13x16 horizontal side crank.
No. S71 13x18 four valve Russell automatic.
No. S72 13x20x15 Armington & Sims cross compound condensing.
No. S73 13x16 Erie horizontal.
No. S74 14x14 automatic Ideal.
No. S75 14x24 Richards horizontal.
No. S76 14x24 box bed.
No. S77 14x20 Atlas automatic.
No. S78 14x24 Bay State.
No. S78 14x30 Cumner.
No. S79 14½x13 Armington & Sims automatic.
No. S80 15x14 automatic Ideal.
No. S81 16x14 Smith, Beggs & Rankin automatic.
No. S207 16x36 Woodruff & Beach.
No. S208 17¾x24 pr. auto. Williams, coupled.
No. S82 18x30 250 H. P.
No. S83 20x22 Corliss.
No. S84 20x36 Corliss.
No. S85 20x42 Corliss.
No. S86 26x48 Corliss.
No. S87 20x24 horizontal, box bed.
No. S209 66x20 Chandler & Taylor.
No. S210 40 H. P. Rice automatic.
No. S211 25 H. P. Chandler & Taylor.
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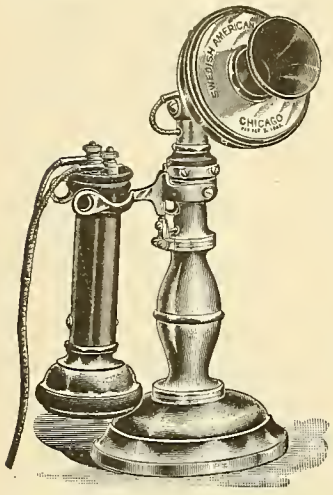

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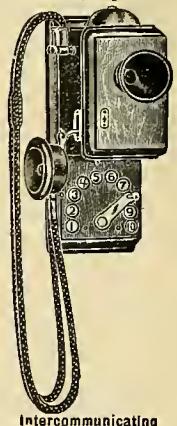

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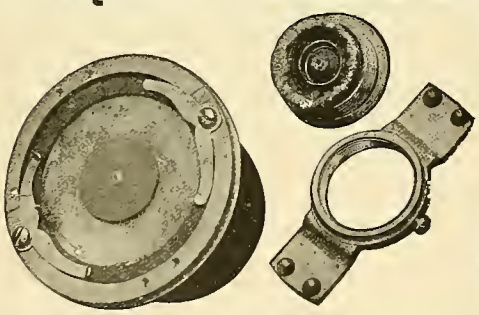

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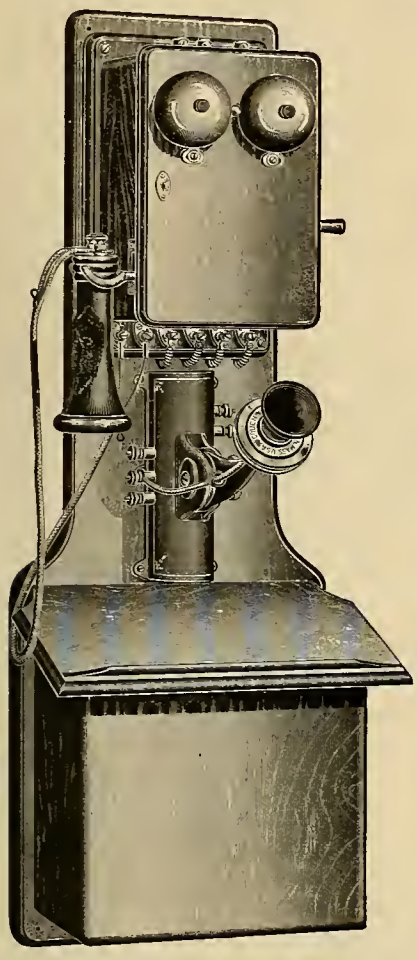

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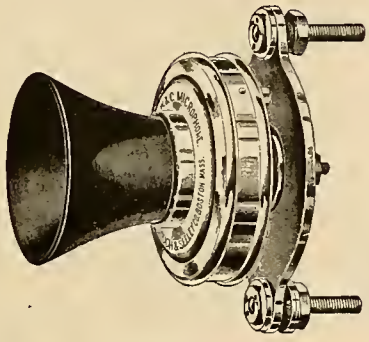

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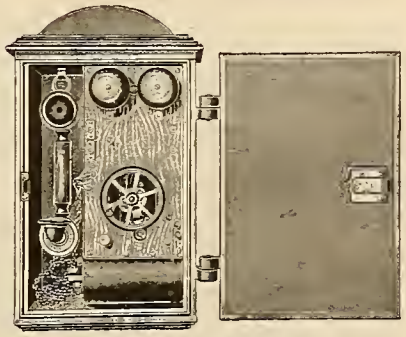

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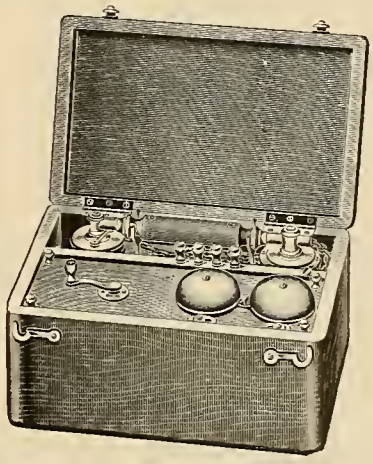

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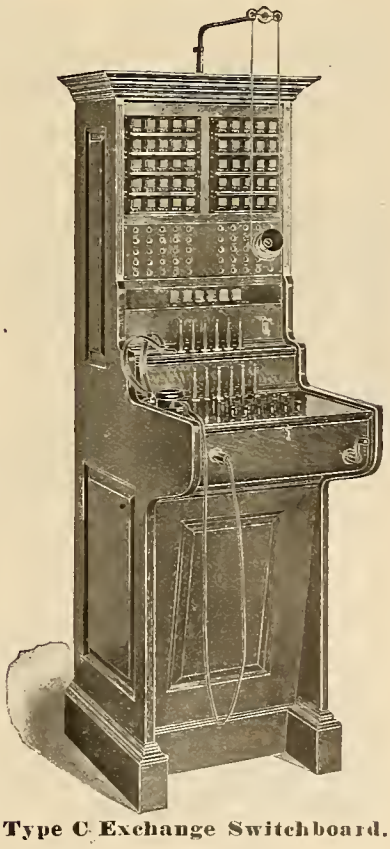

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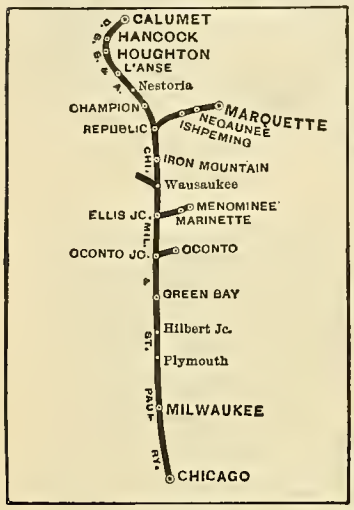

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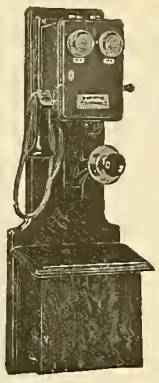

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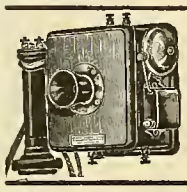

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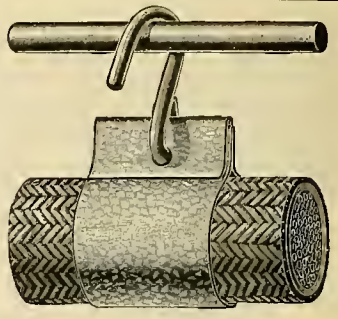

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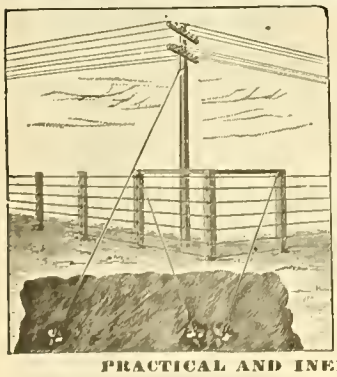

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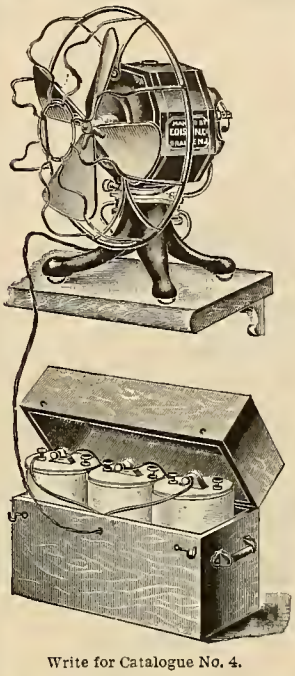

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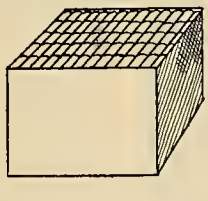

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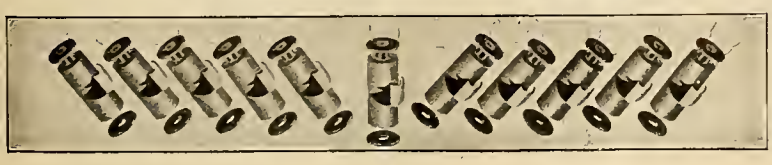

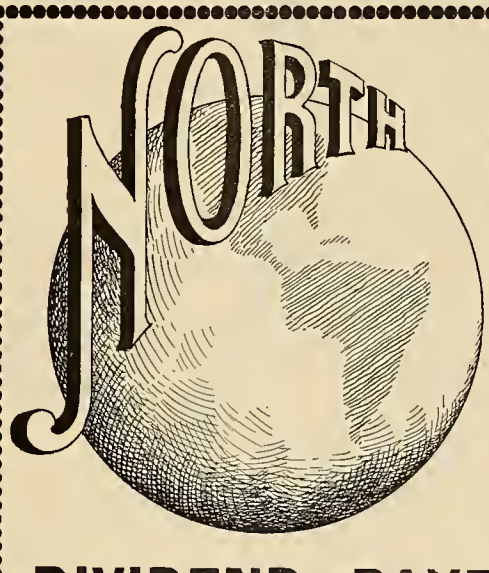

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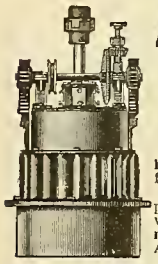

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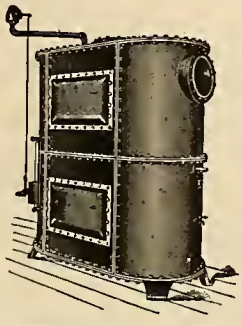

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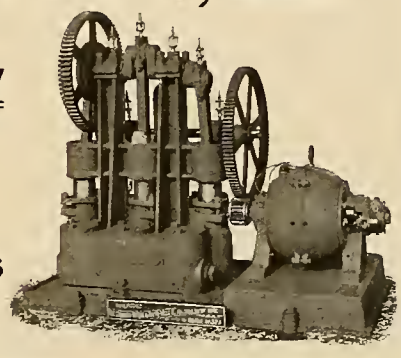

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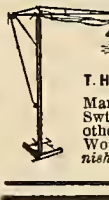

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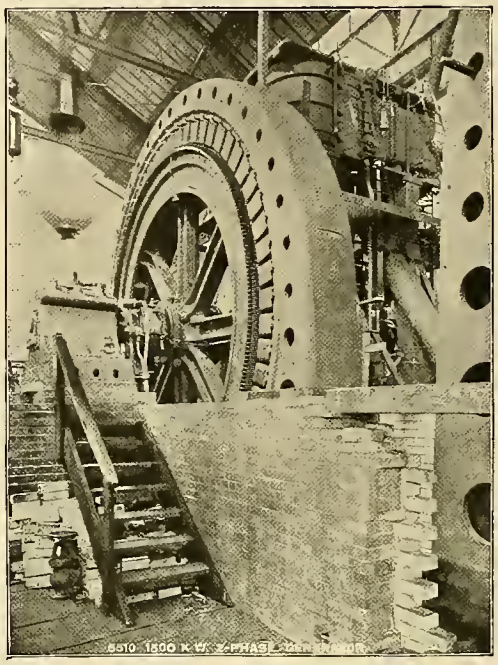

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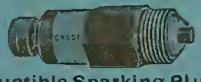

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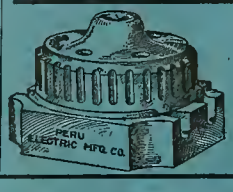

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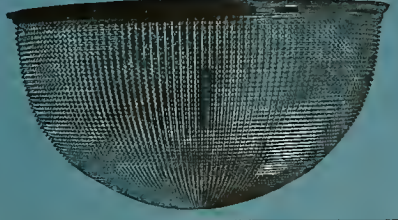

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OUR SELF-STARTING SINGLE-PHASE A. C. MOTORS AND WHAT A CUSTOMER THINKS OF THEM.

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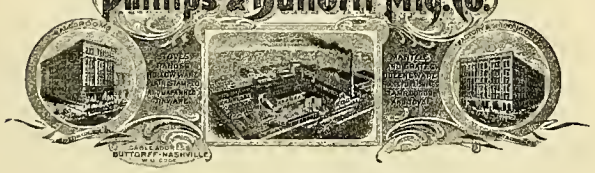

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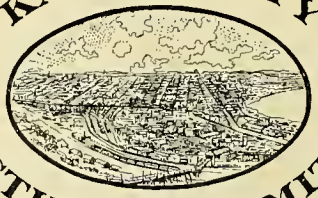

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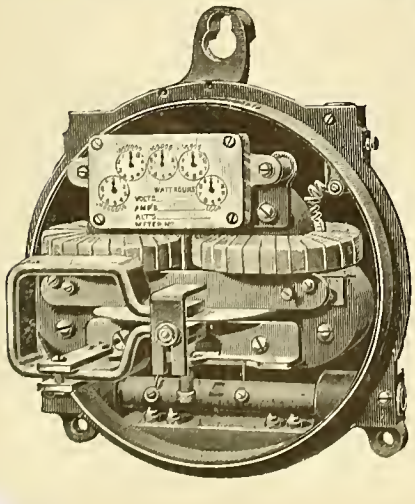

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An Accurate and Sensitive Meter.
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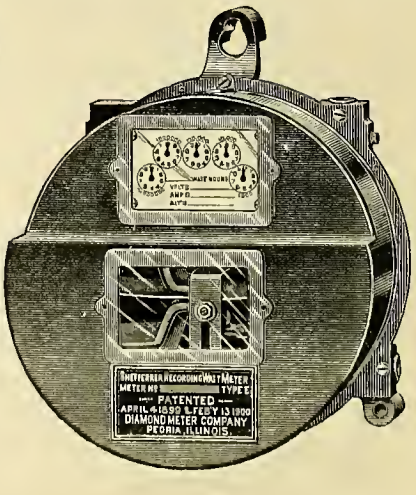

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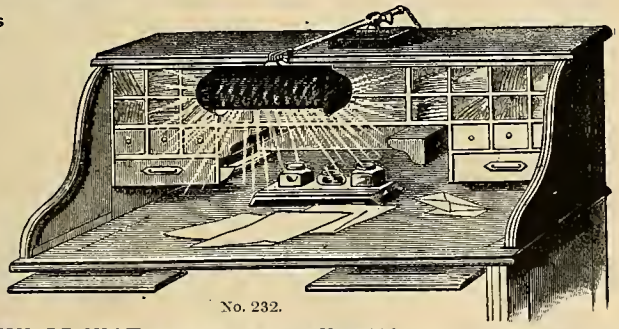

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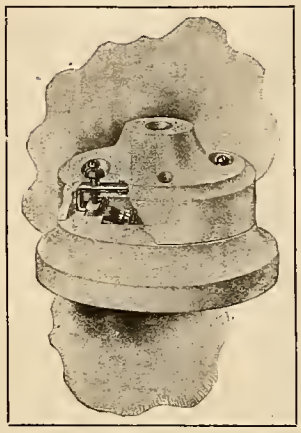

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Cap attached to base by quarter-turn, or cap rigidly fixed to base by screws.

A quarter-turn of the cap of the P. K. Rosette attaches it to the base by means of extra strong spring contact-arms, which lock the cap sufficiently for general work. Where rosettes are subject to vibrations, the lock-screws in the cap may be readily tightened (see illustration No. 811), so that the contact-arm connection is practically one piece.

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No Sliding Contacts.
Does not feed through Clutch.
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Sturtevant Co., H. F.
Books, Electrical.
Electrician Publishing Co.
Bridges and Buildings (Steel).
American Bridge Co.
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Becker Bros.
Central Electric Co.
General Electrical Repair Co.
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Sage & Bro., F. H.
Burglar Alarms.
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Western Elect. Supply Co.
Cables (See Insulated Wires.)
Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
American Steel & Wire Co.
Central Electric Co.
Eastern Electric Cable Co.
General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.
Carbons, Points & Plates
Central Electric Co.
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Electric Appliance Co.
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Reisinger, Hugo.
Speer Carbon Co.
United States Carbon Co.
Western Elect. Supply Co.
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Chains.
Jeffrey Mfg. Co.
Link Belt Machinery Co.
Circuit Breakers.
Cutler Elec. & Mfg. Co.
Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.
Coils and Magnets.
Miller-Knoblock El. Mfg. Co.
Varley Duplex Magnet Co.
Coloring (Inc. Lamp).
Barrett & Co., M. L.
Vitro Chrome Chemical Co.
Webster Chemical Co.
Compound.
Amer. Battery Compound Co.
Dearborn Drug & Chem. Wks.
McLennan & Co., K.
Western Electric Co.
Western Elect. Supply Co.
Conduit and Conduits.
Amer. Vitrified Conduit Co.
Central Electric Co.
Electric Appliance Co.
Electrolysis Proof Conduit Mfg. Co.
McRoy, John T.
Richmondt Conduit Co.
Sprague Electric Co.
Western Elect. Supply Co.
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American Elec. Fuse Co.
McIntire Co., The C.
Construction & Repairs.
Becker Bros.
Chicago Edison Co.
General Electrical Repair Co.
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General Electric Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
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Sprague Electric Co.
Stanley Electrical Mfg. Co.
Star Dynamo Works.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
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American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
National India Rubber Co.
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Correspondence Schools
American School of Corresp.
Elec. Engineer Corr. Inst.
Int. Correspond. Schools.
Cross-Arms, Pins and Brackets.
Blue Ridge Locust Pin Co.
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Munsell & Co., Eugene.
National India Rubber Co.
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Okonite Co., The.
Palste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
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Vulcanized Fibre Co.
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American Steel & Wire Co.
Bunnell & Co., J. H.
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Eastern Electric Cable Co.
Electric Appliance Co.
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India Rubber & Gutta Percha Insulating Co.
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New York Insulated Wire Co.
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Phillips, Eugene F.
Phillips Insulated Wire Co.
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Johnston, Thomas J.
Page, Chas. G.
Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.
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Berthold & Jennings.
Davis & Stitt Co.
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Rockwood Mfg. Co.
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Stillwell-Bierce Smith-Vaile.
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Amer. Reflector & Ltg. Co.
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Federal Battery Co.
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Crost Manufacturing Co.
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Queen & Co.

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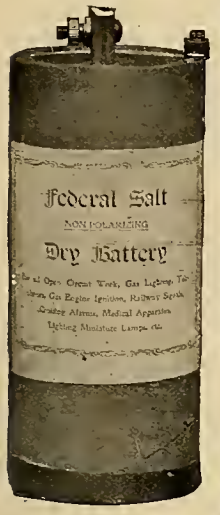

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Higher Voltage and Amperage.

Will do more Hard Work than any Dry Battery on the Market.

No more Running Down on the Shelf.

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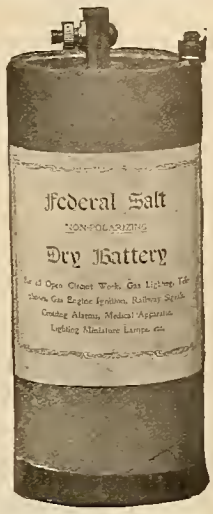

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SAME PRICE TO ALL.

16 C. P., Barrel Lots, 17c. Each.

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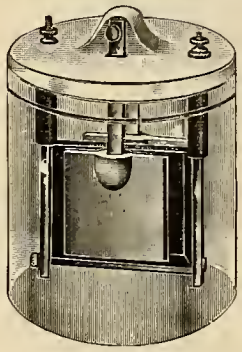
FOR GAS ENGINES, SLOT MACHINES, AUTOMOBILES, RAILROAD SIGNALS, CROSSING BELLS, SMALL MOTORS, ETC.



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IMPROVED DUNCAN INTEGRATING WATTMETERS.

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HAVING A CONSTANT POWER FACTOR WITH ANY NUMBER OF LAMPS IN SERIES. NO REGULATOR REQUIRED.

3 Lamps in Series on 220 to 240 Volts.
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13 Lamps in Series on 1,000 Volts.
Any Number of Lamps in Series by Using Step-Up or Step-Down Transformer.

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STANDARD FOR DIRECT CURRENT MEASUREMENTS.

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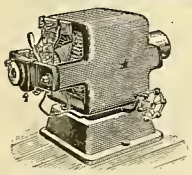

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DYNAMOS and MOTORS
Open and Enclosed for All Purposes.
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OF EVERY DESCRIPTION
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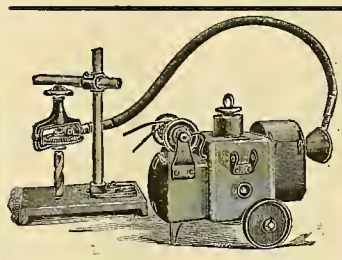

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COMBINATION OF
Stow Flexible Shaft
—AND—
MULTI-SPEED MOTOR.
Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.
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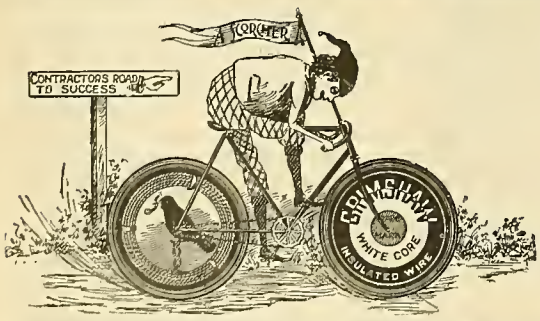

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RAVEN WHITE CORE, RAVEN BLACK CORE, COMPETITION LINE WIRE, GRIMSHAW AND COMPETITION TAPES AND SPLICING COMPOUNDS.

New York Insulated Wire Company,

MAIN OFFICE: 12-17 Cortlandt St., New York
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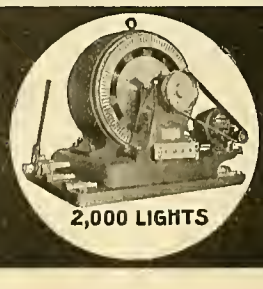

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A RECORD BREAKING RECORD.

9 GOLD MEDALS, 3 SILVER MEDALS, 2 SILVER CUPS

AWARDED TO

The Hewitt-Lindstrom Motor Co.'s Vehicles

In Open Competition at the Automobile Show.

FLEXIBLE RUNNING GEAR.

PERFECT MOTOR SUSPENSION.

FLEXIBLE PERCH.

STYLE A. RUNABOUT.
Travels 45 Miles on One Charge of Accumulators.
Maximum Speed, 25 Miles per Hour. Weight 1,850 lb.

ARTISTIC IN DESIGN.

PERFECT MECHANICAL CONSTRUCTION.

HIGHEST GRADE MATERIALS.

Intending Purchasers of Automobiles, for Pleasure or Commercial Use, Should Not Fail to Inspect

THE SUPERIOR QUALITIES OF THESE VEHICLES.

HEWITT-LINDSTROM MOTOR CO.,

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TELEPHONE SYSTEMS

—FOR—

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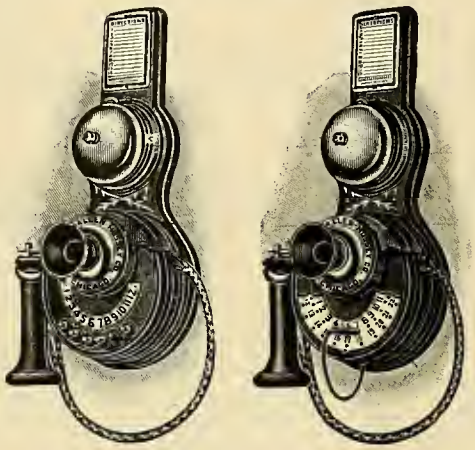
OFFICES,
RESIDENCES,



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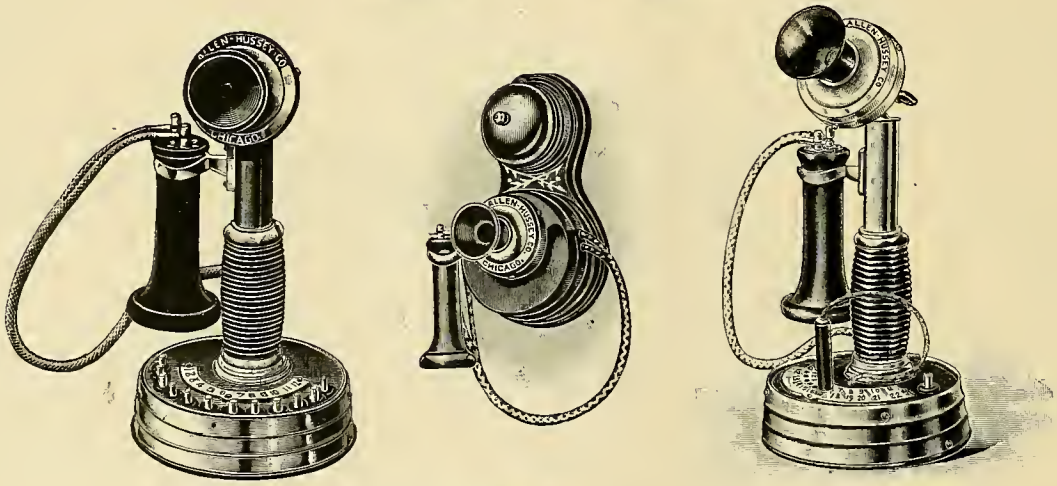

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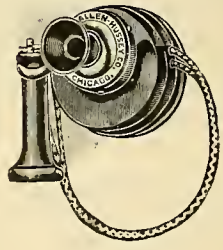

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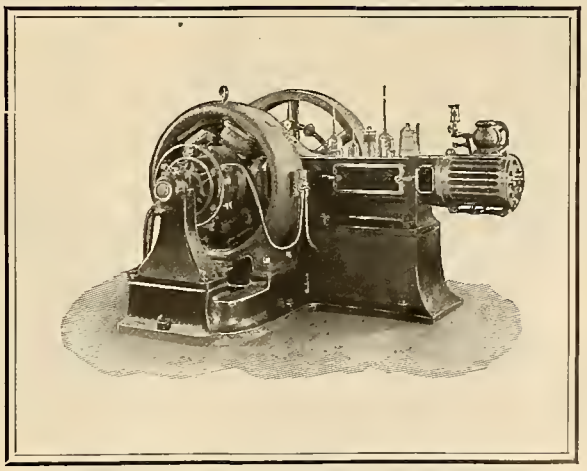

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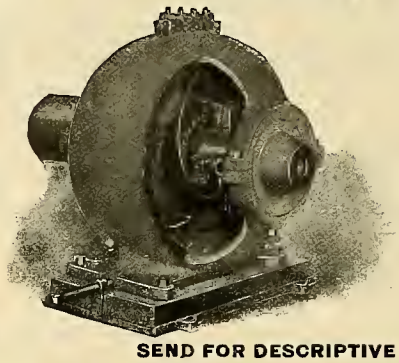

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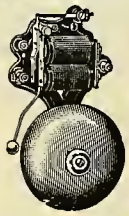

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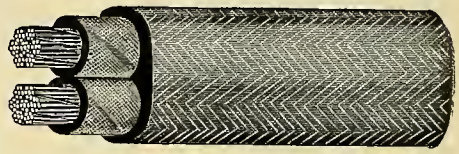

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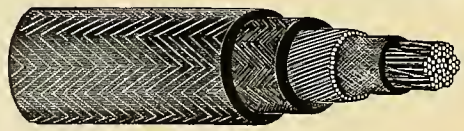

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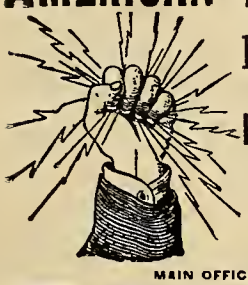

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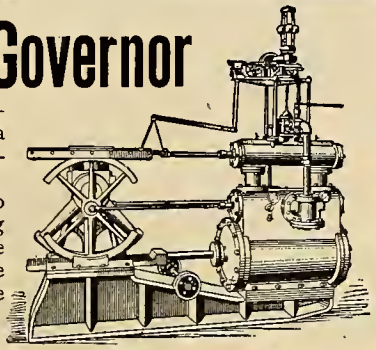

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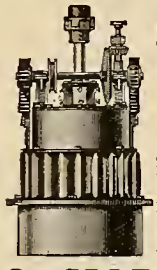

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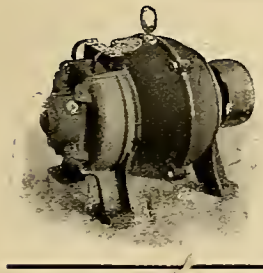

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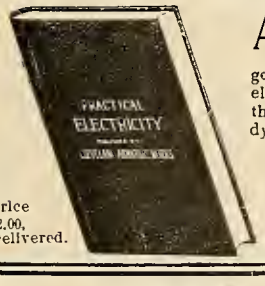

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1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
1 6000-light Westinghouse, 300 K. W., toothed armature, composite wound, self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.

Arc Dynamos—Continued.

1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 60-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westingh'se, self-oiler.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 3 H. P. Crocker Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 6 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Both, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Eickmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

1 30 H. P. Edison, 25 K. W., self-oiler.
1 50 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 75 H. P. Sprague, self-oiler, new arm't.
1 225 H. P. Crocker-Wheeler, M. P.

500-Volt Motors.

1 ¼ H. P. Detroit, series wound.
1 1 H. P. Jenney, self-oiler.
1 1 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jenney, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. C. & C.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
1 40 H. P. Jenney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

Alternating-Current Motors.

SINGLE PHASE.

1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oilers, single-phase.
1 2½ H. P. Ft. Wayne, 100 volts, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

Alternating Current Motors.

MULTIPHASE.

1 1 H. P. Westinghouse, self-oiler, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 3-phase, type, 8-10-900, Form A, 60-cycle, 110 volts.

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1 Wood's electric runabout, with top, carries 2 persons, practically new.
1 Electric open phaeton, seats 3 persons, fine condition.
1 Electric "trap," carries 4 persons, new.

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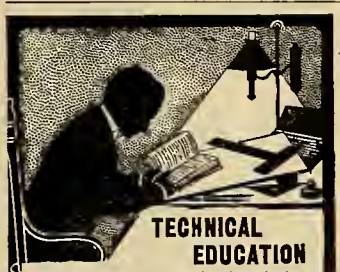

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One Amer. Wood, 20-light, 2,000 c. p.
One West. Elec., 30-light, 2,000 c. p.
One Ft. Wayne Wood, 35-light, 1,200 c. p.
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One A60 G. E.

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One T.-H. m. p. 75, 500 v., 75 k. w.
One Edison b. p., 500 v., 100 k. w.

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One Diehl, ½ h. p.
One Edison, ¾ h. p.
One Elbridge, ¾ h. p.
One Card, 1 h. p.
One Sprague, 1 h. p.
One Nowotny, 3 h. p.
One Daft, 10 h. p.
One U. S., 20 h. p.
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One Nowotny, 1 h. p., new.
One Nowotny, 1 h. p.
One Davis, 5 h. p.
One Daft, 10 h. p.
One E. R. & C. C., 10 h. p.
One Edison b. p., 15 h. p.

500-VOLT MOTORS.

One Davis, 20 h. p.
One Brush, 25 h. p.
One Wood b. p., 60 h. p.
One T.-H. m. p. 15, 90 h. p.
One Edison, 100 k. w., 120 h. p.

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We are constantly purchasing entire factories and plants. We bought from the Sioux City Traction Co. the following:

No. S1 2 13x22x12 Westinghouse compound engines.
No. S2 1 pair 17¾x24 Williams automatic engines, coupled together.
No. S3 2 generators, type U. S. Westinghouse, bi-polar, size, 80 K. W.
No. S4 2 60x16 horizontal tubular boilers.
No. S5 1 450 H. P. Hazleton water tube boiler, 2 Roney furnaces with stokers.
No. S6 1 Worthington duplex pump, 6x4x6.
No. S7 1 Koerschell heater, 2x9 feet.
No. S8 1 Hancock inspirator, 1¼ inches.
No. S9 38 feet 6¾-inch shafting.
No. S10 29 feet 8-inch shafting.
No. S11 8 feet 4⅞-inch shafting.
No. S12 15 feet 10-inch shafting.
No. S13 2 6¾-inch flanged couplings.
No. S14 1 8-inch flanged coupling.
No. S15 1 6¾x4¾ flanged couplings.
No. S16 1 60x38x6⅜ in. double arm drive pulley.
No. S17 4 60x16x6⅜ in. Hill friction clutch pulleys.
No. S18 1 60x28x6⅜ in. iron pulley, leather covered face.
No. S19 1 60x16x4⅜ in. iron pulley.
No. S20 1 14x43x8 in. iron pulley.
No. S21 2 6⅜x20 chain oiling pillow blocks.
No. S22 5 6⅜x15 chain oiling pillow blocks.
No. S23 1 4⅜x15 chain oiling pillow blocks.
No. S24 1 72x26x8 in. Dodge wood pulley.
No. S25 2 14 ft. x 16 in. cable drums; 6 grooves for 1¼-inch cable.
No. S26 1 12 ft. x 17 in. x 15 in. spur gear.
No. S27 10 8x18 in. pillow blocks.
No. S28 2 double ply dynamo belts, 16-inch width, 57 feet long.
No. S29 1 double ply dynamo belt, 14½-inch width; 71 feet long.
No. S30 1 double ply dynamo belt, 14½-inch width; 48 feet long.

WE PURCHASED FROM P. D. ARMOUR & CO., Union Stock Yards, their entire boiler outfit. Armour & Co. changed their motive power from steam to electricity at a cost of over $2,000,000, as a result of which they sold to us all their fine horizontal tubular boilers, consisting of 48—60x16. 12—54x16, 12—60x18.

They are all in excellent condition and have been thoroughly overhauled, all weak parts replaced.

We also purchased the HASTINGS, NEB., ELECTRIC PLANT, consisting of the following:

No. S326 1 9½x12 Armington & Sims engine.
No. S327 2 650-light incandescent dynamos.
No. S328 2 25-light Ball arc dynamos.
No. S329 2 60x16 horizontal tubular boilers.
No. S330 2 66x16 horizontal tubular boilers.
Shafting, hangers, couplings, etc.

ENGINES.

No. S64 12x20x12 Westinghouse automatic compound.
No. S65 12x20x14 Ball automatic compound.
No. S66 12x24 Zeahm Bros.
No. S67 12x20 horizontal slide valve.
No. S205 13x16 Twin engines, tandem bed.
No. S70 13x16 horizontal side crank.
No. S71 13x18 four valve Russell automatic.
No. S72 13x20x15 Armington & Sims cross compound condensing.
No. S73 13x16 Erie horizontal.
No. S74 14x14 automatic Ideal.
No. S75 14x24 Richards horizontal.
No. S76 14x24 box bed.
No. S77 14x20 Atlas automatic.
No. S78 14x24 Bay State.
No. S78 14x30 Cumner.
No. S79 14½x13 Armington & Sims automatic.
No. S80 15x14 automatic Ideal.
No. S81 16x14 Smith, Beggs & Rankin automatic.
No. S207 16x36 Woodruff & Beach.
No. S208 17¾x24 pr. auto. Williams, coupled.
No. S82 18x30 250 H. P.
No. S83 20x22 Corliss.
No. S84 20x36 Corliss.
No. S85 20x42 Corliss.
No. S86 26x48 Corliss.
No. S87 20x24 horizontal, box bed.
No. S209 66x20 Chandler & Taylor.
No. S210 40 H. P. Rice automatic.
No. S211 35 H. P. Chandler & Taylor.
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No. S92 40 H. P. slide valve.
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No. S97 No. 1 Russell high-speed automatic.
No. S98 12 H. P. Giant.
No. S99 14 H. P. Giant.
No. S100 6 H. P. automatic Westinghouse.
No. S101 10 H. P. gas engine.
No. S102 13 H. P. Dayton gasoline.
No. S103 35 H. P. upright.
No. S104 40 H. P. Otto gas.
No. S105 50 H. P. Otto gas.
No. S106 19 H. P. Lewis gasoline.
No. S107 50 H. P. Raymond gasoline.
No. S172 68 H. P. Atlas.
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No. S174 Otis furnace hoist engine, 2 cyl., 8x10.
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No. S273 16x30 balance wheel, 14 feet diam.
No. S274 1 H. P. gasoline.
No. S275 16½x30 Buckeye.
No. S276 6x12 horizontal slide valve.
No. S277 14x28 horizontal slide valve.
No. S278 12x24 marine oscillating.
No. S279 30x30 slide valve.
No. S280 36x42 slide valve.
No. S281 24x30 slide valve.
No. S282 10x15 center crank.
No. S283 6x8 box bed, side crank.
No. S284 16x36 Sinker & Davis.
No. S285 9x9 upright, center crank.
No. S286 9x14 horizontal, side crank
No. S287 9x12 Nagel.
No. S288 7x7 side crank.

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No. SM147 1 25-light C. & C. dynamo.
No. SM148 1 250-light Edison dynamo.
No. SM149 1 100-light Rockford dynamo.
No. SM150 2 500-light T.-H. dynamos.
No. SM151 1 150-light Eddy dynamo.
No. SM152 1 100-light, 110-volt, Weston dynamo.
No. SM153 1 250-light Hawkeye dynamo.

500-VOLT GENERATORS.

No. SM154 1 No. 8 T.-H., 75 K. W., 500-volt.

650-VOLT GENERATORS.

No. SM155 2 type U. S. Westinghouse bi-polar; 80 K. W.; 350 revolutions, 550-volt.

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No. SM158 1 500-light T.-H. alternator; 1,000-volt.
No. SM159 1 600-light T.-H.; 2,040-volt.
No. SM160 2 25 K. W. Westinghouse Alternators; 1,150-volt; 16,000 alternations; switchboard and instruments.

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No. SM163 1 No. 8; 60-light; arc; 2,000 c. p.; Wood.
No. SM164 1 80-light Western Electric dynamo.
No. SM165 20-light, 2,000 c. p. Sperry; switchboard and instruments.

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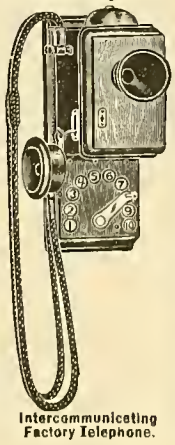

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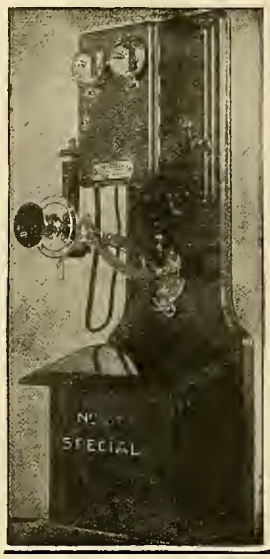

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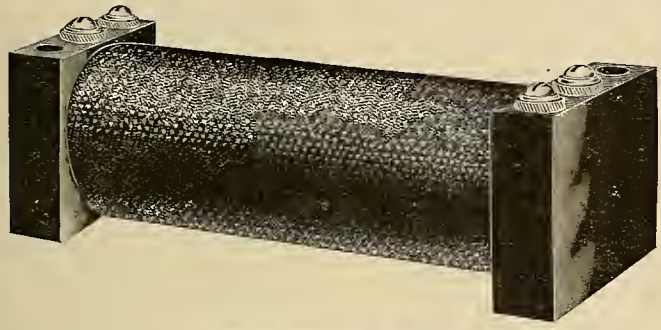

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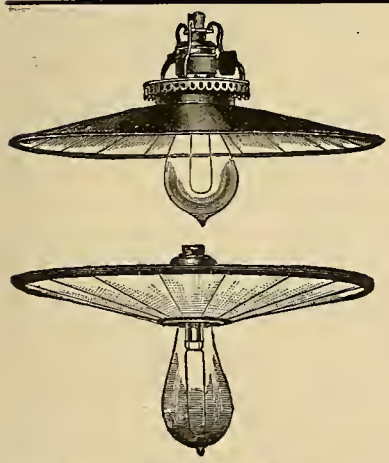

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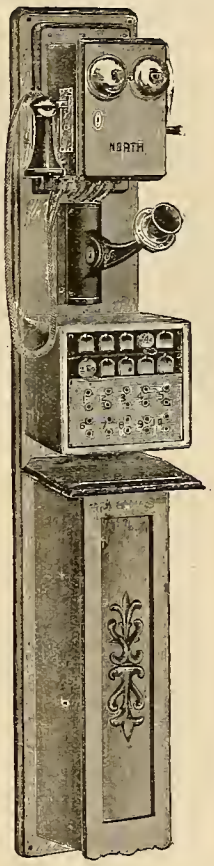

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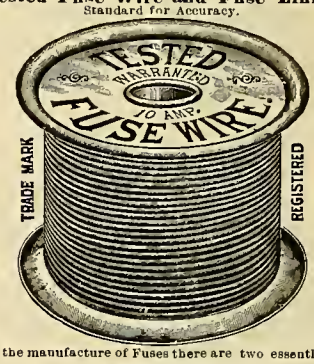

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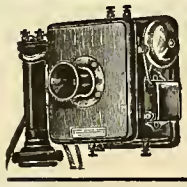

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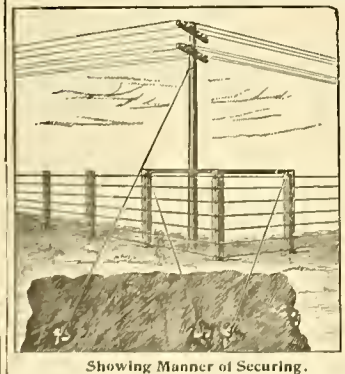

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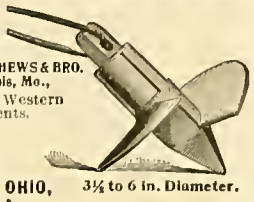

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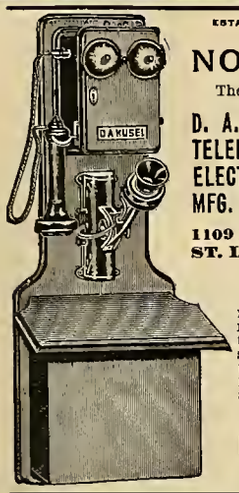

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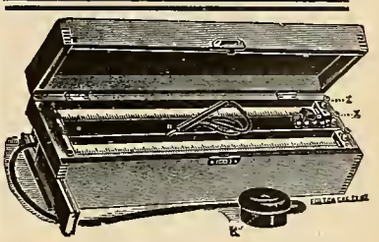

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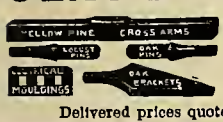

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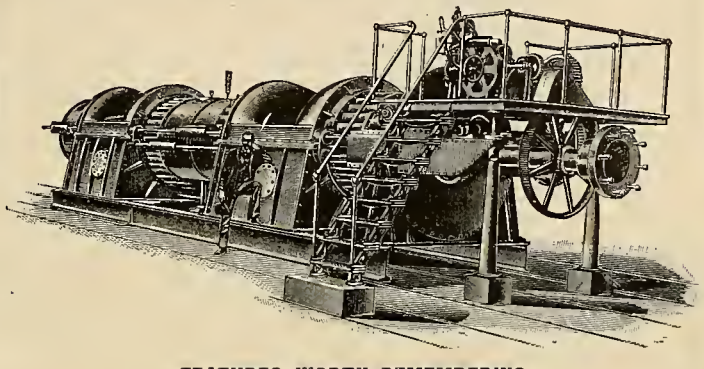

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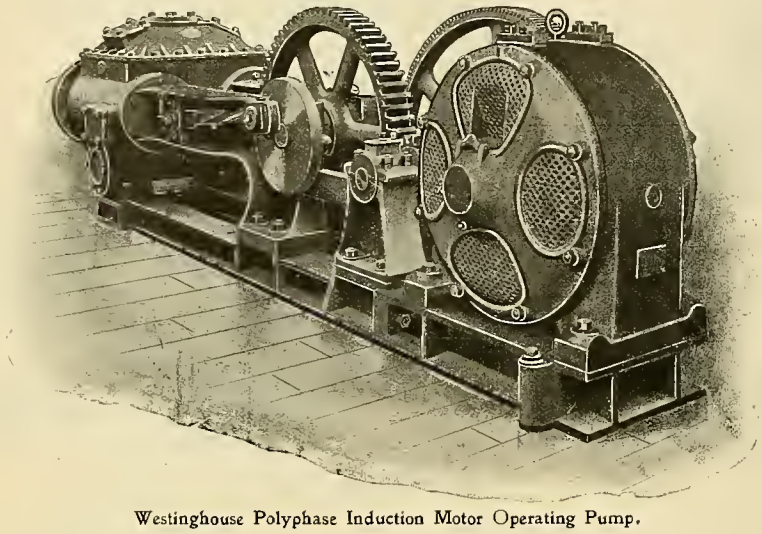

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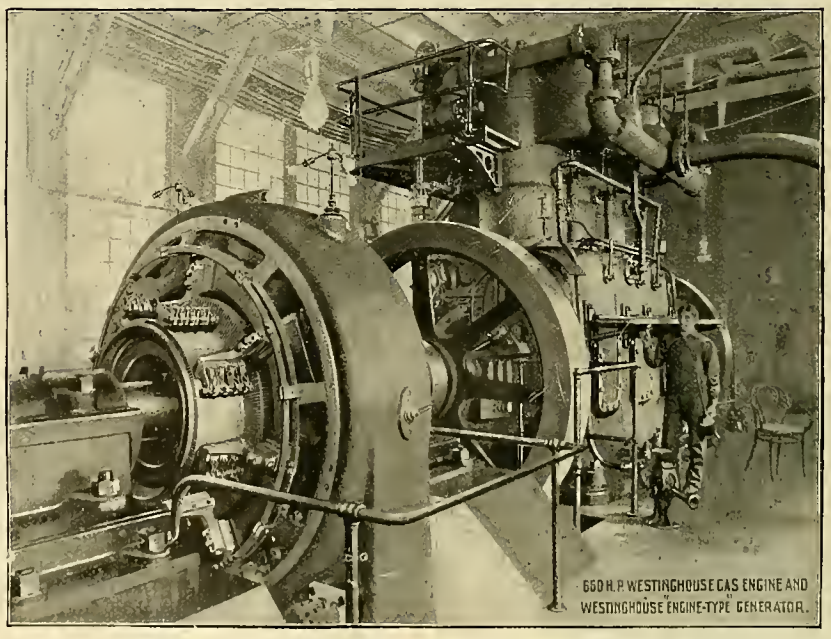

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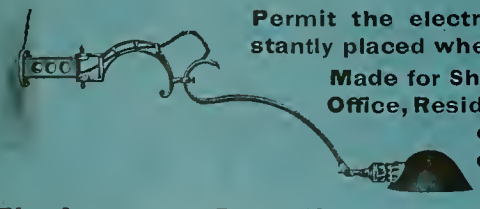

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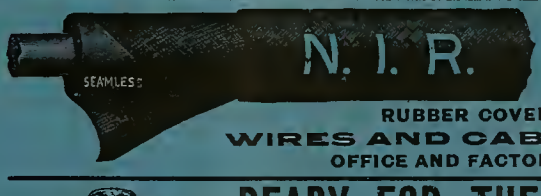

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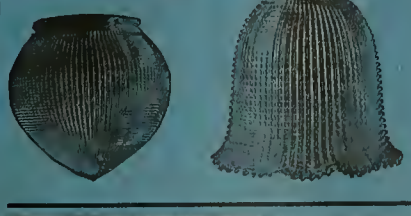

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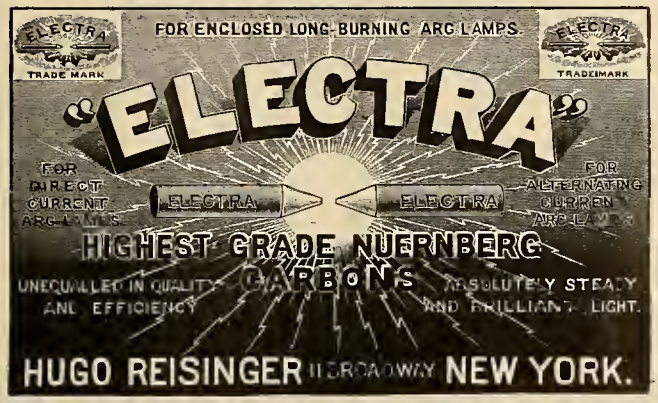

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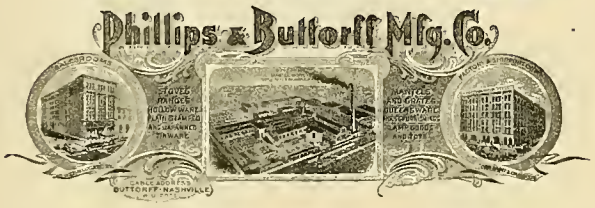

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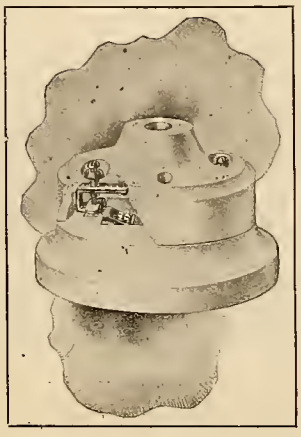

P. K. ROSETTES.

2 KINDS IN 1.

Cap attached to base by quarter-turn, or cap rigidly fixed to base by screws.

A quarter-turn of the cap of the P. K. Rosette attaches it to the base by means of extra strong spring contact-arms, which lock the cap sufficiently for general work. Where rosettes are subject to vibrations, the lock-screws in the cap may be readily tightened (see illustration No. 811), so that the contact-arm connection is practically one piece.

The parts are few and strong, and the porcelain is of the ***highest grade and finish.*** The design is plain, and will not catch or hold the dust.

Std. Pkg.	List No.		List Price.
250	*810*	For Cleat Work, Solid Cast Lugs	.26
250	*811*	For Concealed Work	.26
250	*812*	For Moulding Work	.26

P. K. BRACKET ROSETTES.

100	*813*	For Cleat Work	.36
100	*814*	For Concealed Work	.36
100	*815*	For Moulding Work	.36

DISCOUNTS:

50 per cent. less than Standard Package.
50 per cent. and 10 per cent. Standard Package.

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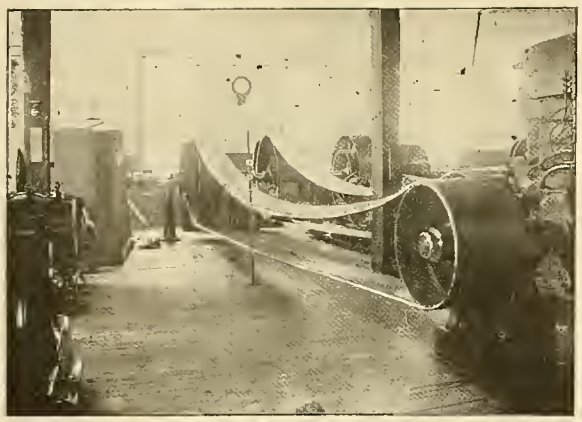
CHICAGO,

GENERAL SALES AGENTS.



CLING-SURFACE.

We guarantee these results from Cling-Surface:
Slipping stopped.
Belts made pliable and elastic.
Power increased at least 15%.
Belts will run easy or slack.

ASK US FOR THE ONLY BOOKLET OF SLACK BELTS YOU EVER SAW.

CLING-SURFACE MFG. CO.,
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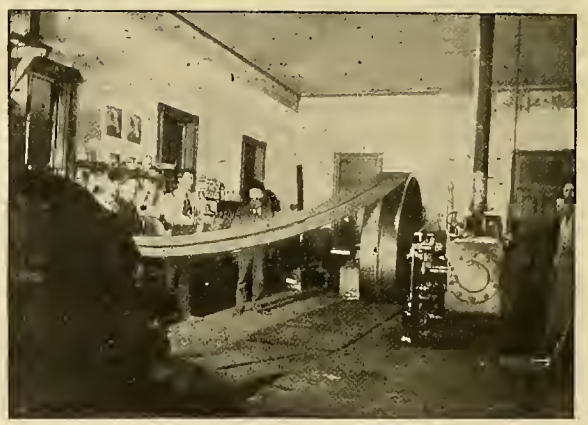
Chicago, St. Louis, New York, Boston, New Orleans.



ROCKLAND, ME., February 22, 1900.

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GENTLEMEN:—These two 16-in. belts have been treated with Cling-Surface for some time. They run this way all the time. The load sometimes jumps from zero to full load, yet there is no slip.
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MOUND CITY, MO., March 5, 1900.

Cling-Surface Mfg. Co.
GENTLEMEN:—Have used Cling-Surface four months. It has stopped all slipping. Belts 10 in., 30-ft. centers, run with 22-in. sag, yet carry full load, are pliable and in fine condition. Used to run very tight. We highly recommend Cling-Surface.
MOUND CITY ELEC. LT. & TELEPHONE CO.

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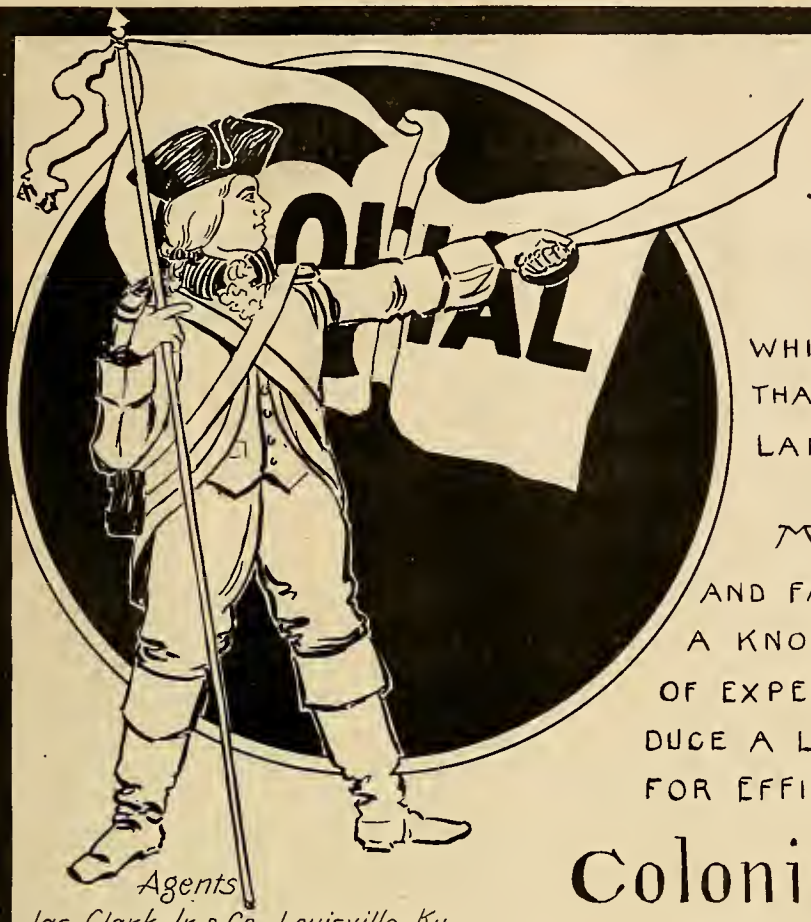

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YOU are an Electric Lighting Company, or a Railway Company.

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No Wear on Commutator.
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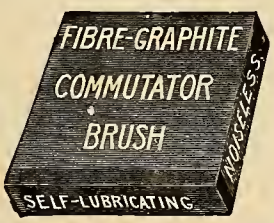

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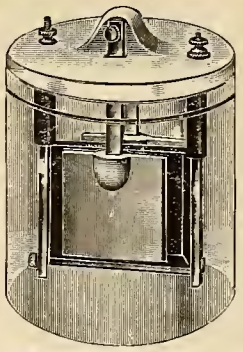

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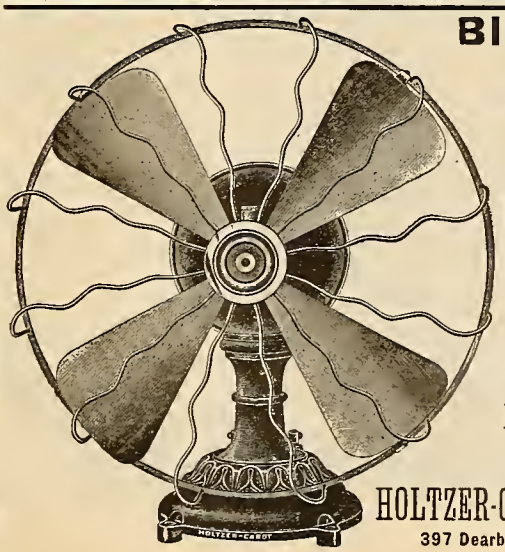

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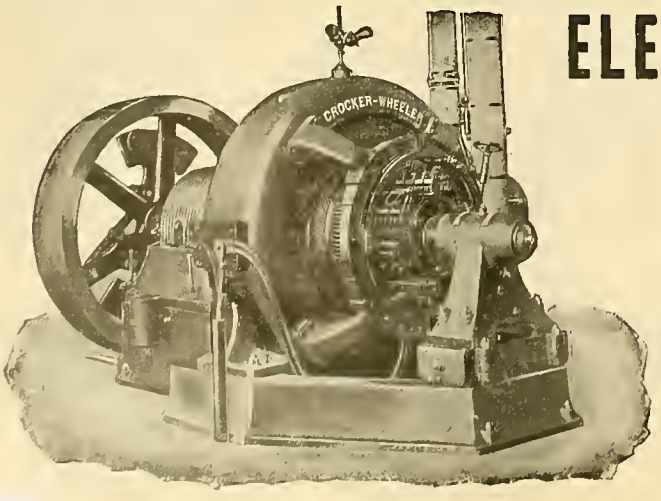

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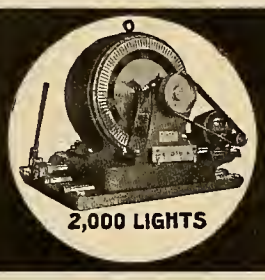

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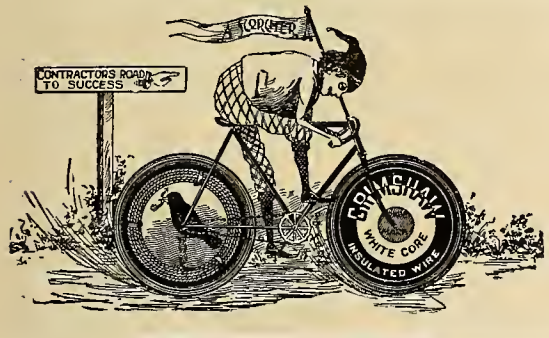

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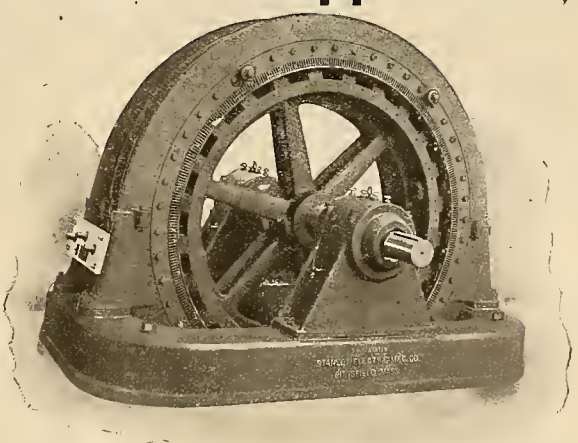

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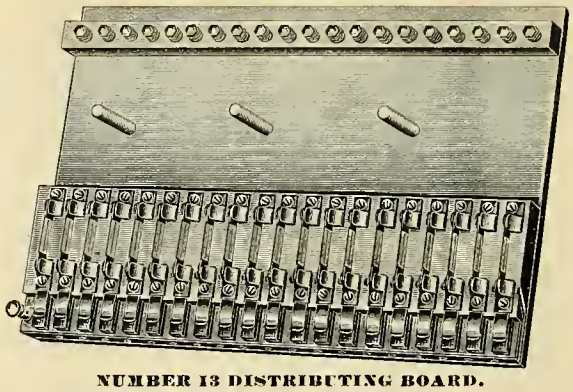

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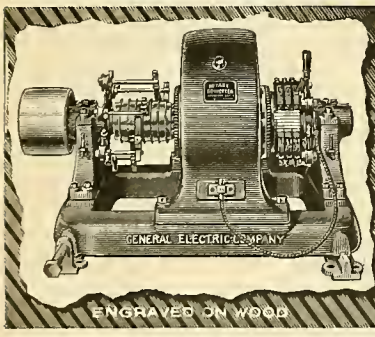

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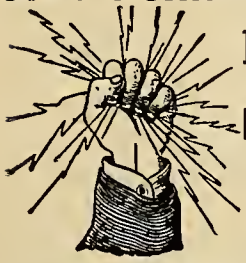

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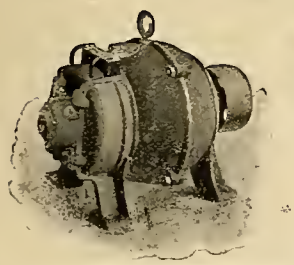

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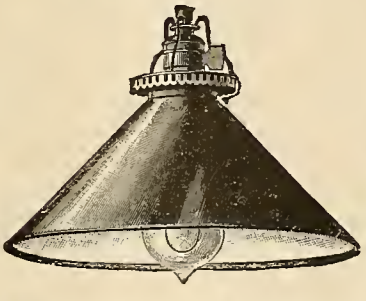

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Dr. J. S. Romine of Chadron, Neb., will sell $10,000 stock of Chadron Electric Light and Power Co. for $3,000 cash; balance stock, $4,000, held by J. D. Bacon of Chadron, a retired banker, he will sell on account of my selling, for $2,000 cash or on time, or keep his stock. Plant cost over $16,000; no bonds, mortgages or debts; no other light plant; city contract. Coal, $2.95 per ton. Pure city spring water. City of 3,000, healthy, good school, academy, six churches. Business can be greatly increased. Reason for selling, age and business keep me away all the time.

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4—45-K. W., Edison, bi-polar, 110-volt dynamos.
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A practical telephone man to take $5,000 of stock in a telephone system, the money to be used in constructing a new exchange to be added to the system. A permanent position is offered to the right man at a fair salary. Address at once,

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Position as engineer or electrician by a competent man who understands all the details of the electric-light business. 15 years of practical experience with steam and 12 years in electrical work. Address "COMPETENT," care Western Electrician, 510 Marquette Building, Chicago.

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Postponed Till Nov. 10.——Bankrupt Sale.

Entire Property of The Suburban Electric Co., Covington, Ky., Offered For Sale.

Notice is hereby given that pursuant to an order in bankruptcy, in the matter of the Suburban Electric Company, a corporation organized under the laws of the state of Kentucky, bankrupt, No. 276, in the District Court of the United States for the District of Kentucky, I will, on the 10th day of November, 1900, at 10 o'clock a. m., at the Scott street entrance of the United States Court in Covington, Ky., sell at public auction to the highest bidder, all the property, real and personal, of every kind and description belonging to the Suburban Electric Company, bankrupt, including all the rights, privileges and franchises, except the franchise to be a corporation, and also its electric lighting plant, power station, machinery, engines, boilers, dynamos, electric machine, electric lamps and other appliances and appurtenances, poles, lines, wires and all contracts, claims and demands, and all other property of every kind and description, also the following described real estate belonging to the said bankrupt, situated in the city of Covington, Kenton County, Kentucky, and bounded as follows:

1. Beginning at a point on the east line of Madison avenue at the northeast corner of Madison avenue and an alley running parallel to and between Fourth and Fifth streets; thence northwardly along the east line of said Madison avenue toward Fourth street ninety (90) feet; thence at right angles to Madison avenue one hundred and ninety (190) feet to another alley; thence with said other alley and at right angles to said first-named alley ninety (90) feet to said first-named alley; thence westwardly along the same one hundred and ninety (190) feet to the place of beginning.

And also the following described piece of real estate belonging to said bankrupt, situated in the city of Newport, Campbell County, Kentucky, to wit:

2. Lot No. 280 in the Cote Brilliant Lot & Home Company's subdivision, fronting thirty (30) feet on the west side of Park avenue, and extending back one hundred and twenty (120) feet to an alley.

The first tract of real estate above described will be sold subject to such lien as Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, or either of them, may have upon said real estate, which lien is as yet undetermined in amount.

The property above described will be sold free from any and all liens or encumbrances, except the lien or encumbrance in favor of Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, upon the said first described real estate aforesaid.

The second piece of real estate described aforesaid will be sold separately.

All the balance of the real estate, and all the other property and assets of every kind, and the rights, privileges and franchises of the Suburban Electric Company will be sold as an entirety and as a going concern.

The terms of the sale will be one-third (⅓) cash, to be paid upon the confirmation of the sale, the balance in equal installments of six and twelve months from date of sale, deferred payments to draw six (6) per cent interest and to be secured by lien upon the property sold and also by bond with sureties satisfactory to the referee in bankruptcy herein; or purchaser may pay cash for said property upon the confirmation of the sale. No bid for said property will be received from any bidder who shall not place in the hands of the undersigned at the time of making said bid, as a pledge that said bidder will make good his bid if the sale is confirmed, the sum of fifteen thousand ($15,000) dollars, which sum of fifteen thousand dollars will be credited upon the first payment of the purchase-money for said sale.

Inspection of property invited. Full information given upon application at the office of the bankrupt in Covington, Ky.

CHARLES H. SHAW,
Trustee in Bankruptcy of the Suburban Electric Company.

SIMRALL & GALVIN,
Attorneys for Trustee in Bankruptcy.

FOR SALE.

A Hoffman & Billings Corliss engine, size 14x32.

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BELOIT, WIS.

MANUFACTURERS.

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110-Volt Incandescent Dynamos.

1 12-light Hartley, self-oiler, multipolar.
2 12-light Edison, ¾ K. W.
1 26-light Perrett.
1 50-light Hawkeye.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 50-light C. & C., self-oiler.
1 65-light Edison, 3 K. W., self-oiler, comp.
1 60-light Mather.
1 60-light Thomson-Houston, 75 v., comp. with extra armature.
1 75-light Thomson-Houston, D. 5.
1 75-light Wood, self-oiler.
1 90-light Westinghouse.
1 100-light Cutten.
1 100-light Jenney, comp.
1 210-light Triumph, self-oiler.
1 225-light United States.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp. self-oiler.
1 270-light T.-H., comp. self-oiler, D. 15.
3 270-light Westinghouse, M. P., slow speed, 15 K. W., October delivery.
1 300-light Columbian, multipolar, comp., self-oiler.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp., wound.
1 350-light National, self-oiler, compound.
3 350-light Edison, 20 K. W., self-oilers.
1 360-light Duplex multipolar, self-oiler, compound, slow speed.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elekmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., for direct connection.

220-Volt Generators.

1 7½ K. W. General Electric, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 15 K. W. Edison, compound, self-oiler.
1 25 K. W. Edison, self-oiler.
1 40 K. W. E. & C., multipolar, slow speed.
1 200 K. W. Crocker-Wheeler multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.

500-Volt Generators—Continued.

1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
3 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x24x14, all complete, fine.
1 150 K. W. Detroit (Rae) multipolar, compound, self-oiler, new armature.

Alternating Generstors.

1 350-light Thomson-Houston, A. 18, comp. wound.
1 600-light Bain, 30 K. W., self-oiler, new toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 60 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed arm't.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
1 6000-light Westinghouse, 200 K. W., toothed armature, composite wound, self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.

Arc Dynamos—Continued.

1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westlogh'se, self-oiler.
3 125-light 1200 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 3 H. P. Crocker Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 6 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Elekmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

1 30 H. P. Edison, 25 K. W., self-oiler.
1 60 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 75 H. P. Sprague, self-oiler, new arm't.
1 225 H. P. Crocker-Wheeler, M. P.

500-Volt Motors.

1 ¼ H. P. Detroit, series wound.
1 1 H. P. Jenney, self-oiler.
1 1 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jenney, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. C. & C.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
1 40 H. P. Jenney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

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SINGLE PHASE.

1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oilers, single-phase.
1 2½ H. P. Ft. Wayne, 100 volts, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

Alternating Current Motors.

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1 1 H. P. Westinghouse, self-oiler, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 3-phase, type, 8-10-900, Form A, 60-cycle, 110 volts.

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1 Wood's electric runabout, with top, carries 2 persons, practically new.
1 Electric open phaeton, seats 3 persons, fine condition.
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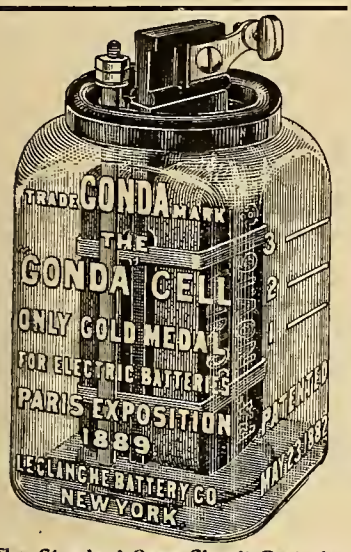

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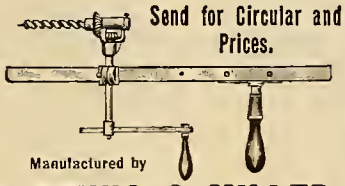

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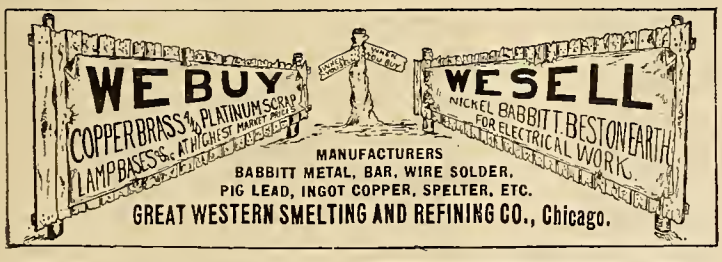

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We are constantly purchasing entire factories and plants. We bought from the Sioux City Traction Co. the following:

No. S1 2 13x22x12 Westinghouse compound engines.
No. S2 1 pair 17¾x24 Williams automatic engines, coupled together.
No. S3 2 generators, type U. S. Westinghouse, bi-polar, size, 80 K. W.
No. S4 2 60x16 horizontal tubular boilers.
No. S5 1 450 H. P. Hazleton water tube boiler, 2 Roney furnaces with stokers.
No. S6 1 Worthington duplex pump, 6x4 x6.
No. S7 1 Koerschell heater, 2x9 feet.
No. S8 1 Hancock inspirator, 1¼ inches.
No. S9 38 feet 6⅜-inch shafting.
No. S10 39 feet 8-inch shafting.
No. S11 8 feet 4⅞-inch shafting.
No. S12 15 feet 10-inch shafting.
No. S13 2 6⅜-inch flanged couplings.
No. S14 1 8-inch flanged coupling.
No. S15 1 6⅜x4⅞ flanged couplings.
No. S16 1 60x38x6⅜ in. double arm drive pulley.
No. S17 4 60x16x6⅜ in. Hill friction clutch pulleys.
No. S18 1 60x28x6⅜ in. iron pulley, leather covered face.
No. S19 1 60x16x4⅞ in. iron pulley.
No. S20 1 14x43x8 in. iron pulley.
No. S21 2 6⅜x20 chain oiling pillow blocks.
No. S22 5 6⅜x15 chain oiling pillow blocks.
No. S23 1 4⅜x15 chain oiling pillow blocks.
No. S24 1 72x26x8 in. Dodge wood pulley.
No. S25 2 14 ft. x 16 in. cable drums; 6 grooves for 1¼-inch cable.
No. S26 1 12 ft. x 17 in. x 15 in. spur gear.
No. S27 10 5x18 in. pillow blocks.
No. S28 2 double ply dynamo belts, 16-inch width, 57 feet long.
No. S29 1 double ply dynamo belt, 14½-inch width; 71 feet long.
No. S30 1 double ply dynamo belt, 14½-inch width; 48 feet long.

WE PURCHASED FROM P. D. ARMOUR & CO., Union Stock Yards, their entire boiler outfit. Armour & Co. changed their motive power from steam to electricity at a cost of over $2,000,000, as a result of which they sold to us all their fine horizontal tubular boilers, consisting of 48—60x16. 12—54x16, 12—60x18.

They are all in excellent condition and have been thoroughly overhauled, all weak parts replaced.

We also purchased the HASTINGS, NEB., ELECTRIC PLANT, consisting of the following:

No. S326 1 9½x12 Armington & Sims engine.
No. S327 2 650-light incandescent dynamos.
No. S328 2 25-light Ball arc dynamos.
No. S329 2 60x16 horizontal tubular boilers.
No. S330 2 66x16 horizontal tubular boilers.
Shafting, hangers, couplings, etc.

ENGINES.

No. S64 12x20x12 Westinghouse automatic compound.
No. S65 12x20x14 Ball automatic compound.
No. S66 12x24 Zeahm Bros.
No. S67 12x20 horizontal slide valve.
No. S205 13x16 Twin engines, tandem bed.
No. S70 13x16 horizontal side crank.
No. S71 13x18 four valve Russell automatic.
No. S72 13x20x15 Armington & Sims cross compound condensing.
No. S73 13x16 Erie horizontal.
No. S74 14x14 automatic Ideal.
No. S75 14x24 Richards horizontal.
No. S76 14x24 box bed.
No. S77 14x20 Atlas automatic.
No. S78 14x24 Bay State.
No. S78 14x30 Gumaer.
No. S79 14½x13 Armington & Sims automatic.
No. S80 15x14 automatic Ideal.
No. S81 16x14 Smith, Beggs & Rankin automatic.
No. S207 16x36 Woodruff & Beach.
No. S208 17¾x24 pr. auto. Williams, coupled.
No. S82 18x30 250 H. P.
No. S83 20x22 Corliss.
No. S84 20x36 Corliss.
No. S85 20x42 Corliss.
No. S86 26x48 Corliss.
No. S87 20x24 horizontal, box bed.
No. S209 66x20 Chandler & Taylor.
No. S210 40 H. P. Rice automatic.
No. S211 35 H. P. Chandler & Taylor.
No. S88 22x42x48 Allis tandem condensing.
No. S89 14x20 Russell automatic.
No. S90 10 H. P. Davis & Rankin.
No. S91 10 H. P. slide valve.
No. S92 40 H. P. slide valve.
No. S93 60 H. P. slide valve.
No. S94 20 H. P. Milburn.
No. S95 No. 874 Racine automatic, 9-inch stroke.
No. S96 80 H. P. Farquhar.
No. S97 No. 1 Russell high-speed automatic.
No. S98 12 H. P. Giant.
No. S99 14 H. P. Giant.
No. S100 6 H. P. automatic Westinghouse.
No. S101 10 H. P. gas engine.
No. S102 13 H. P. Dayton gasoline.
No. S103 35 H. P. upright.
No. S104 40 H. P. Otto gas.
No. S105 50 H. P. Otto gas.
No. S106 19 H. P. Lewis gasoline.
No. S107 60 H. P. Raymood gasoline.
No. S172 68 H. P. Atlas.
No. S173 10x20 side crank.
No. S174 Otis furnace hoist engine, 2 cyl., 8x10.
No. S177 13x16 Twin engines, tandem bed.
No. S179 7x14 Ames cylinder.
No. S273 16x30 balance wheel, 14 feet diam.
No. S274 1 H. P. gasoline.
No. S275 16½x30 Buckeye.
No. S276 6x12 horizontal slide valve.
No. S277 14x28 horizontal slide valve.
No. S278 12x24 marine oscillating.
No. S279 30x30 slide valve.
No. S280 36x42 slide valve.
No. S281 24x30 slide valve.
No. S282 10x15 center crank.
No. S283 6x8 box bed, side crank.
No. S284 16x36 Sinker & Davis.
No. S285 9x9 upright, center crank.
No. S286 9x14 horizontal, side crank
No. S287 9x12 Nagel.
No. S288 7x7 side crank.

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110-VOLT INCANDESCENT DYNAMOS.

No. SM145 2 T.-H. 500-light, 110-volt, direct connected.
No. SM146 1 50-light Edison dynamo.
No. SM147 1 25-light C. & C. dynamo.
No. SM148 1 250-light Edison dynamo.
No. SM149 1 100-light Rockford dynamo.
No. SM150 2 500-light T.-H. dynamos.
No. SM151 1 150-light Eddy dynamo.
No. SM152 1 100-light, 110-volt, Weston dynamo.
No. SM153 1 250-light Hawkeye dynamo.

500-VOLT GENERATORS.

No. SM154 1 No. 8 T.-H., 75 K. W., 500-volt.

550-VOLT GENERATORS.

No. SM155 2 type U. S. Westinghouse bi-polar; 80 K. W.; 350 revolutions, 550-volt.

ALTERNATORS.

No. SM156 1 60 K. W.; 1,000-volt; Westinghouse; complete with switchboard, exciter, one extra braud new armature for exciter, two field coils.
No. SM157 1 500-light National; exciter on shaft.
No. SM158 1 600-light T.-H. alternator; 1,000-volt.
No. SM159 1 600-light T.-H.; 2,040-volt.
No. SM160 2 25 K. W. Westinghouse Alternators; 1,150-volt; 16,000 alterations; switchboard and instruments.

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No. SM161 25-light; 2,000 c. p. low tension; one extra armature for same.
No. SM162 3 50-light; 2,000 c. p.; T.-H.
No. SM163 1 No. 8; 60-light; arc; 2,000 c. p.; Wood.
No. SM164 1 80-light Western Electric dynamo.
No. SM165 20-light, 2,000 c. p. Sperry; switchboard and instruments.

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No. SM166 1 20 H. P., 500-volt, Ft. Wayoe.
No. SM167 1 3 H. P., 500-volt., T.-H.
No. S168 1 McGowan condenser, steam cyl., 8-inch.
No. S169 1 hoisting engine and boiler, 6x12, made by Kendall & Bro.

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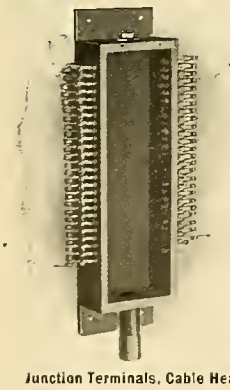

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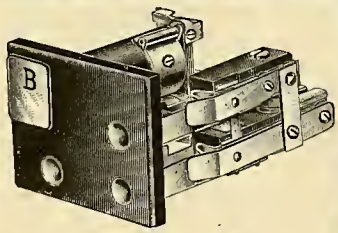

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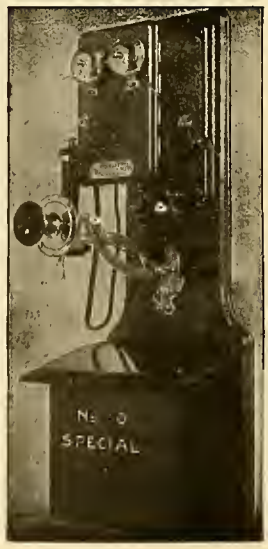

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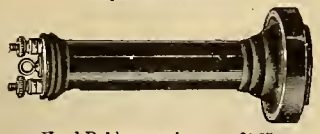

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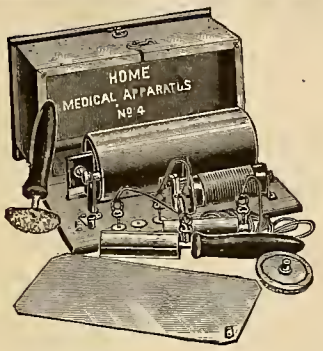

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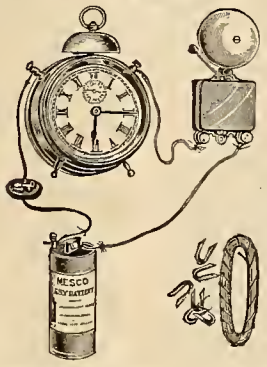

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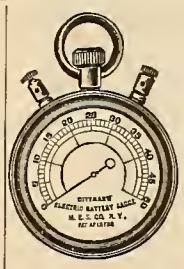

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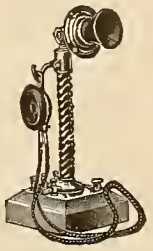

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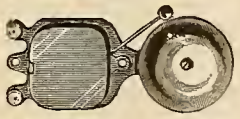

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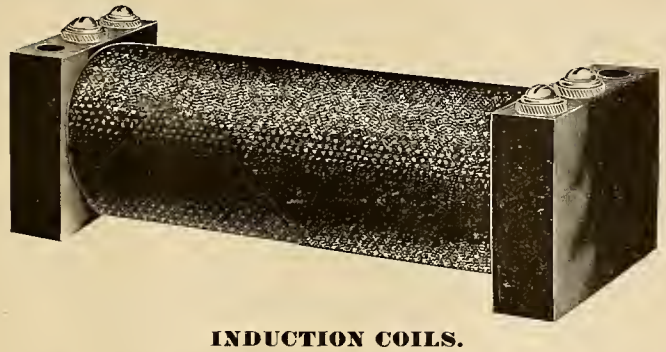

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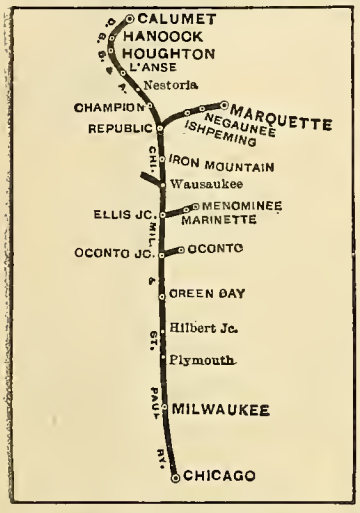

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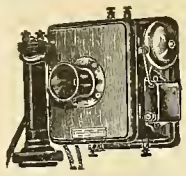

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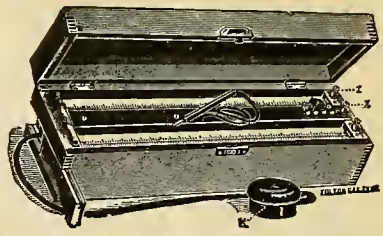

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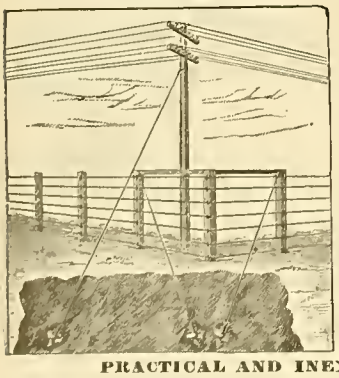

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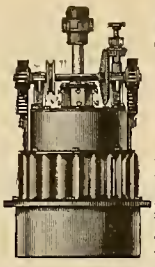

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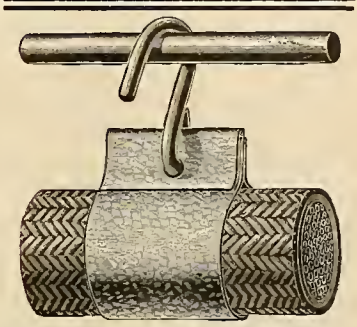

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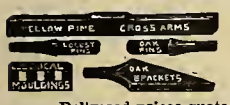

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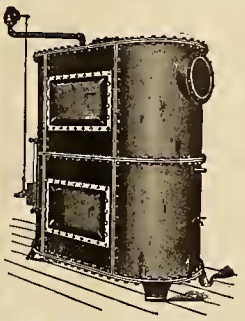

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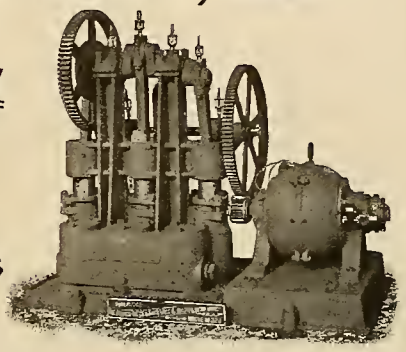

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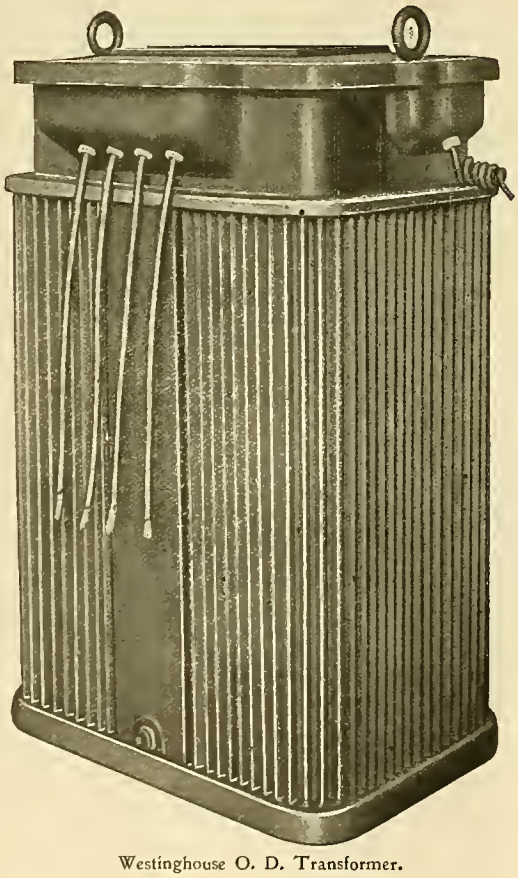

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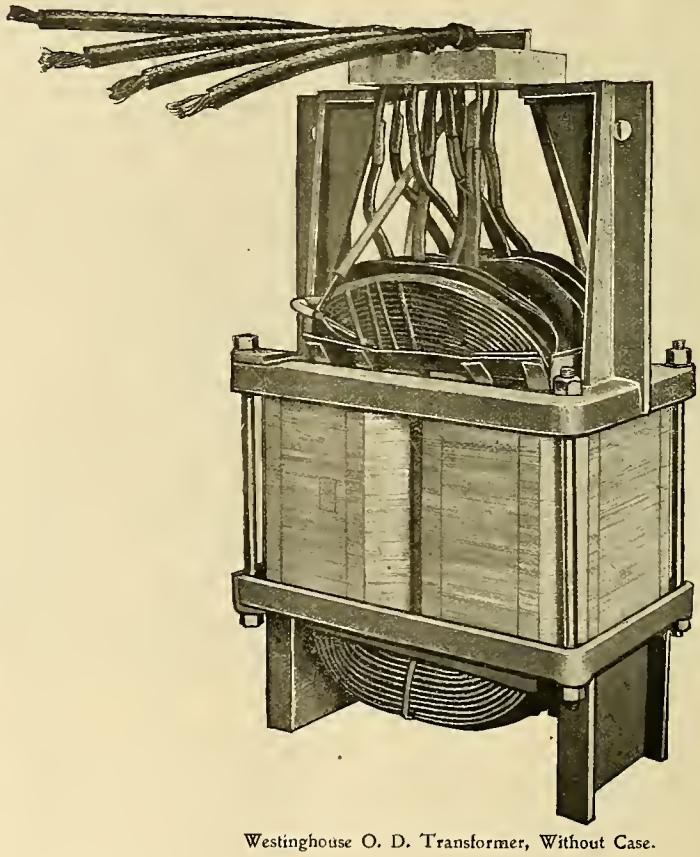

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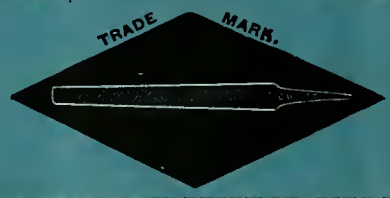

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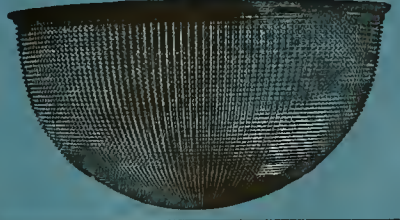
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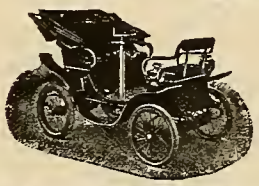

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

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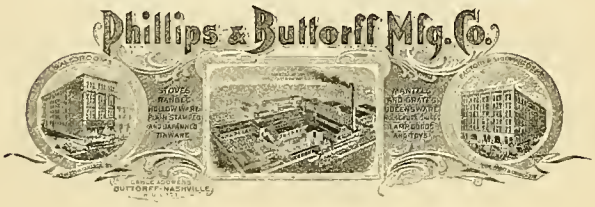
CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

OUR SELF-STARTING SINGLE-PHASE A. C. MOTORS AND WHAT A CUSTOMER THINKS OF THEM.



Nashville, Tenn. June 1, 1900

Mr. Jas Shingleton.
Dear Sir:—
The Four Wagner Motors you installed in our Work shop last Summer, have proven satisfactory in every respect, not requiring any attention whatever, and the current consumption has been remarkably low, exceeding our most sanguine expectations.

Yours Truly
Phillips & Buttorff Mfg Co
P. Buttorff

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AMERICAN STREET RAILWAY CONVENTION

In Kansas City, Mo., October 16-19, 1900, should travel via the Chicago & Alton.

CHICAGO & ALTON

EQUIPMENT ALL BRAND-NEW.

FINEST TRAIN IN SERVICE.

"THE ONLY WAY."

PALATIAL SLEEPERS. CAFE OBSERVATION CARS.

TO KANSAS CITY

CITY TICKET OFFICE: **101 ADAMS STREET.** TELEPHONE CENTRAL 1767.

The "Alton" will make SPECIAL LOW RATES from Chicago, Peoria and St. Louis, and give the best accommodations. Travel via completely rock-ballasted, dustless line. For complete particulars address

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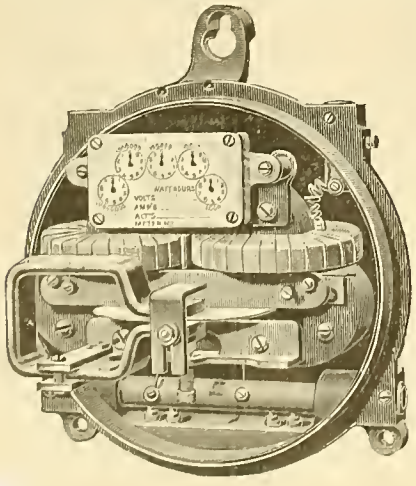

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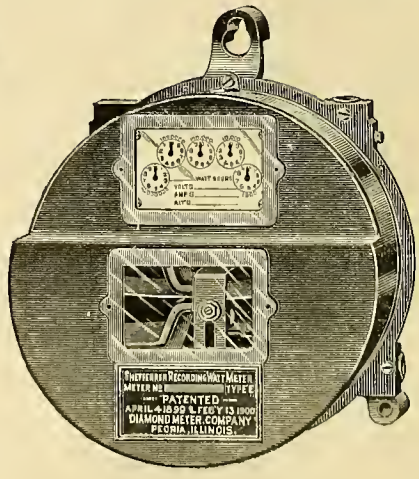
ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.



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GUARANTEED TO MEET REQUIREMENTS OF ALL PRACTICAL ENGINEERS.

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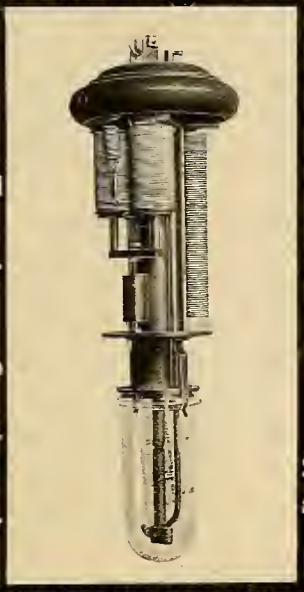
Accessibility to working parts, which are few and absolutely interchangeable.



Positive cable contact.

Resistance cannot be short-circuited.

10-in. globe, using full size carbon.

Solid copper or aluminum case.

WE WANT ACTIVE AND RESPONSIBLE AGENTS IN ALL THE PRINCIPAL CITIES.

Catalogue and Terms on Request.

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ALDEN ELECTRIC CO., Chicago Agents. ANDERSON, IND., U. S. A.

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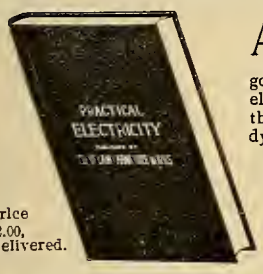

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Cleveland Armature Works, Cleveland, Ohio.

Gentlemen:—I received your book, Practical Electricity, and would not part with it for four times its cost if I could not get another copy. Yours truly, E. R. WAUGAMAN.

CLEVELAND ARMATURE WORKS, 1281 Hamilton St., Cleveland, O.

"WITHOUT A PEER"

That's the Endorsement Given

THE "BELDEN" SYSTEM OF ARC LIGHTING.

MECHANICALLY PERFECT, ARTISTIC IN DESIGN.

If you're open to conviction send for our catalog, which tells what an Arc Lamp should be and what the Belden is.

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OKONITE IT NEVER DISAPPOINTS

"FACTS ARE SOMETIMES STUBBORN THINGS."

OKONITE IT NEVER DISAPPOINTS

Okonite Wires and Cables.

Having been so long and favorably known to the trade, we respectfully call to their attention the following

FACTS

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES have the indorsement of the best electrical authorities in the world.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will not deteriorate, but improve with age.

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IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will not deteriorate when placed in lime or mortar.

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IT IS A FACT that OKONITE INSULATED WIRES AND CABLES are submerged in water for three days (72 hours), and then carefully tested with Thompson's Reflecting Galvanometer.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES are tested, in addition to the Galvanometer test, with a dynamo current of not less than 2,000 volts.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES, when used in constructing telephone, telegraph, electric light and railway lines or feeders, owing to their high insulating qualities and efficiency, prove a paying investment, though the original cost may be somewhat higher than for lines constructed of cheaper material.

As General Western Agents of the OKONITE COMPANY, LIMITED, we carry in Chicago stock a complete line of their products, and thus are in position to fill all orders promptly.

CENTRAL ELECTRIC COMPANY,

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CHICAGO.

OKONITE IT NEVER DISAPPOINTS

OKONITE IT NEVER DISAPPOINTS

BY EVERY TEST THE BEST.

Constant Potential,

3 to 5 AMPERES.

Constant Current Series,

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Alternating Current,

4 and 6 AMPERES.

OUR CATALOGUE GIVES FULL DESCRIPTION . . .

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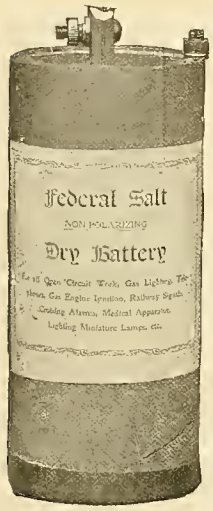

Wonderful Recuperatioo.

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Will do more Hard Work than any Dry Battery oo the Market.

No more Running Down on the Shelf.

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FOR CARBON CYLINDER and CARBON-MANGANESE BATTERIES.

Gives More Current, Longer Life, Absolutely No Crystals.

Both salts have a depolarizer in the mixture. Federal Sslt No. 1 has more depolsrizer than Federalite, and so will last longer. That's the only difference.

It's the DEPOLARIZER that INCREASES the STRENGTH, GIVES LONGER LIFE, and DOES AWAY ABSOLUTELY WITH CRYSTALLIZATION and CREEPING SALTS.

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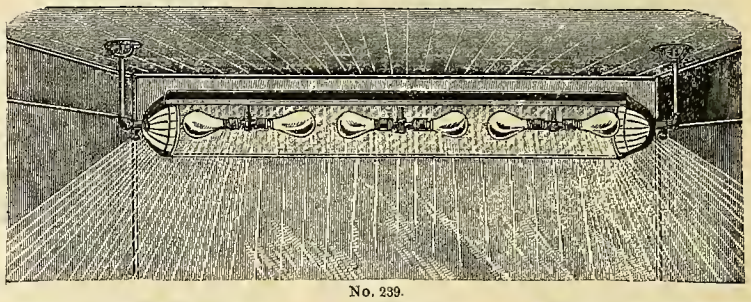
"KLEMM" PATENT ADJUSTABLE REFLECTOR, cheapest and best.
Reflector for Lighting **Show Windows and Art Galleries.**

"KLEMM" ADJUSTABLE DESK SHADES, the best in the market.
Send for Catalogue of Reflectors for Stores, Churches and general purposes.



No. 239.

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Reflectors and Shades for Electric Light.

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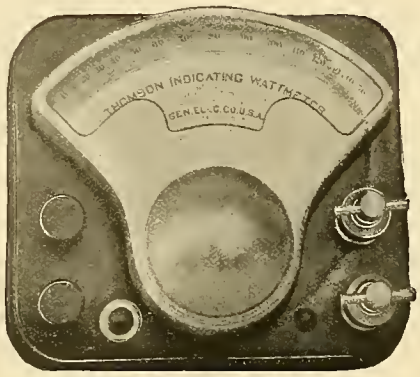

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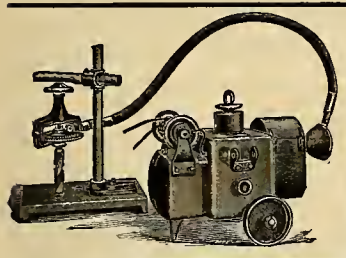

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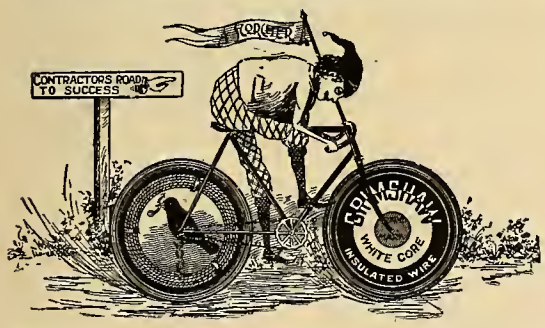

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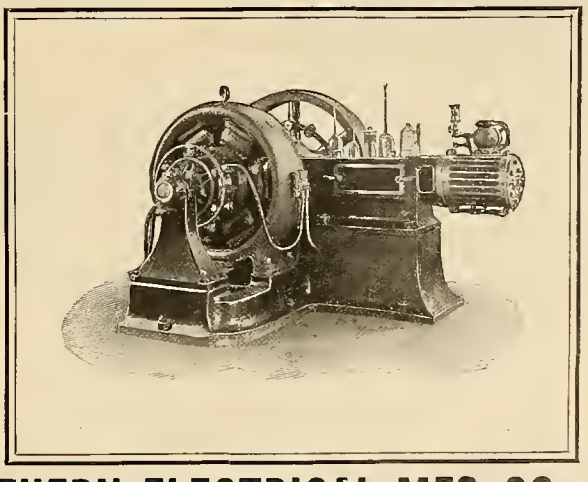

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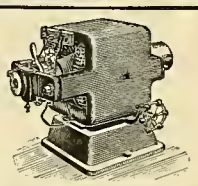

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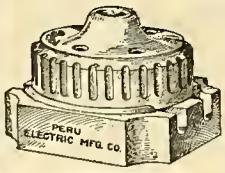

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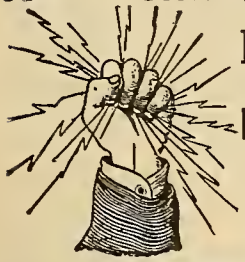

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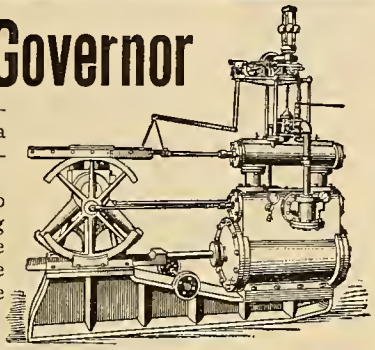

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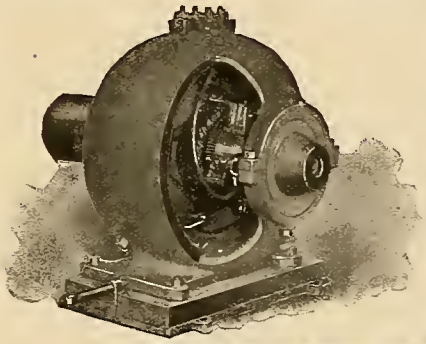

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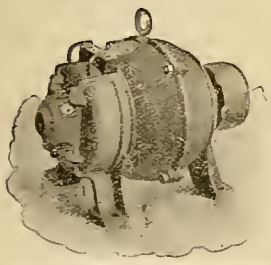

A Lundell Motor

Is adapted to all sorts and conditions of use and is unsurpassed for actual efficiency, durability, regulation of speed, margin for overloads and large current, and general workmanship. It has a strong starting torque, is non-sparking, compact and reliable. The sizes run from $\frac{1}{20}$ H. P. up and can be shunt, series or compound wound. All parts are standard, interchangeable and easily replaced. Full description in catalogue No. 0358.

SPRAGUE ELECTRIC COMPANY,

GENERAL OFFICES: 527-531 West 34th St., New York.

CHICAGO: Fisher Building. BOSTON: 275 Devonshire St.

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.

ELECTRO GALVANIZED CONDUIT

INTERIOR AND UNDERGROUND CONDUIT AND ALL FITTINGS

RICHMONDT CONDUIT CO.

MILWAUKEE U.S.A.

BEST BECAUSE BETTER.

Send for Catalog.

JAS. L. ROBERTSON & SONS,

198 Fulton St., New York.

Branches: Boston—Philadelphia.

EUREKA PACKING, with a RED DIAMOND LABEL, gives more power, lasts two to three times longer and costs less than any other good packing.

HINE ELIMINATOR gives dry steam to engine, keeps oil out of the boiler.

ROBERTSON-THOMPSON INDICATOR—a grand adjunct and at very moderate cost.

ROBERTSON FEED-WATER HEATER heats water to about boiling point with exhaust steam.

TIC-A-TOC GREASE CUP. Send for circular. A very successful novelty—circular.

WANTED.

A practical telephone man to take $5,000 of stock in a telephone system, the money to be used in constructing a new exchange to be added to the system. A permanent position is offered to the right man at a fair salary. Address at once,

Wolf River Telephone Company,
WEYAUWEGA, WIS.

WANTED.

A young man to work in winding department of an electrical repair shop; must have had some experience. This situation is open to promotion.

The F. Bissell Co.,
Toledo, Ohio.

WANT NOTICE.

WANTED—By an Electric Railway Manufacturing Company, the services of a young man with a knowledge of electricity, as an assistant in the Engineering Department. Must be a competent draftsman. State age, experience, salary required, etc. Address "Railway," care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Position by a technical graduate in electrical engineering. Have had technical training in construction, design, testing and operation of electrical machinery and apparatus. Willing to start low and can furnish best of references. Address C. H. C., care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Position as engineer or electrician by a competent man who understands all the details of the electric-light business. 15 years of practical experience with steam and 12 years in electrical work. Address "COMPETENT," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Position as Manager and Electrician by first-class telephone man, thirty years of age, strictly temperate. Have seven years' experience in telephone work. Have had charge of city construction-work; have installed and operated metallic, common-return and ground switchboards. Have been manager in my present position for over two years. Best of references. Address "O. M." care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED TO BUY.

We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

CAMP ENGINEERING CO.,
18 South Canal Street, Chicago, Ill.

AN OPPORTUNITY.

I have for sale 30 shares of stock at $100 per share in the Texas Arm & Pin Co., the largest and most flourishing cross-arm institution in the United States. My customer is in very poor health and needs funds, which is the only reason for selling. Will furnish further particulars upon application.

J. T. BEATY, Lawyer, Beaumont, Tex.

FOR SALE.

0000 Weatherproof Copper Feed Wire, about six miles, in A No. 1 condition, in lengths of 1,800 to 2,200 feet. For further particulars address

IRA H. EVANS, Receiver,
Austin Rapid Transit Railway Company,
AUSTIN, TEXAS.

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One 10 H. P. Wagner Motor, 500 volts, with rheostat. In use about three months. Address

The Ludlow-Saylor Wire Co.,
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We have for sale lot of 100,000 Electric Carbons, best German makes, various sizes. Address for particulars

A. KERN & CO.,
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A Hoffman & Billings Corliss engine, size 14x32.

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FOR SALE—A BARGAIN.

118 cells, Chloride make, size 7x7x10½ in.

THOS. ALEXANDER, 183 E. Randolph St, CHICAGO.

WE BUY AND SELL

SECOND-HAND ELECTRICAL MACHINERY.

WALSH'S SONS & CO.,
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MANUFACTURERS.

What have you an **overstock** of that you will sell at a bargain for **CASH?**

Send description and catalogue.

GEORGE W. CONOVER,
General Purchasing Agent,
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EXCEPTIONAL BARGAINS!

4—45-K. W., Edison, bi-polar, 110-volt dynamos.
1—New 40-K. W., Stanley, two-phase, 2,000-volt alternator.
1—400-ampere-hour, Chloride Accumulator Co., storage battery.
1—15 x 14 Ideal engine.
1—14½ x 15 McIntosh & Seymour engine.
2—18½ x 18 Ideal engines.
1—20x36x18 Ideal, cross-compound engine.
1—7½ x 5 x 6 Duplex feed pump.
1—1,000-H. P. Austin open heater.

Write for our latest price list No. 40.

ILLINOIS MAINTENANCE COMPANY,
E. H. CHENEY, Mgr. 204 Dearborn St, Chicago.

"AMERICAN" STORAGE CELLS

ARE THE BEST. Send for descriptive Circular.
Absolutely Non-Infringing. Protection Guaranteed.
AMERICAN BATTERY CO.,
CHICAGO. 178 S. Clinton St., Chicago, Ill.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

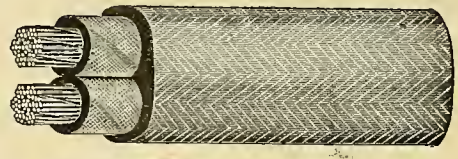
STERLING EXTRA INSULATING VARNISH.

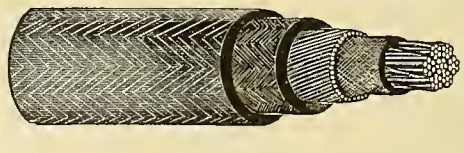
Sterling Extra Black Finishing Varnish.
Sterling Black Air Drying Varnish.
Sterling Black Core Plate Varnish.

THE STERLING VARNISH CO.,
Pittsburg, Pa., U. S. A.

THE STERLING VARNISH CO.,
95 Colmore Row, Birmingham, England.

INSULATED RUBBER WIRES AND CABLES.





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WORKS AT
TRENTON, N. J.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO.

--FOR SALE--

110-Volt Incandescent Dynamos.

1 12-light Hartley, self-oiler, multipolar.
2 12-light Edison, ¾ K. W.
1 26-light Perrett.
1 50-light Hawkeye.
1 50-light Card, self-oiler.
1 50-light Nowotny, self-oiler.
1 60-light C. & C., self-oiler.
1 55-light Edison, 3 K. W., self-oiler, comp.
1 60-light Mather.
1 60-light Thomson-Houston, 75 v., comp. with extra armature.
1 75-light Thomson-Houston, D. 6.
1 75-light Wood, self-oiler.
1 90-light Westinghouse.
1 100-light Cutten.
1 100-light Jenney, comp.
1 210-light Triumph, self-oiler.
1 225-light United States.
1 250-light Westinghouse, horizontal type.
1 250-light Commercial, comp. self-oiler.
1 270-light T.-H., comp. self-oiler, D. 15.
3 270-light Westinghouse, M. P., slow speed, 15 K. W., October delivery.
1 300-light Columbian, multipolar, comp., self-oiler.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, comp., wound.
1 350-light National, self-oiler, compound.
3 350-light Edison, 20 K. W., self-oilers.
1 360-light Duplex multipolar, self-oiler, compound, slow speed.
1 400-light Wood, M. P., self-oiler, 25 K. W.
1 450-light Edison, 25 K. W., self-oiler.
1 450-light Rockford, self-oiler.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elckmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
4 800-light Edison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., for direct connection.

220-Volt Generators.

1 7½ K. W. General Electric, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Eddy, self-oiler, new arm't.
1 15 K. W. Edison, compound, self-oiler.
1 25 K. W. Edison, self-oiler.
1 40 K. W. E. & C., multipolar, slow speed.
1 200 K. W. Crocker-Wheeler multipolar, slow speed, practically new.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler, D. 25, compound.
1 25 K. W. Edison, self-oiler.

500-Volt Generators—Continued.

1 30 K. W. Jenney, self-oiler.
1 35 K. W. Jenney, self-oiler, compound.
1 35 K. W. Mather, self-oiler.
3 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x24x14, all complete, fine.
1 150 K. W. Detroit (Rae) multipolar, compound, self-oiler, new armature.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp. wound.
1 600-light Bain, 30 K. W., self-oiler, new toothed armature.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 60 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed arm't.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.
1 6000-light Westinghouse, 300 K. W., toothed armature, composite wound. self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 2000 C. P. Western Electric, self-oiler.
1 30-light 2000 C. P. Brush, No. 7.

Arc Dynamos—Continued.

1 35-light 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, hall arm.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westingh'se, self-oiler.
3 125-light 1200 C. P. Excelsior, intest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers, M. P., slow speed.
1 3 H. P. Crocker Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type 1. B., self-oiler.
1 3 H. P. C. & C., self-oiler.
2 3 H. P. Card, slow speed, self-oilers.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Elckmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

1 30 H. P. Edison, 25 K. W., self-oiler.
1 60 H. P. E. & C., multipolar, slow speed.
1 50 H. P. Northern, M. P., self-oiler, newly rewound throughout.
1 75 H. P. Sprague, self-oiler, new arm't.
1 225 H. P. Crocker-Wheeler, M. P.

500-Volt Motors.

1 ¼ H. P. Detroit, series wound.
1 1 H. P. Jenney, self-oiler.
1 1 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jenney, self-oiler.
2 3½ H. P. Rockford, ironclad, self-oilers.
1 10 H. P. Eddy, self-oiler, multipolar.
1 10 H. P. C. & C.
1 10 H. P. C. & C., self-oiler.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 15 H. P. Eddy, self-oiler.
1 18 H. P. Thomson-Hooston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
1 40 H. P. Jenney, self-oiler.
1 40 H. P. Mather, self-oiler.
1 60 H. P. Edison, 45 K. W., self-oiler.

Alternating-Current Motors.

SINGLE PHASE.

1 ¼ H. P. Stanley, 100 volts, 16000 alternations, single-phase.
2 1 H. P. Ft. Wayne, 100 v., 125 cycle, self-oilers, single-phase.
1 2½ H. P. Ft. Wayne, 100 volts, self-oiler, single-phase.
1 5 H. P. Wagner, single-phase, 60 cycle, 200 volts.

Alternating Current Motors.

MULTIPHASE.

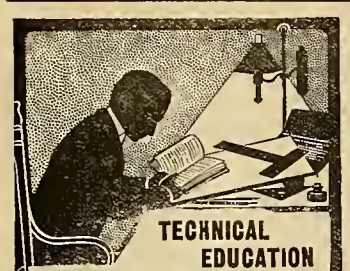
1 1 H. P. Westinghouse, self-oiler, 2-phase, 60-cycle, 100 volts.
1 10 H. P. Gen. Electric, self-oiler, 3-phase, type, 8-10-900, Form A, 60-cycle, 110 volts.

Automobiles.

1 Wood's electric runabout, with top, carries 2 persons, practically new.
1 Electric open phaeton, seats 3 persons, fine condition.
1 Electric "trap," carries 4 persons, new.

TRANSFORMERS, METERS AND ARC LAMPS.

NOTICE.—All machines are actually in stock ready for prompt delivery. All machines are guaranteed. Write for particulars and send for MONTHLY BARGAIN SHEET with net cash price.



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American School of Correspondence,
(Chartered by the Commonwealth of Mass)
Boston, Mass. U. S. A.

OUR STUDENTS SUCCEED

INCREASED SALARY.

I was getting $30 a month as assistant in an Electric Lighting Plant when I took up the Electrical Engineering Course. Since that time, I have passed four Civil Service Examinations, and have had my salary raised four times. I am now getting $87 per month, and can truthfully say that I owe my success to correspondence instruction.

R. G. ELLIOTT,
Dannemora, N. Y.

MACHINIST TO ENGINEER.

I recommend The International Correspondence Schools as being one of the best means through which to obtain an education. The method employed is simple and easily understood. At the time I enrolled, I was holding a position as machinist and steam fitter. I am now chief engineer for J. S. & T. Elkinton, Philadelphia, Pa.

WM. R. HORNER,
Philadelphia, Pa.

$12 to $70, in Small Monthly Installments, pays for a

Salary-Raising Education

In Electrical Engineering, Electric Light and Power, Telephony, Telegraphy, Steam, Mechanical, and Civil Engineering.

ESTABLISHED 1891. CAPITAL, $1,500,000.

Send for Circulars and Local References.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS,
Box 1002, Scranton, Penna.

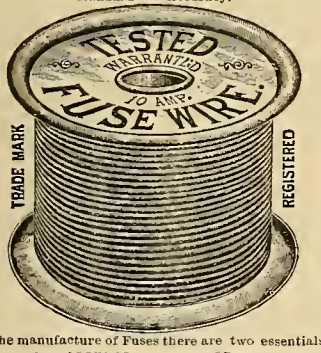
WE BUY OLD BELTS

OR SCRAPS, ANY SIZE OR CONDITION.

WE CLEAN, REPAIR AND RENEW OLD BELTS.

LEATHER PRESERVER MFG. CORP.
27 W. MONROE ST., CHICAGO.

TRADE MARK.
Tested Fuse Wire and Fuse Links.
Standard for Accuracy.



In the manufacture of Fuses there are two essentials.

1ST, ACCURACY; 2D, UNIFORMITY.

The steady increase in our business during the past twelve years is the best evidence that our goods meet all requirements.

All kinds of Telephone Fuses and Bases, well made and at low prices.

CHICAGO FUSE WIRE & MFG. CO.,
58-64 N. Jefferson St., Chicago 369 Broadway, New York.

The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,
111 to 117 East 131st St., N. Y.

WANTED FOR SPOT CASH

BURNED OUT INCANDESCENT LAMPS AND BASES.
Freight Paid and Highest Prices Guaranteed.

GEO. F. SCHWALM CO., - HARRISON, N. J.

BARGAINS in ELECTRICAL MACHINES.

The following list of thoroughly overhauled machines are in stock and ready for prompt delivery.

DYNAMOS—

110-Volt Incandescent.

One 12-light Elbridge.
One 50-light Nowotny, new.
One 100-light Daft.
One 250-light U. S.
One 350-light Davis.
One 800-light G. E.
One 1,800-light Ft. Wayne, new.

DYNAMOS—ARC.

One Brush, 1-light, 3,000 c. p.
One Brush, 3-light, 2,000 c. p.
One Amer. Wood, 20-light, 2,000 c. p.
One West. Elec., 30-light, 2,000 c. p.
One Ft. Wayne Wood, 35-light, 1,200 c. p.
One T. H. L. D., 35-light, 2,000 c. p.

ALTERNATORS.

One 3A Slattery.
One A60 G. E.

STEWART ELECTRICAL CO.,
S. E. Cor. Fifth and Sycamore,
CINCINNATI, O.

GENERATORS.

One Wood b. p., 500 v., 45 k. w.
One T.-H. m. p. 75, 500 v., 75 k. w.
One Edison h. p., 500 v., 100 k. w.

110-VOLT MOTORS.

One Diehl, ½ h. p.
One Edison, ¾ h. p.
One Elbridge, ¾ h. p.
One Card, 1 h. p.
One Sprague, 1 h. p.
One Nowotny, 3 h. p.
One Daft, 10 h. p.
One U. S., 20 h. p.
One Q. C., 28 h. p.

220-VOLT MOTORS.

One Nowotny, 1 h. p., new.
One Nowotny, 1 h. p.
One Davis, 5 h. p.
One Daft, 10 h. p.
One E. R. & C. C., 10 h. p.
One Edison h. p., 15 h. p.

500-VOLT MOTORS.

One Davis, 20 h. p.
One Brush, 25 h. p.
One Wood b. p., 60 h. p.
One T.-H. m. p. 15, 90 h. p.
One Edison, 100 k. w., 120 h. p.

MACHINERY AND SUPPLIES

AT BARGAIN PRICES.

FOR SALE.

We are constantly purchasing entire factories and plants. We bought from the Sioux City Traction Co. the following:

No. S1 2 13x22x12 Westinghouse compound engines.
No. S2 1 pair 17¾x24 Williams automatic engines, coupled together.
No. S3 2 generators, type U. S. Westinghouse, bi-polar, size, 80 K. W.
No. S4 2 60x16 horizontal tubular boilers.
No. S5 1 450 H. P. Hazleton water tube boiler, 2 Roney furnaces with stokers.
No. S6 1 Worthington duplex pump, 6x4 x6.
No. S7 1 Koerschell heater, 2x9 feet.
No. S8 1 Hancock inspirator, 1¼ inches.
No. S9 38 feet 6⅝-inch shafting.
No. S10 39 feet 8-inch shafting.
No. S11 8 feet 4⅞-inch shafting.
No. S12 15 feet 10-inch shafting.
No. S13 2 6⅜-inch flanged couplings.
No. S14 1 8-inch flanged coupling.
No. S15 1 6⅜x4⅞ flanged couplings.
No. S16 1 60x38x6⅜ in. double arm drive pulley.
No. S17 4 60x16x6⅜ in. Hill friction clutch pulleys.
No. S18 1 60x28x6⅜ in. iron pulley, leather covered face.
No. S19 1 60x16x4⅞ in. iron pulley.
No. S20 1 14x43x8 in. iron pulley.
No. S21 2 6⅜x20 chain oiling pillow blocks.
No. S22 5 6⅜x15 chain oiling pillow blocks.
No. S23 1 4⅞x15 chain oiling pillow blocks.
No. S24 1 72x26x8 in. Dodge wood pulley.
No. S25 2 14 ft. x 16 in. cable drums; 6 grooves for 1¼-inch cable.
No. S26 1 12 ft. x 17 in. x 16 in. spur gear.
No. S27 10 9x18 in. pillow blocks.
No. S28 2 double ply dynamo belts, 16-inch width, 57 feet long.
No. S29 1 double ply dynamo belt, 14½-inch width; 71 feet long.
No. S30 1 double ply dynamo belt, 14½-inch width; 48 feet long.

WE PURCHASED FROM P. D. ARMOUR & CO., Union Stock Yards, their entire boiler outfit. Armour & Co. changed their motive power from steam to electricity at a cost of over $2,000,000, as a result of which they sold to us all their fine horizontal tubular boilers, consisting of 48—60x16. 12—54x16, 12—60x18.

They are all in excellent condition and have been thoroughly overhauled, all weak parts replaced.

We also purchased the HASTINGS, NEB., ELECTRIC PLANT, consisting of the following:

No. S326 1 9½x12 Armington & Sims engine.
No. S327 2 650-light incandescent dynamos.
No. S328 2 25-light Ball arc dynamos.
No. S329 2 60x16 horizontal tubular boilers.
No. S330 2 66x16 horizontal tubular boilers.
Shafting, hangers, couplings, etc.

ENGINES.

No. S64 12x20x12 Westinghouse automatic compound.
No. S65 12x20x14 Ball automatic compound.
No. S66 12x24 Zeahm Bros.
No. S67 12x20 horizontal slide valve.
No. S205 13x16 Twin engines, tandem bed.
No. S70 13x16 horizontal side crank.
No. S71 13x18 four valve Russell automatic.
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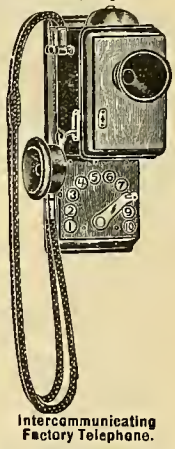

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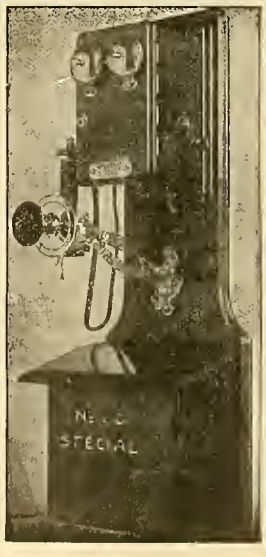

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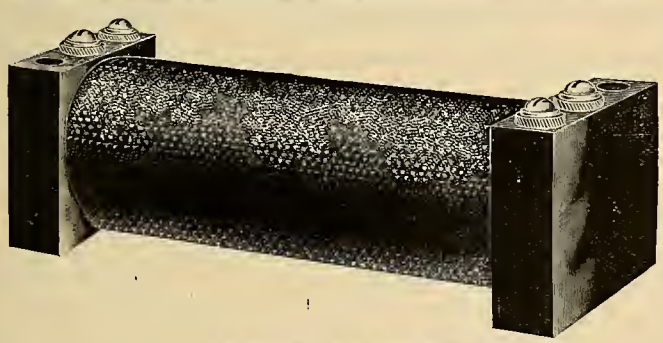

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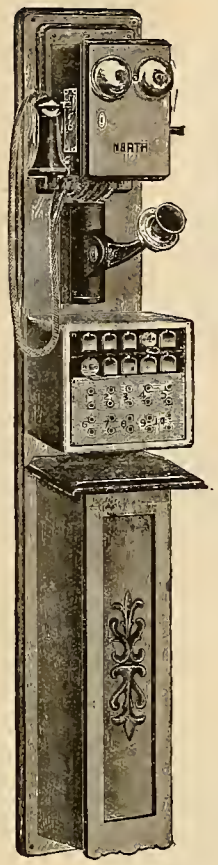

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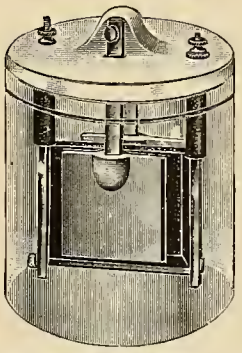

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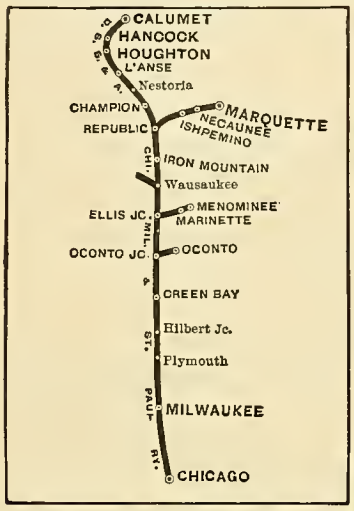

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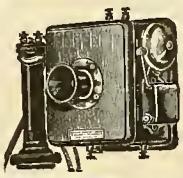

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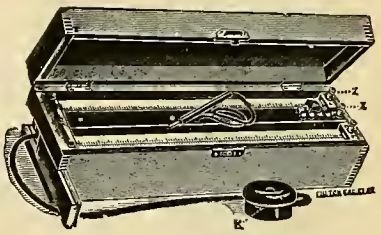

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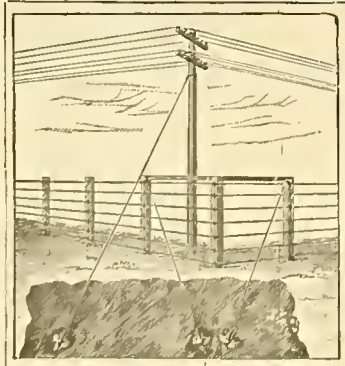

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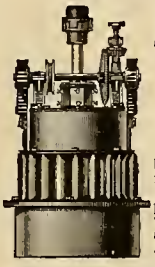

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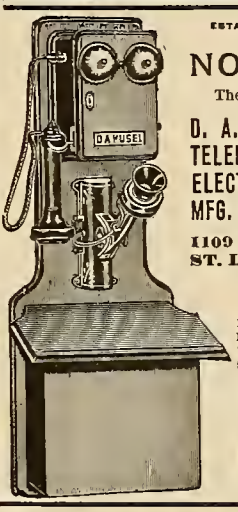

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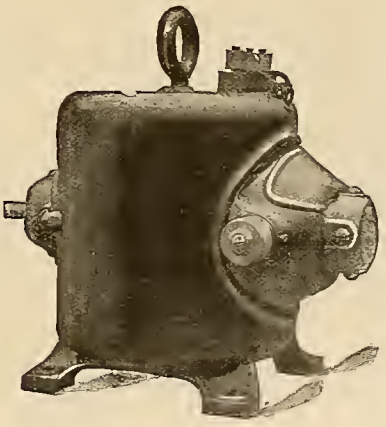

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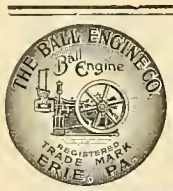

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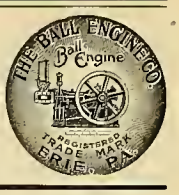

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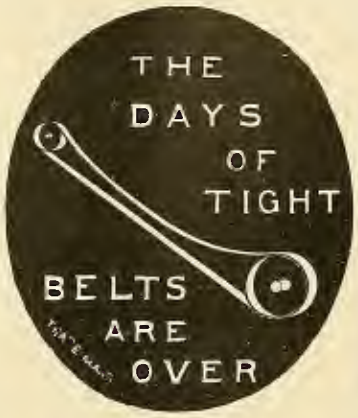

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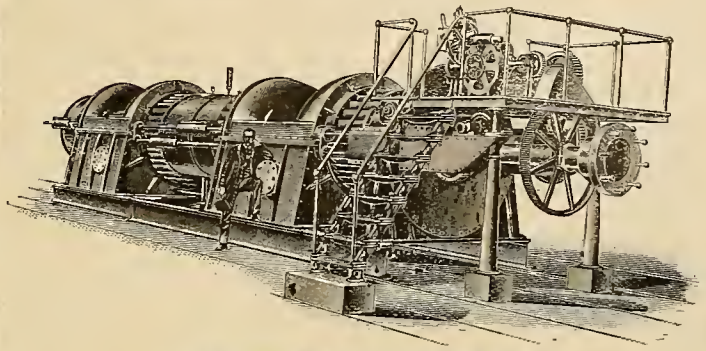

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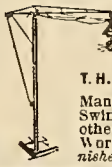

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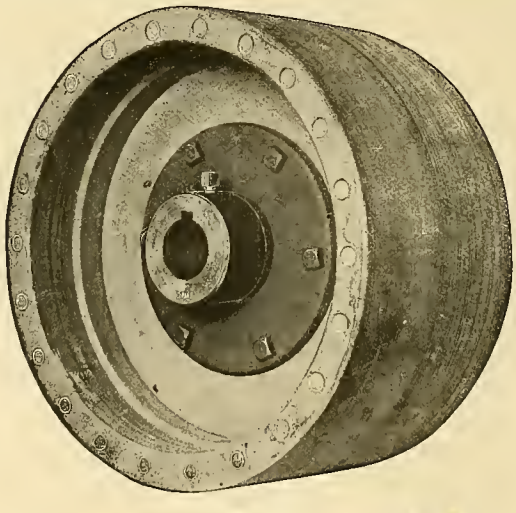

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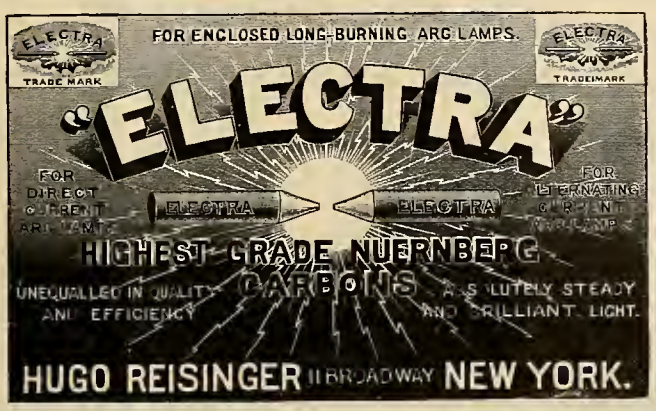

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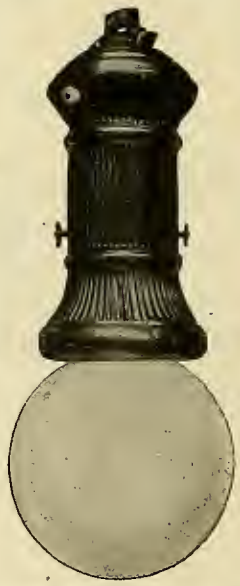

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Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Palste Co., B. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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American Electrical Works.
American Steel & Wire Co.
Bunnell & Co., J. H.
Central Electric Co.
Driver-Harris Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Bazard Manufacturing Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
McDermid Mfg. Co.
Miller-Knoblock El. Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
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Standard Underground C. Co.
Western Elect. Supply Co.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lacquers.
Barrett & Co., M. L.

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Central Electric Co.
Chicago Edison Co.
Colonial Electric Co.
Economy Electric Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
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Eureka Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Klein & Son, Mathias.

Magnet Wires.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Valle.

Meters.
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Fort Wayne Elec. Wrks, Inc.
General Inc. Arc Light Co
Siemens & Halske Electric Co. of America.

Mica.
Chicago Mica Co.
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Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co
Siemens & Halske Electric Co. of America.
Stanley Electrical Mfg. Co.
Westinghouse El. & Mfg. Co.

Motors — See Dynamos and Motors.

Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

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Gt. West. Sm. and Refining Co.

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Independent Tel. Supply Co.
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Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
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Noblett, E. J.

X-Ray Outfits.
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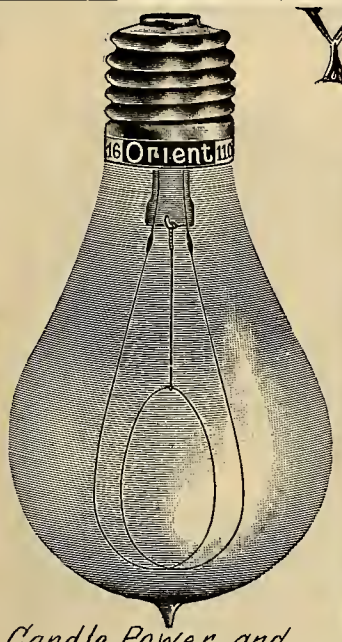

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DIRECT ON YOUR MAINS.

No regulator or automatic transformer required. Constant current at all loads.
Lamps are protected against short circuits.
Minimum cost of installation—Minimum cost of maintenance.
3 lamps in series on 220 to 240 volts.
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Any number of lamps in series by using step-up or step-down transformer.
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Many thousands of these Wattmeters are in daily use. Our sales are increasing. All electrical instruments should be perfect and register accurately. The large use of and increasing demand for our meters indicate that they meet these important requirements.

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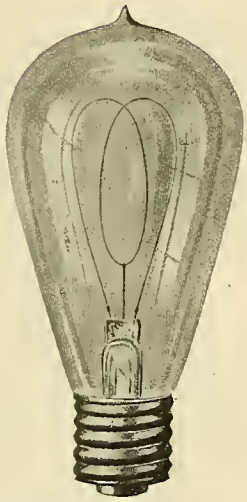
Street Railway Cars.



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To withstand all vibrations and jarring in any position. TO RESIST RAIN AND MOISTURE.

Specially Selected

For CLOSE UNIFORMITY IN CURRENT, INSURING uniform lighting, uniform power consumption and LONG LIFE.

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Throws brilliant path of light when used with paraholic reflector.

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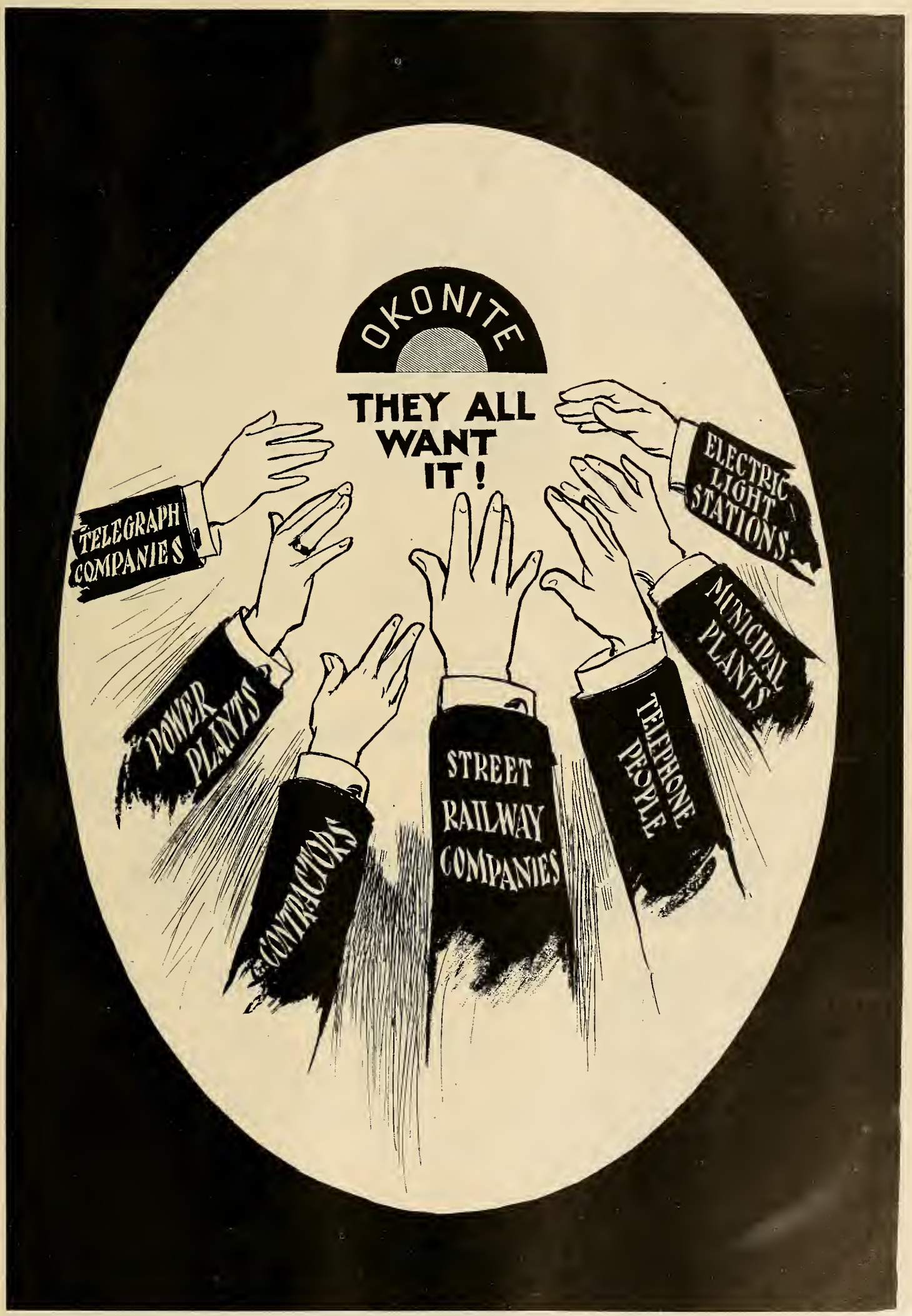
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Color Music in Water.

WATER AND COLOR PLAYED AUTOMATICALLY.

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Operated Automatically.

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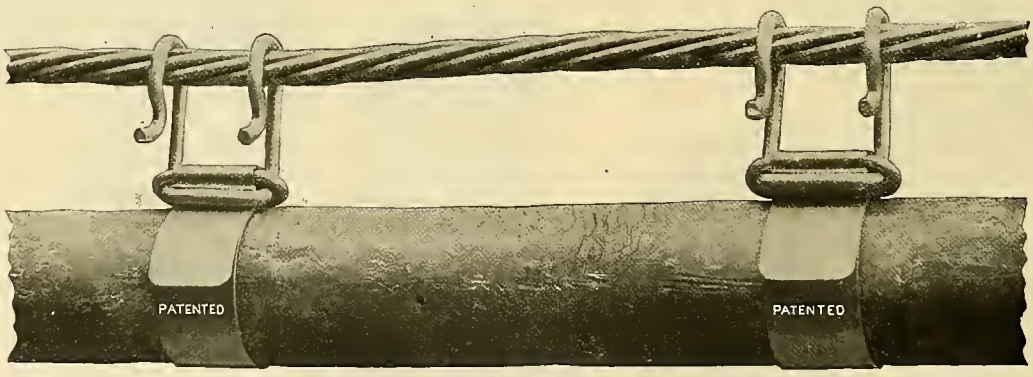

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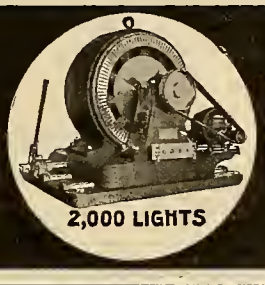

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1-20 TO 2 1-2 ACTUAL HORSEPOWER.

SIMPLE, RELIABLE, SATISFACTORY.

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Two of the best known non-conductors of the electric age combined.

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COMPOSED OF ASPHALT AND PAPER.

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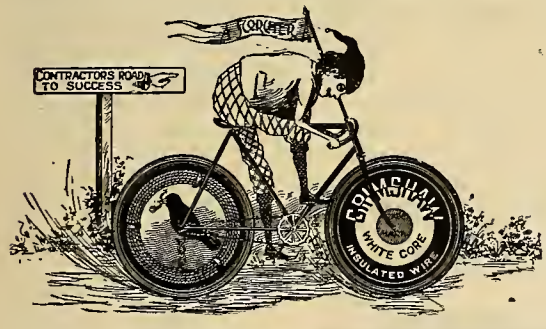

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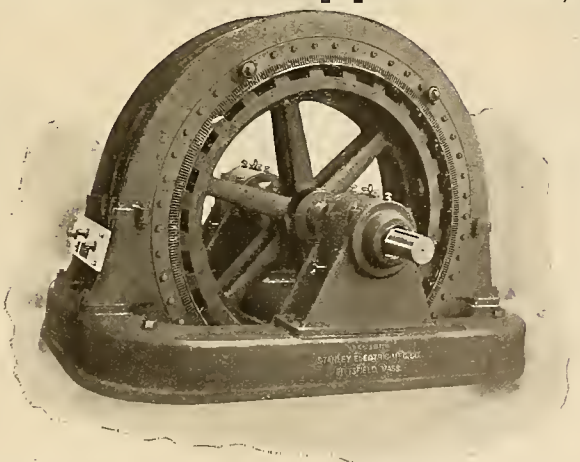

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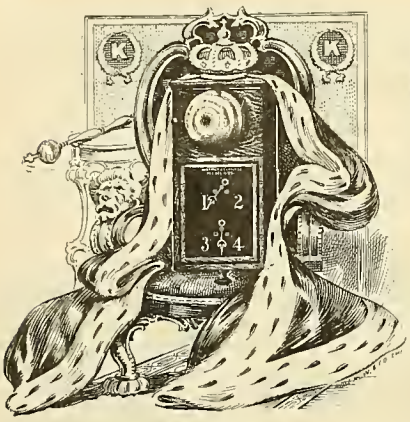

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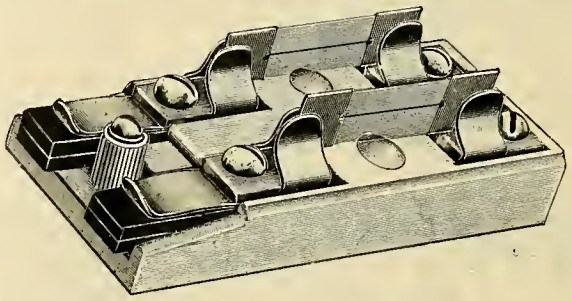

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INDIA & AMBER **MICA** IN ANY SHAPE OR PATTERN.

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M·I·C· COMPOUND UNEQUALED.
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No Wear on Commutator.
No Shifting of Quadrant.
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AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

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YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

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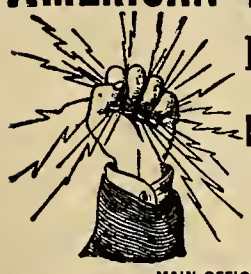

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FOR SWITCHBOARD, RAILWAY and MOTOR USE.

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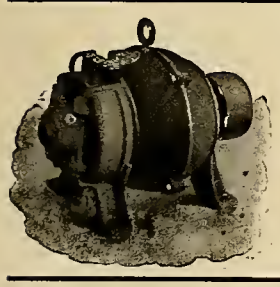

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1 5 H. P. Westinghouse, self-oiler.
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1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Eickmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new arm't.
1 18 H. P. Edison, self-oiler.

220 Volt Motors—Continued.

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1 50 H. P. E. & C., multipolar, slow speed.
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1 1 H. P. Crocker - Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
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1 20 H. P. Card, self-oiler.
1 30 H. P. T.-H., self-oiler, D. 25.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 35 H. P. Jenney, self-oiler.
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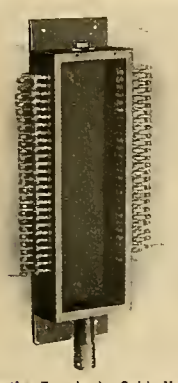

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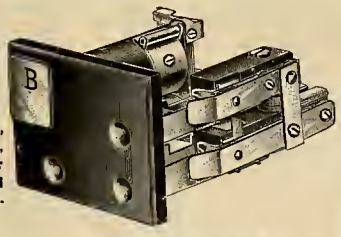

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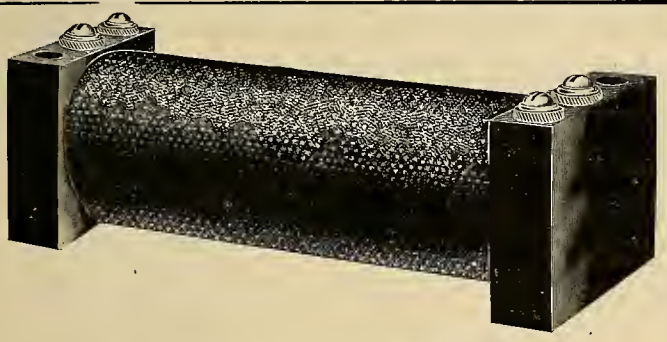

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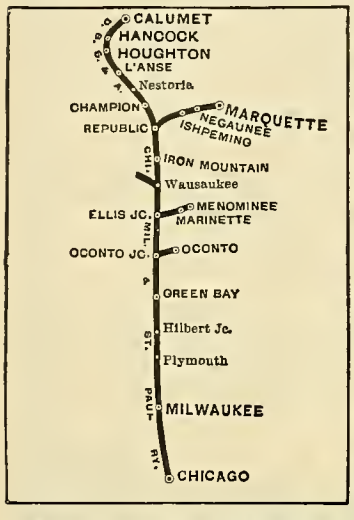

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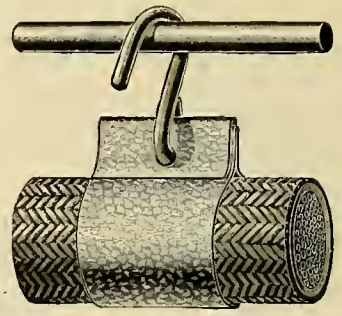

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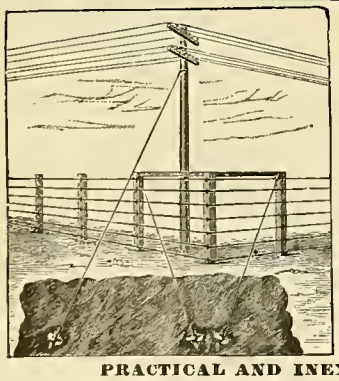

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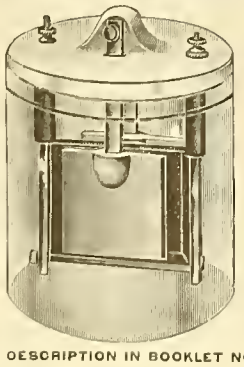

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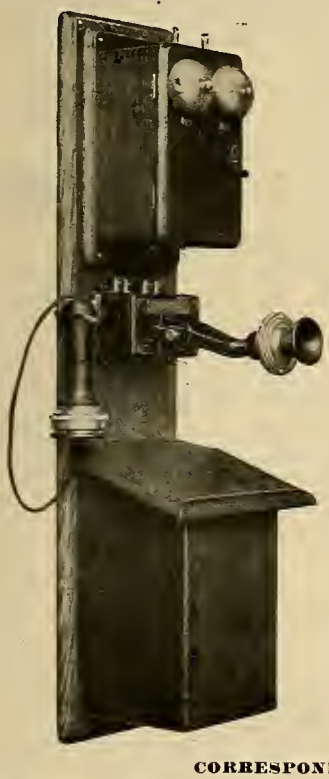

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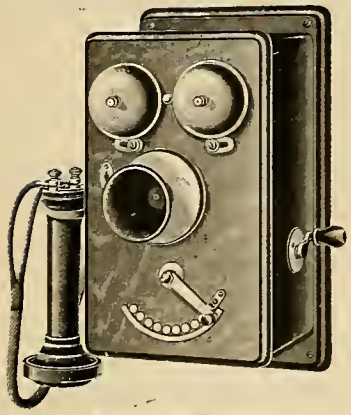

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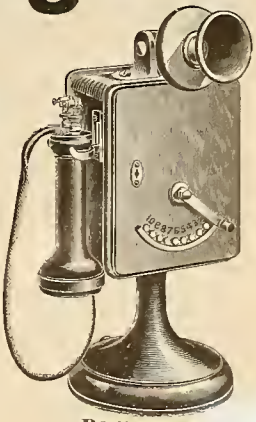

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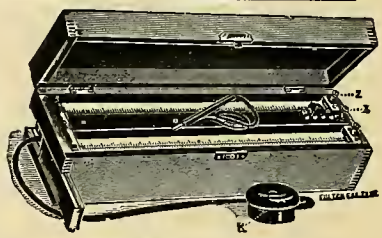

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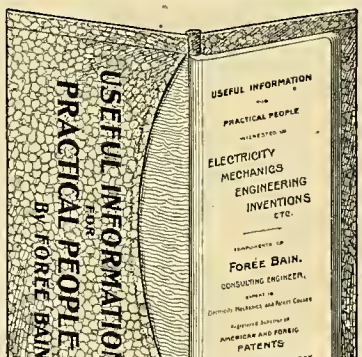

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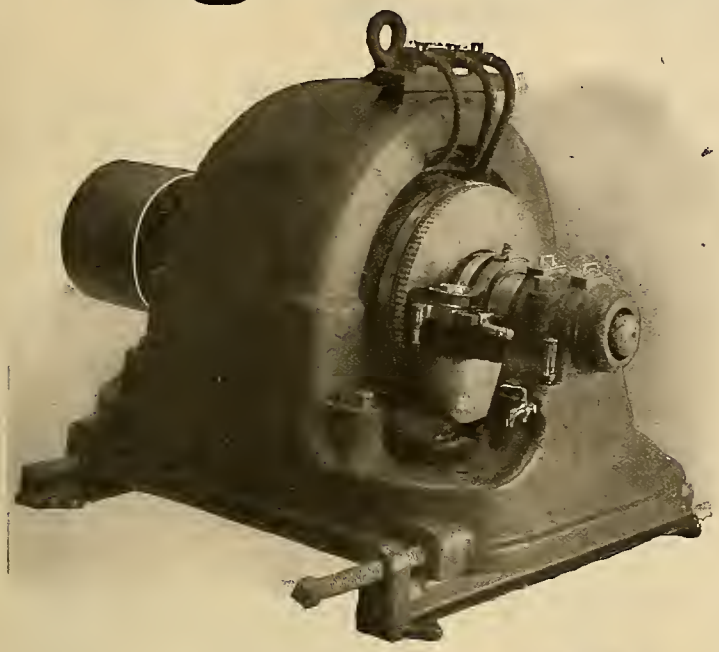

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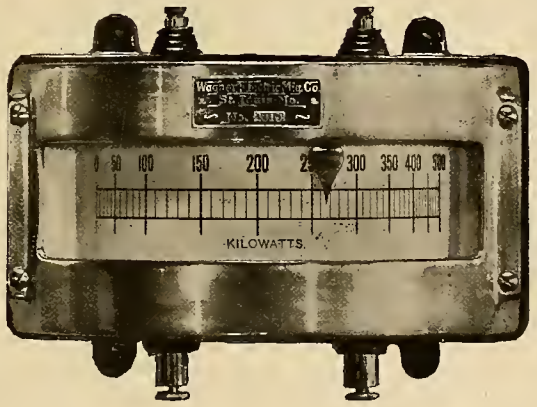

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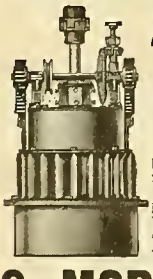

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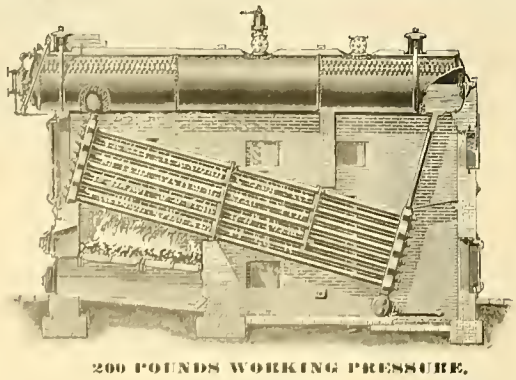

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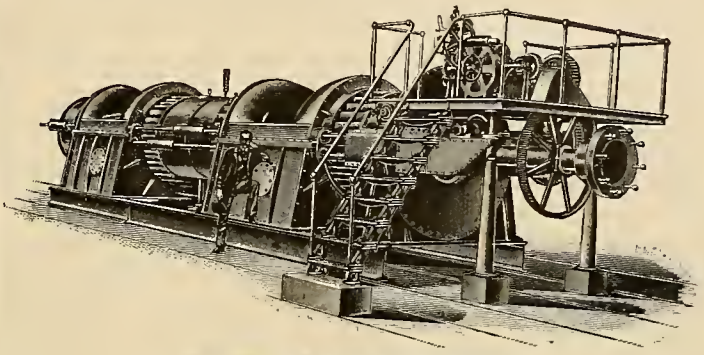

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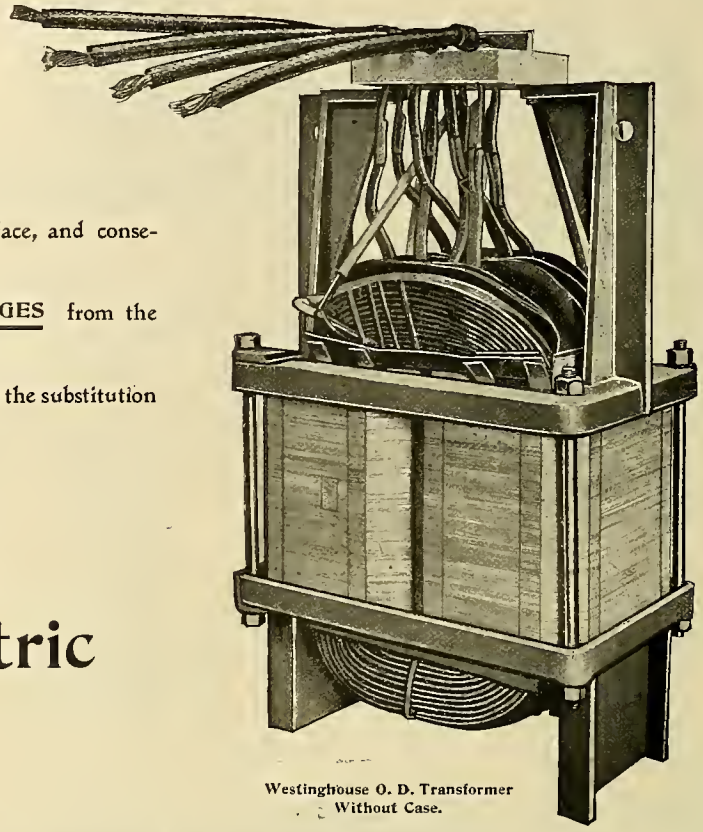

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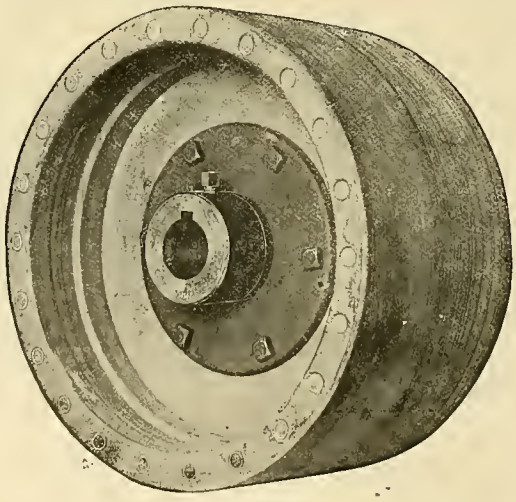

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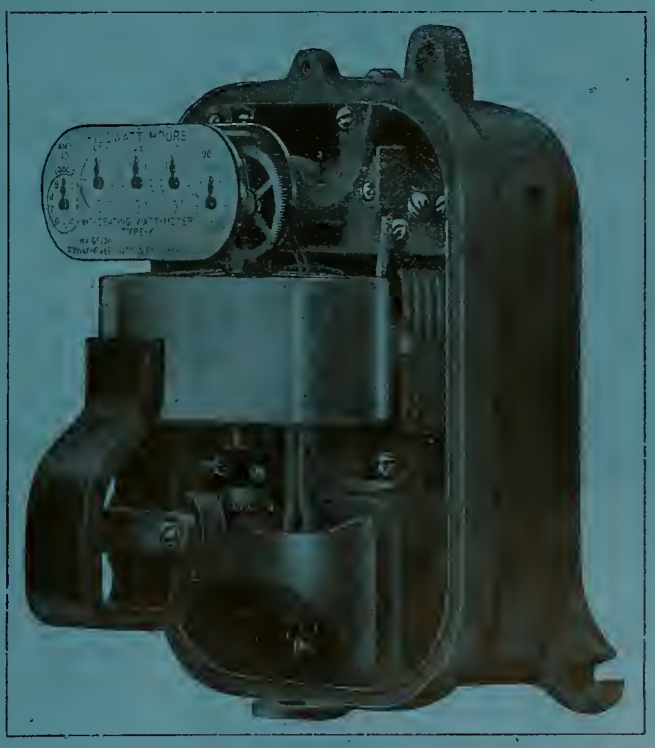

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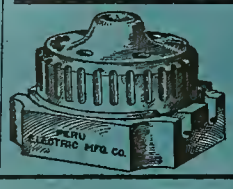

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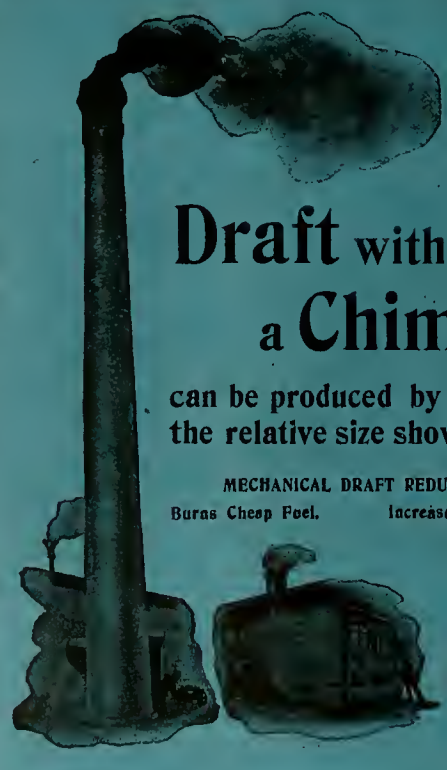

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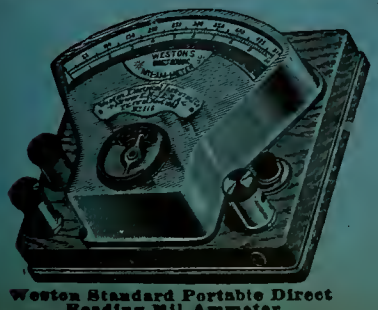
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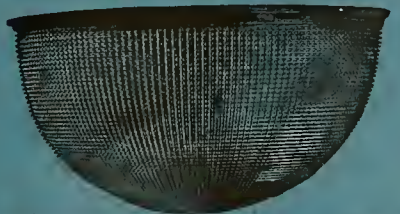
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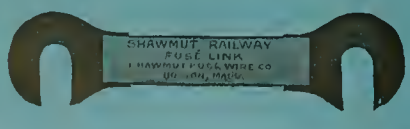

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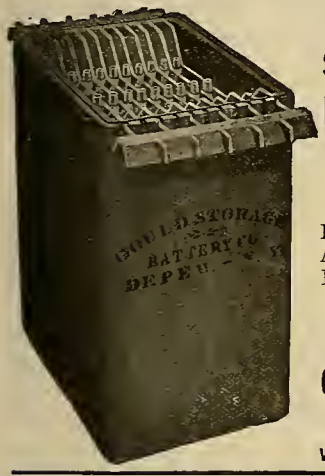

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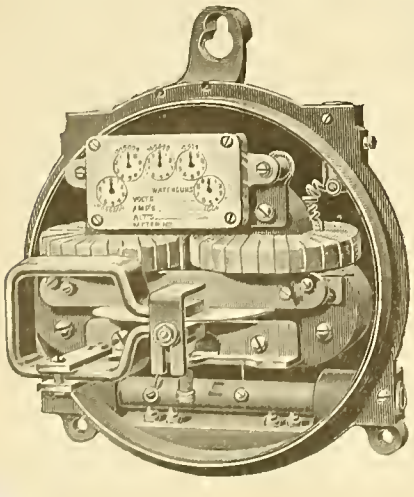

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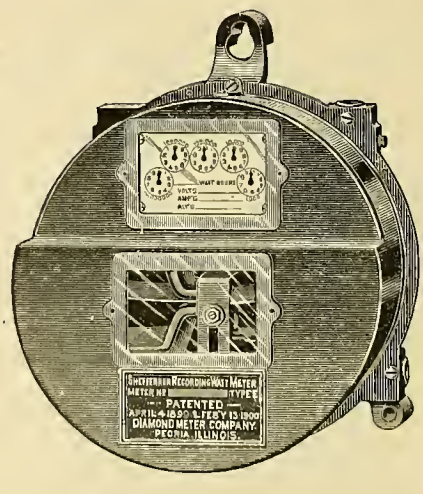

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Worcester Co., C. H.

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Peru Elec. Mfg. Co.

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Jeffrey Mfg. Co.
Link Belt Machinery Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

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Rockwood Mfg. Co.
Smith Co., S. Morgan.
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American Steel & Wire Co.

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Gt. West. Sm. and Refining Co.

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Klemm & Co.

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Chicago Edison Co.
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Rossiter, Mac Govern & Co.
Schureman & Bayden.
Stewart Electrical Co.

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Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.

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Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co

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Harnes Co., The Wallace.
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Bossert Elec. Const. Co.

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Oxide Battery Co

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Independent Tel. Supply Co
Kansas City Tel. Mfg. Co.
Kellogg Switchb. & Sup Co
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Kusel, D. A., Tel. & El. Mfg. Co.
Manhattan Elec. Supply Co.
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Standard Tel. & El. Co.
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Swedish-American Tel. Co.
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Viaduct Mfg. Co.
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Phillips Insulated Wire Co.
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Acorn Brass Works.

Woodwork, Electrical.
Noblett, E. J.

X-Ray Outfits.
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1,000,000 Burned Out Incandescent Lamps.

We will pay cash for one million burned out lamps. Write to our address, stating how many you have. If you have several different makes, advise how many you have of each, and we will then submit our proposition.

THE ECONOMY ELECTRIC CO.,

WARREN, OHIO.

L-H Enclosed Arc Lamps.

FOR ALL CIRCUITS.

GUARANTEED TO MEET REQUIREMENTS OF ALL PRACTICAL ENGINEERS.

Designed on scientific principles and constructed of the highest grade materials.

Accessibility to working parts, which are few and absolutely interchangeable.

Positive cable contact.

Resistance cannot be short-circuited.

10-in. globe, using full size carbon.

Solid copper or aluminum case.

WE WANT ACTIVE AND RESPONSIBLE AGENTS IN ALL THE PRINCIPAL CITIES.

Catalogue and Terms on Request.

Lea-Hooven Manufacturing Co.,

ALDEN ELECTRIC CO., Chicago Agents. ANDERSON, IND., U. S. A.

Mention this paper.

Petite Enclosed Arc Lamps.

For Indoor and Outdoor Use.

Burn from 150 to 160 hours with single trimming.

Great Economy of Operation.

Few Working Parts.

All Currents and Voltages.

Send for Petite Arc Lamp Catalogue.

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Antwerp, 32 Rue Boudewyns, Paris, 46 Avenue de Breteuil.

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Railway, Lighting, Power Transmission.

IMPROVED DUNCAN INTEGRATING WATTMETERS.

Many thousands of these Wattmeters are in daily use. Our sales are increasing. All electrical instruments should be perfect and register accurately. The large use of and increasing demand for our meters indicate that they meet these important requirements.

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"CROWN" ELECTRIC LIGHT AND POWER WIRES AND CABLES.

Most uniform and reliable conductors.
Most perfect insulation.

EVERY PROCESS—Drawing the wire, Insulating with Rubber or Weatherproof material, cabling, armoring, lead-encasing—all done in our works.

EVERY ORDER SATISFACTORY.

LAMP CORD. UNDERWRITERS' WIRE.
WEATHERPROOF LINE WIRE. SLOW-BURNING WEATHERPROOF.
INTERIOR, AERIAL, UNDERGROUND, SUBMARINE.

"CROWN" Rubber insulation is unequaled.

LET US FIGURE WITH YOU.

Kilfyre DRY POWDER COMPOUND

"KILFYRE"

IS THE

Ideal Fire Protection for Switchboards

AND ALL

Electrical Apparatus.

Adopted by the leading electric light and power companies, telephone and telegraph companies of the United States.

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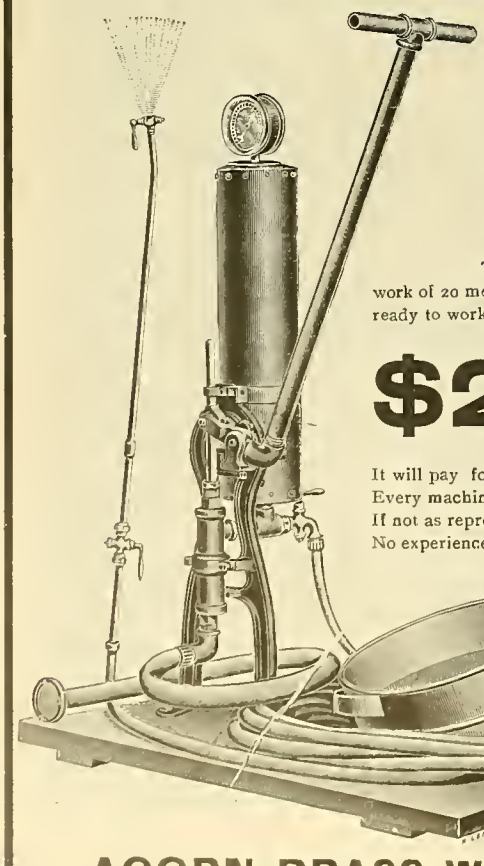
WHITEWASHING AND COLD WATER PAINTING.



This machine will do the work of 20 men. Furnished complete, ready to work, for

$29.00

It will pay for itself on the first job. Every machine tested and guaranteed. If not as represented, money refunded. No experience necessary to operate.

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Sole Agents and Licensed Manufacturers in the United States of America for

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Motors, Motorcycles, Motorettes.

Our New York Type Motorette, Weight 700 pounds. Capacity 3 Persons. Price $1,200.00.

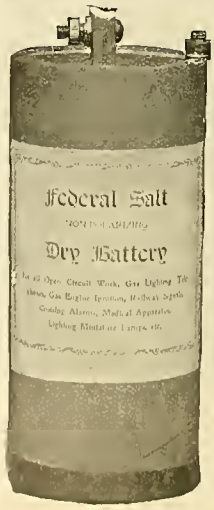
SIMPLICITY, FLEXIBILITY, LIGHTNESS, STRENGTH, RELIABILITY, EASILY OPERATED, PERFECTLY CONTROLLED, ABSOLUTELY SAFE, ABSENCE OF ALL OIL AND DIRT, ECONOMY.

Not an EXPERIMENT, but a TRIED and PROVED SUCCESS.

Over 20,000 DE DION-BOUTON MOTORS operating Motorcycles and Motorettes.

GENERAL OFFICES AND FACTORY: CHURCH LANE AND 37TH ST., BROOKLYN, N. Y.

De Dion Motor Supplies and Batteries Always in Stock.



Wonderful Recuperation.

Higher Voltage and Amperage.

Will do more Hard Work than any Dry Battery on the Market.

No more Running Down on the Shelf.

FEDERAL SALT.

FOR CARBON CYLINDER and CARBON-MANGANESE BATTERIES.

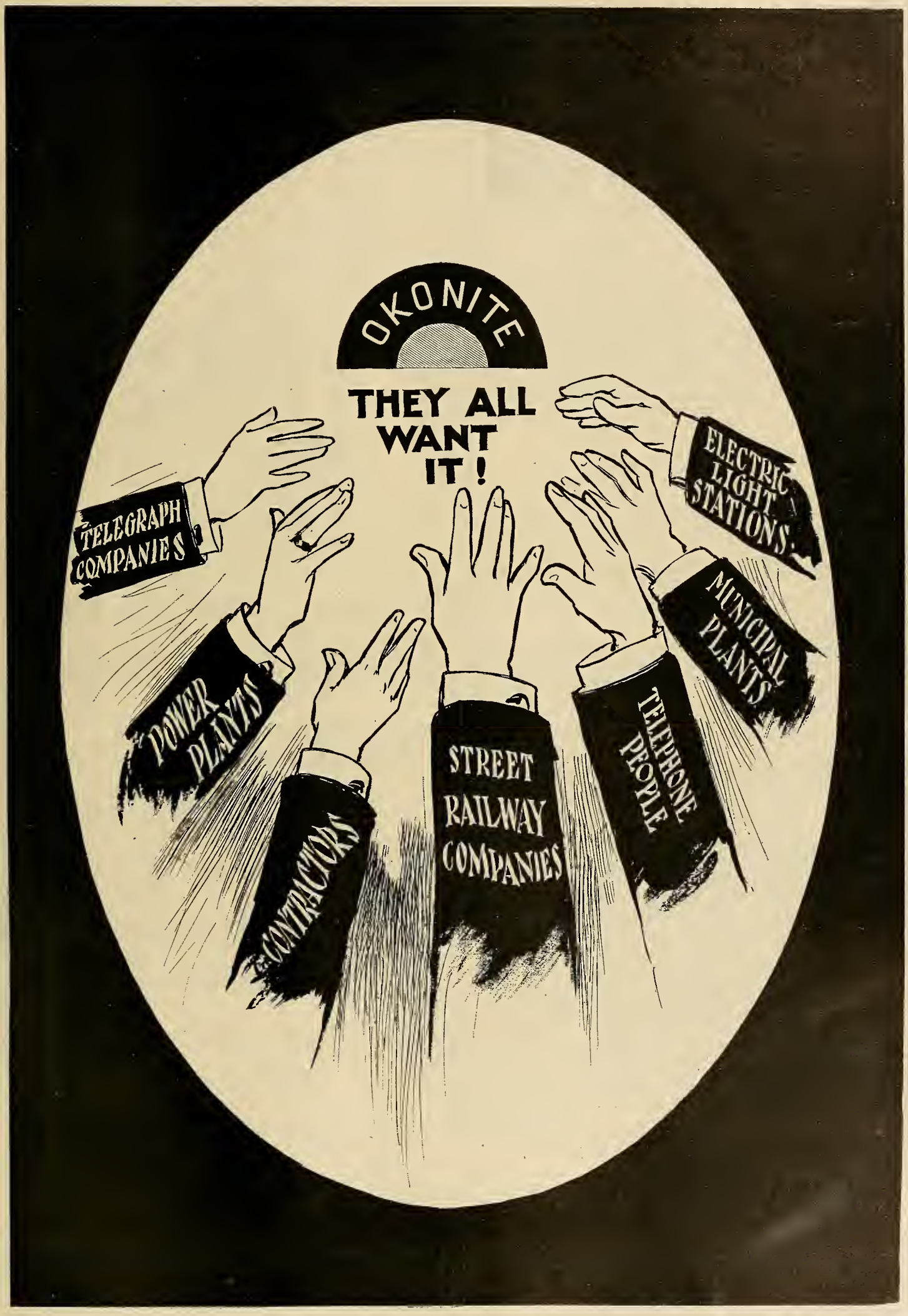
Gives More Current, Longer Life, Absolutely No Crystals.

Both salts have a depolarizer in the mixture. Federal Salt No. 1 has more depolarizer than Federalite, and so will last longer. That's the only difference.

It's the DEPOLARIZER that INCREASES the STRENGTH, GIVES LONGER LIFE, and DOES AWAY ABSOLUTELY WITH CRYSTALLIZATION and CREEPING SALTS.

Made by

FEDERAL BATTERY CO., 11 Pine St., N. Y.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THEY ALL WANT IT!
TELEGRAPH COMPANIES
ELECTRIC LIGHT STATIONS
POWER PLANTS
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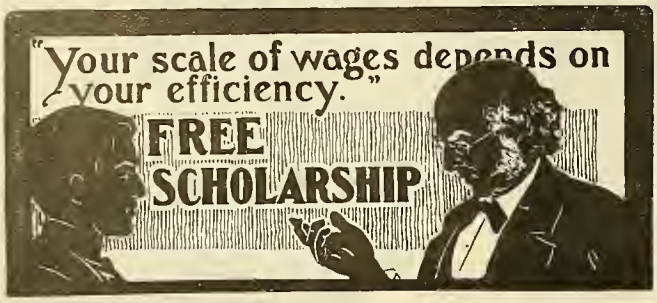
CONTRACTORS
STREET RAILWAY COMPANIES
TELEPHONE PEOPLE



TO establish the superior merits of its courses, the trustees of the **American School of Correspondence** have to award to a few well recommended, ambitious men in each manufacturing plant in the country a **free scholarship.**

IN ELECTRICAL, MECHANICAL, MARINE, STATIONARY or LOCOMOTIVE (Including MECHANICAL DRAWING) ENGINEERING

THE holders of these **free scholarships** will be asked to answer inquiries as to the benefit and value of the instruction, and also to recommend the school to their friends, thus establishing an endless chain of enthusiastic students who will advertise the school more thoroughly than tons of printed matter or an army of agents. Application blank on request.

(Mention WESTERN ELECTRICIAN.)

American School of Correspondence

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BOSTON, MASS., U. S. A.

Code of Moral Suasion and Correct Procedure To Establish a Claim.

AMERICAN ELECTRIC COMPANY,
56 E. 6th St., St. Paul, Minn.,

vs.

JOHN DOE ET AL.

Greeting:—The purchasing agent of your plant is hereby cited and summoned to hold a conference with himself, immediately upon receipt of this document, to then and there decide and determine that the claims herein set forth are true, viz.:

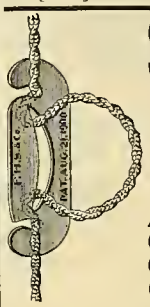
That the undersigned carry the largest stock of up-to-date electrical supplies in the great Northwest; that they are the exclusive selling agents in your territory for the Western Electric Arc and Incandescent Dynamos, Fan Motors, Petite Enclosed Arc Lamps, for both direct and alternating currents, for Simplex Rubber Covered Wires and Cables and Sunbeam Incandescent Lamps; that they are prepared to furnish anything and everything electrical, promptly as the circumstances will warrant, and always at the right price; that they carry in stock at St. Paul, besides all the "knicknacks" in Supplies, a large quantity of Weather Proof and Rubber Covered Wires, Circular Loom, Iron Armored and Loricated Conduit, Cross-Arms, Cross-Arm Braces, Lag Screws, Pole Steps, Insulators, etc.; that they are out for business and want your orders; that their constantly increasing trade is evidence of the appreciation of a thoroughly equipped electrical supply house in the Northwest; that this concern is tireless in its efforts to please, and that this is being done can easily be established.

It, therefore, behooves you to get in line with others and send your orders where they will receive the best attention.

Dated this 20th day of October, 1900.

AMERICAN ELECTRIC COMPANY, St. Paul, Minn.

[Seal.]



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Cuts illustrate two methods of adjustment.

A device everyone wants.
Can be used on any size of cord.
Can be adjusted easily.
Can be used after rosette and socket are connected.
Made of fiber.
Sold as cheap as common wood adjusters.
Order from your supply house or us.
Same price everywhere.

SAMPLES FREE.

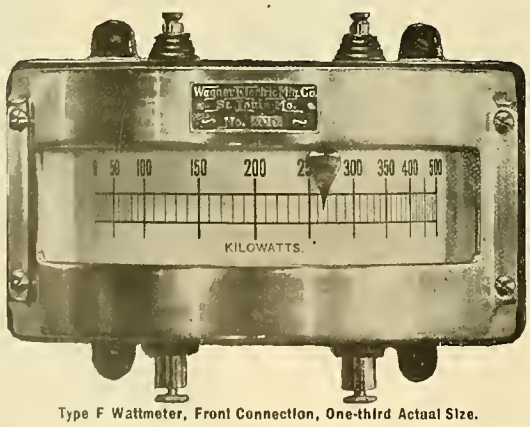
FRANK H. STEWART & CO.,

Manufacturers and dealers in
ALL ELECTRICAL SUPPLIES.
35 N. 7th St., Philadelphia, Pa.

OUR LATEST

FRONT OF THE BOARD TYPE

Switchboard Instrument.



Type F Wattmeter, Front Connection, One-third Actual Size.

Our Indicating Wattmeters, Voltmeters and Ammeters are also built for BACK OF THE BOARD.

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FOREIGN DEPARTMENT, Havemeyer Bldg., New York City.
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LONDON, ENG., 47 Victoria St., C. R. Heap, Agent. YOKOHAMA, JAPAN, Bagnall & Hilles, Agents.
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DESIGNERS AND BUILDERS OF

Steel Bridges, Steel Buildings,

AND ALL CLASSES OF METALLIC STRUCTURES.

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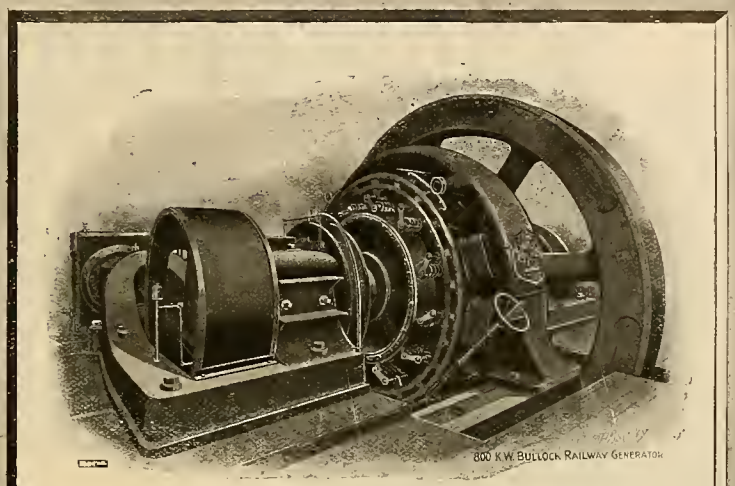

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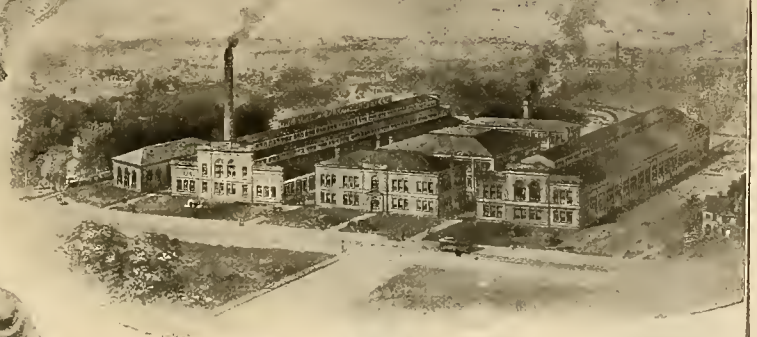
CINCINNATI, OHIO, U.S.A.

OUR RAILWAY GENERATORS POSSESS THE SAME CHARACTERISTICS THAT HAVE MADE OUR LIGHT AND POWER APPARATUS FAMOUS



Works of Bullock Electric Mfg. Co.

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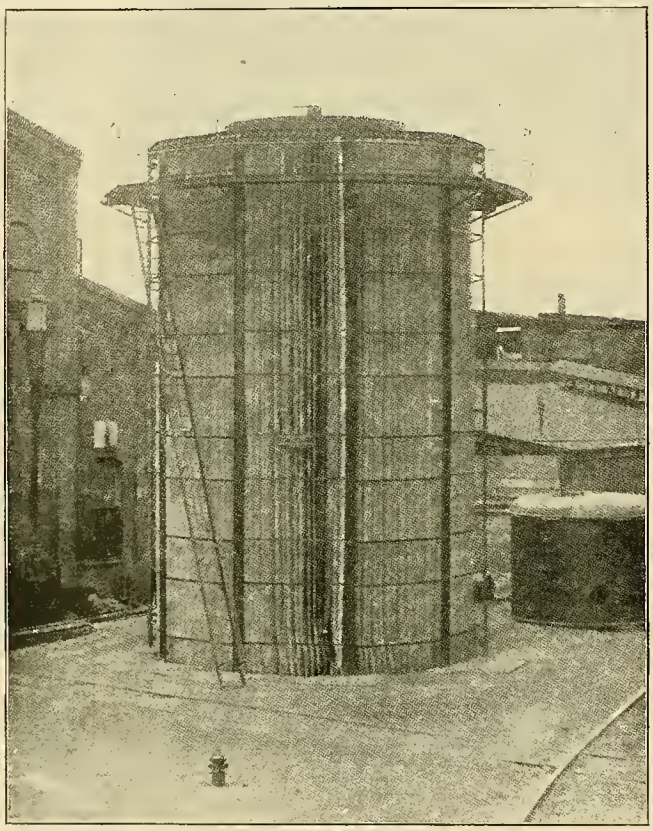
Wheeler Condenser and Engineering Co.,

HEAD OFFICES: 120-122 Liberty Street, NEW YORK.

Branches: CHICAGO, SAN FRANCISCO, LONDON, PARIS.



1000 H. P. BARNARD FANLESS SELF-COOLING WATER TOWER (Patented).

Proprietors and Manufacturers

BARNARD FANLESS SELF-COOLING WATER TOWER

(PATENTED).

NO POWER USED.
WEAR AND TEAR.
ATTENTION REQUIRED.

VACUUM GUARANTEED.

ROOF OR GROUND INSTALLATIONS.

Operates in Sections, Caring for Variable Loads.

EVERY STEAM USER IMMEDIATELY AND PROFITABLY INTERESTED.

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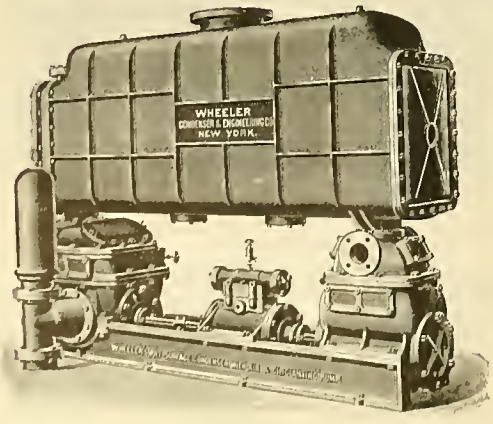

ALSO

Wheeler Surface Condenser,
Wheeler Feed Water Heater,
Barnard Cooling Tower (Fan Type).

COMPLETE CONDENSING PLANTS DESIGNED AND ERECTED.

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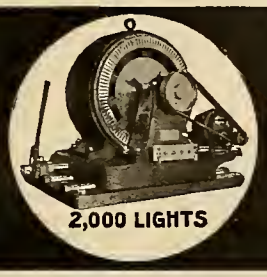
Drug and Chemical Works,
Laboratories---Water Chemists.
Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

29, 30, 31, 32 and 33 RIALTO BUILDING, CHICAGO, ILL.

IMPROVED WARREN ALTERNATOR



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Alden Electric Co.

(Formerly Alden & Co.)

WILL OCCUPY THEIR BUILDING AT

52 and 54 W. Van Buren St., Chicago,

on and after October 1st and will have in stock

All Lines of General Electric Supplies.

"Crescent" Rubber Covered. Insulated Wires and Cables, "Index Brand" Weatherproof.

PITTSBURG TRANSFORMERS. "L.-H." ENCLOSED ARC LAMPS.

UP-TO-DATE ELECTRICAL GOODS.

This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Cut-Outs

Knife Switches, Jenkins Snap Switches, etc. Guarantees Satisfaction

PHILADELPHIA. H. T. PAISTE CO. CHICAGO.

ELECTROLYSISPROOF CONDUITS.

Electrolysisproof Linings and Coverings.

Two of the best known non-conductors of the electric age combined.

ASPHALT PAPER CONDUIT

COMPOSED OF ASPHALT AND PAPER.

An absolute non-conductor. Perfect insulation guaranteed. Water-tight joints. No scratching of cables. No deterioration. Costs less laid in complete state than any conduit on market. Quickly and easily handled. No skilled workmen required. Made in 7-foot lengths; 3-in. internal diameter; weight, 21b. to foot; made in desired sizes from 2 in. to 10 in. Manufacturers of Electrolysisproof Insulating Materials, Distributing Box and Post Linings, Pipe Coverings, Etc.

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Both-Alternating and Direct Current Apparatus, S. K. C. and Northern Systems.

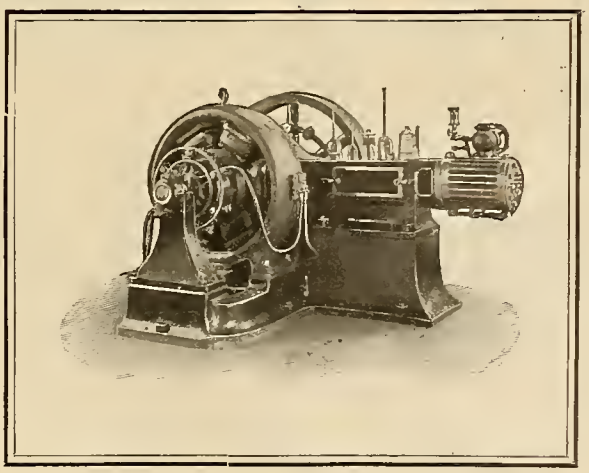
GENERATORS, MOTORS,

Mining Equipments, Factory and Shop Equipments.

POWER PLANTS for LONG DISTANCES.

LIGHTING AND RAILWAY MACHINERY.

Transformers, Instruments, Switchboards.



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BELLS! BELLS! BELLS!

We have made a reduction in price on Iron Box Bells. Send for latest quotations.

When you order, you get them. We keep them in stock.

Electric Appliance Company, Chicago.
ELECTRICAL SUPPLIES.

General Electric Company's
Candelabra, Series, Decorative, Battery and Miniature Lamps are the standard for the world.

Send for Catalogue No. 1017.

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,
Harrison, N. J.

INDIA & AMBER **MICA** IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.
EMPIRE INSULATED Cloths and Papers.
M·I·C. COMPOUND UNEQUALED.
Eugene Munsell & Co. 215 Water St. New York & Chicago, 117 Lake St. Mica Insulator Co.
WRITE FOR SAMPLES AND PRICES.

PERFECT **MICANITE** INSULATOR REGISTERED

ENGINEERING.
HERBERT A. WAGNER,
Consulting Engineer
Railway Lighting and Power Plants,
415 LOCUST ST., ST. LOUIS, MO.

YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., 909, 100 Washington Street, Sole Manufacturers, - CHICAGO.

With Giant Strides the "McRoy" conduits are going underground —24 and 36 duct feet all at once.

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"MANROSS" HAIR SPRINGS FOR ELECTRIC INDICATING AND RECORDING GAUGES STEAM GAUGES, ETC.

Largest Manufacturers of Hair Springs in the United States.
Non-Magnetic Hair Springs of Phosphor Bronze and other non-magnetic metals. Hair springs of any description manufactured to order.
F. N. MANROSS, Forestville, Conn.

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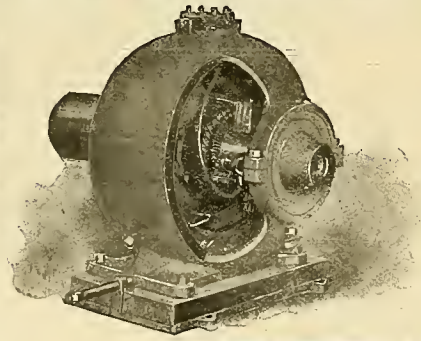

Spherical Type,
Pleasing in Design,
Strongly Built,
High Commercial Efficiency,
Open and Closed Types,
For Floor, Wall or Ceiling.

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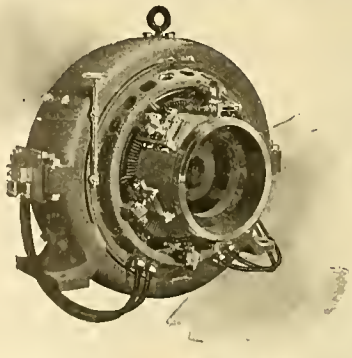

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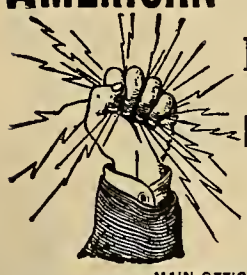

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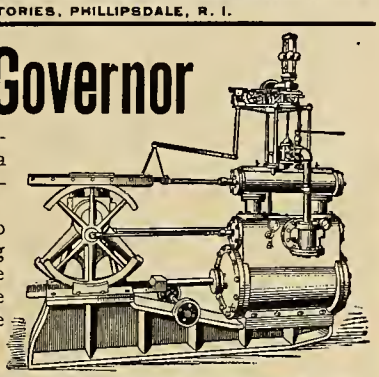

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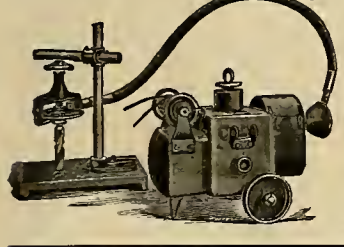

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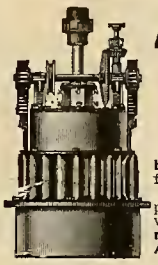

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On Vertical or Horizontal Shaft.
Especially Adapted for Electrical Work.

Gives a higher percentage of useful effect than any other water-wheel heretofore made. All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.

Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with us, as we are willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.

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EUREKA PACKING, with a RED DIAMOND LABEL, gives more power, lasts two to three times longer and costs less than any other good packing.

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Position as foreman or superintendent with manufacturer or electric railroad. Have had 16 years' experience in mechanical and electrical lines. Am good designer in both lines. Am holding responsible position at present. Can give best of reference. Good reasons for wanting to change. Address "FOREMAN," care Western Electrician, 510 Marquette Building, Chicago.

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Company manufacturing a line of standard cast copper articles wishes to extend its line. Has best of facilities for manufacturing. Would be pleased to correspond with parties having articles of this description (those for electrical purposes preferred), with the idea of buying rights therein. Manufacturing under contract or manufacturing and marketing upon commission. Address "MANUFACTURER," care Western Electrician, 510 Marquette Bldg., Chicago.

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We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

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One-third or one-half interest in an up-to-date electric light plant in one of the best towns in Kentucky, to a competent engineer and electrician, or will employ a good man to take charge of plant. Address "KENTUCKY," care Western Electrician, 510 Marquette Bldg., Chicago.

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We have for sale lot of 100,000 Electric Light Carbons, best German makes, various sizes. Address for particulars

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0000 Weatherproof Copper Feed Wire, about six miles, in A No. 1 condition, in lengths of 1 800 to 2,200 feet. For further particulars address

IRA H. EVANS, Receiver,
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Position as Manager and Electrician by first-class telephone man, thirty years of age, strictly temperate. Have seven years' experience in telephone work. Have had charge of city construction-work; have installed and operated metallic, common-return and ground switch boards. Have been manager in my present position for over two years. Best of references. Address "O. M." care of Western Electrician, 510 Marquette Bldg., Chicago.

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By electrician and engineer. 16 years' experience operating Lighting and Street Railway Systems. Good armature winder. References furnished. Address "ARMATURE," care Western Electrician, 510 Marquette Bldg., Chicago.

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By a stationary engineer and electrician, all-around man, understands installing and repairs, steam or electric. Will accept a steady position at once. Licensed. References. 15 years' experience. Address J. BARNES, care Western Electrician, 510 Marquette Bldg., Chicago.

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FOR SALE—A BARGAIN.

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A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

Price, 10 Cents.

Catalogue of mechanical and electrical books free.

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AUCTION SALE.

Postponed Till Nov. 10.——Bankrupt Sale.

Entire Property of The Suburban Electric Co., Covington, Ky., Offered For Sale.

Notice is hereby given that pursuant to an order in bankruptcy, in the matter of the Suburban Electric Company, a corporation organized under the laws of the state of Kentucky, bankrupt, No. 276, in the District Court of the United States for the District of Kentucky, I will, on the 10th day of November, 1900, at 10 o'clock a. m., at the Scott street entrance of the United States Court in Covington, Ky., sell at public auction to the highest bidder, all the property, real and personal, of every kind and description belonging to the Suburban Electric Company, bankrupt, including all the rights, privileges and franchises, except the franchise to be a corporation, and also its electric lighting plant, power station, machinery, engines, boilers, dynamos, electric machine, electric lamps and other appliances and appurtenances, poles, lines, wires and all contracts, claims and demands, and all other property of every kind and description, also the following described real estate belonging to the said bankrupt, situated in the city of Covington, Kenton County, Kentucky, and bounded as follows:

1. Beginning at a point on the east line of Madison avenue at the northeast corner of Madison avenue and an alley running parallel to and between Fourth and Fifth streets; thence northwardly along the east line of said Madison avenue toward Fourth street ninety (90) feet; thence at right angles to Madison avenue one hundred and ninety (190) feet to another alley; thence with said other alley and at right angles to said first-named alley ninety (90) feet to said first-named alley; thence westwardly along the same one hundred and ninety (190) feet to the place of beginning.

And also the following described piece of real estate belonging to said bankrupt, situated in the city of Newport, Campbell County, Kentucky, to wit:

2. Lot No. 260 in the Cote Brilliant Lot & Home Company's subdivision, fronting thirty (30) feet on the west side of Park avenue, and extending back one hundred and twenty (120) feet to an alley.

The first tract of real estate above described will be sold subject to such lien as Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, or either of them, may have upon said real estate, which lien is as yet undetermined in amount.

The property above described will be sold free from any and all liens or encumbrances, except the lien or encumbrance in favor of Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, upon the said first described real estate aforesaid.

The second piece of real estate described aforesaid will be sold separately.

All the balance of the real estate, and all the other property and assets of every kind, and the rights, privileges and franchises of the Suburban Electric Company will be sold as an entirety and as a going concern.

The terms of the sale will be one-third (⅓) cash, to be paid upon the confirmation of the sale, the balance in equal installments of six and twelve months from date of sale, deferred payments to draw six (6) per cent interest and to be secured by lien upon the property sold and also by bond with sureties satisfactory to the referee in bankruptcy herein; or purchaser may pay cash for said property upon the confirmation of the sale. No bid for said property will be received from any bidder who shall not place in the hands of the undersigned at the time of making said bid, as a pledge that said bidder will make good his bid if the sale is confirmed, the sum of fifteen thousand ($15,000) dollars, which sum of fifteen thousand dollars will be credited upon the first payment of the purchase money for said sale.

Inspection of property invited. Full information given upon application at the office of the bankrupt in Covington, Ky.

CHARLES H. SHAW,
Trustee in Bankruptcy of the Suburban Electric Company.

SIMRALL & GALVIN,
Attorneys for Trustee in Bankruptcy.

EXCEPTIONAL BARGAINS!

4—45-K. W., Edison, bipolar, 110-volt dynamos.
1—New 40-K. W., Stanley, two-phase, 2,000-volt alternator.
1—400-ampere-hour, Chloride Accumulator Co., storage battery.
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Dynamos and Motors.

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110-Volt Incandescent Dynamos.

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1 12-light Edison, ¾ K. W., self-oiler.
1 25-light Edison, 1½ K. W., self-oiler.
1 50-light Hawkeye.
1 50-light Card, self-oiler.
1 50-light Nawotny, self-oiler.
1 50-light C. & C., self-oiler.
1 50-light Mather.
1 60-light Thomson-Houston.
1 70-light Crocker-Wheeler, slow-speed.
2 90-light Westinghouse, self-oilers.
1 100-light J. & C., self-oiler.
1 125-light Crocker-Wheeler, self-oiler.
1 150-light Card, self-oiler.
1 150-light Edison, self-oiler, 8½ K. W.
2 180-light Siemens & Halske, M. P.
1 200-light Western Electric, self-oiler, compound.
2 210-light Edison, self-oilers, 12 K. W.
1 250-light Westinghouse.
1 250-light Commercial, comp., self-oiler.
1 250-light Eddy, self-oiler.
1 270-light General Electric, 15 K. W., M. P., direct-connected.
1 270-light Northern, M. P., comp., self-oiler.
2 270-light Westinghouse, M. P.
1 300-light Jenney, self-oiler, compound.
1 300-light Columbian, multipolar.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 350-light National, self-oiler, compound.
1 350-light Edison, 20 K. W., self-oiler.
1 350-light Western Electric.
1 360-light Duplex multipolar.
4 540-light Edison, 30 K. W., self-oilers.
1 540-light Siemens & Halske, M. P., self-oiler, compound, slow speed.
1 600-light Eickmeyer.
1 700-light Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700-light Westinghouse, 10-pole, slow speed, 40 K. W., self-oilers, new.
4 800-lightEdison, 45 K. W., self-oilers.
1 1350-light Waddell-Entz, 80 K. W., M. P., for direct connection.

220-Volt Generators.

1 8½ K. W. Westinghouse, multipolar.
1 9 K. W. Lundell, self-oiler.

220-Volt Generators—Continued.

1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Edison, self-oiler.
1 15 K. W. Edison, compound, self-oiler.
1 25 K. W. Edison, self-oiler.
1 50 K. W. Westinghouse, self-oiler, comp.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler, D. 25, comp.
1 25 K. W. Edison, self-oiler.
1 35 K. W. Mather, self-oiler.
2 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, M. P., self-oiler.
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1 350-light Thomson-Houston, A. 18, comp. wound.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed armature.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T. H., A. 70, 1100 volts, self-oilers, compound wound.

Alternating Generators—Continued.

1 1500-light Wood, 75 K. W., self-oiler, comp. wound, toothed armature, 16800 alternations, 1100 volts, complete with exciter.
1 2000-light Thomson-Houston, 100 K. W., toothed armature.
1 4000-light Wood, 200 K. W., self-oiler, compound wound, slotted armature.

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1 35-light, 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7, Steuben-rausch commutator.
1 50-light 1200 C. P. T.-H., L. D., 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, ring armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. West., self-oilers.
3 125-light 2000 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers. M. P., slow speed.
1 3 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.

220 Volt Motors—Continued.

2 3 H. P. Card, slow speed, self-oilers.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Eickmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new armature.
1 18 H. P. Edison, self-oiler.

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1 1 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 2½ H. P. Holtzer-Cabot, self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jeuney, self-oiler.
1 5 H. P. Westinghouse, M. P., self-oiler.
1 7½ H. P. Thomson-Houston, new arm't.
1 7½ H. P. Eddy, type C, self-oiler.
1 10 H. P. C. & C.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 10 H. P. Eddy, M. P., self-oiler, slow sp.
1 10 H. P. Westinghouse, M. P., self-oiler.
1 15 H. P. Commercial, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers.
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. Thomson-Houston, self-oiler.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 40 H. P. Mather, self-oiler.
2 60 H. P. Edison, 45 K. W., self-oilers.
1 100 H. P. Westinghouse, M. P., self-oiler.

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1 Wood's electric runabout, with top, carries 2 persons, practically new.
1 Electric open phaeton, seats 3 persons, fine condition.
1 Electric "trap," carries 4 persons, new.

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The meter is a direct reading instrument, recording the amount of current which has passed through it, on a dial of much the same appearance as that of an ordinary gas meter. The unit of measurement is the "ampere-hour."

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13	Shallenberger Meters, 40-ampere.....Each	7.00
4	Shallenberger Meters, 80-ampere.....Each	8.00
1	Westinghouse Meter, 10-ampere.....Each	7.00
1	Westinghouse Meter, 80-ampere, 100-volt, single-phase .....Each	9.00

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ALL new stock in original boxes.

1500 5/8x10.
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1500 5/8x 7.
1600 1/2x 7.
1500 1/2x12.
$9.00 per 1000.

Arc Lights and Supplies.

	Each.
45 Excelsior, fine condition, 9½ amperes, 50 volts $5.00	
40 arc light cut-outs	.75
800 arc light globes, all sizes.	.35
200 same, with wire protection	.37

Cut-outs of All Kinds, Fuse Plugs and Tubes.

Practically as good as new.

	Each.
25 General Electric primary cut-outs, iron boxes, double pole, porcelain fuse blocks, about 25 amperes each $1.00	
1150 100-ampere porcelain main line cut-outs.....	.25
75 50-ampere branch blocks	.10
2 3-wire Edison plug cut-outs	.40
20 5-ampere porcelain main line cut-outs.....	.10
50 20-ampere porcelain main line cut-outs.....	.20
2000 Edison fuse plugs, new, 10, 20 and 30 amperes each	.02
5 barrels assorted porcelain tubes, all sizes, new. Prices on application.	
100 porcelain single-pole, 500-volt, 100-ampere, with covers, size, 2¾x9½. Price.....	.30

List of Wire in Stock Oct. 1.

	Feet.
No. 00 weatherproof	690
No. 0 weatherproof	482

List of Wire in Stock—Continued.

No. 1 weatherproof	2598
No. 2 weatherproof	470
No. 2 rubber-covered	900
No. 3 rubber-covered	1500
No. 3 weatherproof	185
No. 4 rubber-covered	9000
No. 6 rubber-covered 15000	
No. 8 weatherproof	195
No. 10 rubber-covered	1000
No. 10 weatherproof	13
No. 12 rubber-covered	300
No. 12 weatherproof	15

Prices on Application.

Transformers.

	Each.
21 No. 4 Westinghouse, 1000 Watts, primary 1000 and secondary 50 or 100.....$	7.50
2 No. 6 Westinghouse, 1500 Watts primary 1000 and secondary 50 or 100.....	8.50
2 Lakon Manufacturing company, 500 Watts, primary 1000 and secondary 50 or 100.....	5.00
1 Lakon Manufacturing company, 1000 Watts, primary 1000, secondary 50 or 100.....	7.50
3 Stanley, with fuse box attached, 1000 Watts, primary 1000 and secondary 50 or 100.....	10.00
3 Lakon Manufacturing company, 500 Watts, primary 1000, secondary 50 or 100.....	25.00
1 Lakon Manufacturing company, 7500 Watts, primary 1000, secondary 50 or 100.....	30.00
3 Stanley, 1000 Watts, primary 1000, secondary 50 or 100	8.00
2 Stanley, 5000 Watts, primary 1000, secondary 50 or 100	45.00
1 Westinghouse, 3000 Watts, primary 1000, secondary 50 or 100	15.00

Switches.

22 Bryant standard switches, with grooved base, double-pole, 40-ampere	.50
25 Bryant standard switches, with grooved base, double-pole, 60-ampere.....	.75
1 50-ampere knife switch	1.00
5 6-point controlling switches	
1 300-ampere, 250-volt, double-pole knife switch, mounted on slate base, good condition, complete with lugs	3.00

Miscellaneous Stock.

11 cluster balls, 40-light, with sockets, price on application.
200 corrugated porcelain white shades, 5½-inch diameter, for 1¾-inch holder ..... .10
6 12-inch, 104-volt General Electric alternating fans, new, never used 7.50
6 compensation coils or transformers, 104 volts, alternating current to 30 volts, 40 amperes.. 3.00
1 Arrton & Perys ammeter, 0 to 200..... 20.00
1 300-drop annunciator, price on application.
1 8-drop annunciator, price on application.
3000 Edison porcelain weatherproof sockets, as good as new ..... .08
3000 Edison porcelain receptacles, good condition ..... .07
2500 genuine Edison keyless sockets, good condition ..... .07

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ALL WARRANTED IN EVERY WAY.

PRICES ON APPLICATION.

1 500-light National, 1000 volts, alternating exciter, attached to shaft complete with sliding base regulator and pulley, in first-class condition. Full description on application; also photograph.
1 Thomson-Houston 400-light compound-wound dynamo, new, 110 volts, 200 amperes, complete with sliding base, belt tighteuer and regulator.
1 Thomson-Houston, 500-light, compound-wound dynamo, 110-volt 200-ampere, complete with sliding base, belt tightener and regulator.
1 United States Weston dynamo, 150-light, 100-volt, 75-ampere, complete with sliding base, belt tightener and regulator.
2 generators, 80 K. W. type, U. S. Westinghouse bipolar, 350 revolutions per minute, 550 volts, size of pulley, 54x18 inches; paper rim; side rails complete.
2 Field Rheostats Westinghouse three-jaw switches for throwing generators in multiple.
1 voltmeter Westinghouse, 0 to 600.
2 amp.-meters Westinghouse, capacity 0 to 160.
1 amp.-meter Westinghouse, capacity 0 to 300.
2 Westinghouse circuit-breakers.
3 Westinghouse lightning arresters.
3 Westinghouse switches, double throw.
1 electric elevator, manufactured by Keystone Electric company of Erie, Pa.; self-oiler, 60-ampere, No. 324, 220-volt, 1025 revolutions; worm gear and cog are solid brass; 53 grooves for ⅝-inch cable on drum; drum 30-inch diameter by 22-inch face; the motor and gearing set on a cast-iron base; this outfit cost $1,400; the worm screw and shaft are cut from solid forging and are steel; the motor is 15 horsepower; the machine is geared to give a speed to the car of 150 feet per minute; was only in operation about four months.
1 Baxter 110-volt motor, 2-horsepower, good as new; complete and starting box and tightener. Price $50.00
1 1000-light Slattery alternating-current dynamo, 1000-volt, complete with exciter and instrument. Practically as good as new.
1 50 K. W. C. and C. 500-volt multipolar ring armature, compound wound, direct connected to a 100-horsepower tandem, compound McEwen engine, 8½x14x12. Only used 14 months, and guaranteed in perfect condition, and 1 Sterling 100-horsepower boiler, 1 Duplex steam pump, and 1 copper-tube heater.
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1 325 K. W. Siemens & Halske, 2000 volts, 7200 alternations, single-phase, 115 R. P. M.
1 300 K. W. Fort Wayne, 2000 volts, 7200 alternations, single-phase.
1 240 K. W. Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 240 K. W. Stanley, two-phase, 380 R. P. M., with engines direct-connected.
2 300 K. W. Westinghouse, single-phase, toothed armatures.
1 150 K. W. Westinghouse, two-phase, 1100 volts, 600 R. P. M., 7200 alternations.
2 A-120 General Electric, single-phase, 1000 volts, 16000 alternations.
2 90 K. W. General Electric, single-phase, 1000 volts, 16000 alternations.
2 120 Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 100 K. W. monocylic General Electric, 1050 volts, 7200 alternations, with exciters.
1 60 K. W. General Electric, single-phase, 2000 volts, 16000 alternations.
1 60 K. W. Stanley, 2000-1000 volts, two-phase, 7200 alternations.
1 75 K. W. Stanley, 2000-1000 volts, two-phase, 16000 alternations.
1 200 H. P. Westinghouse motor, two-phase, 3000 alternations, 400 volts, shaft 4⅞-inch diameter, pulley 25-inch face, 30-inch diameter.
1 45 K. W. Westinghouse, 2200 volts, 16000 alternations.
1 110 K. W. Fort Wayne, 2200 volts, 16000 alternations.

Railway Generators. 500 Volts.

1 500 K. W. M. P., 4, Gen. Electric.
1 300 K. W. M. P., 4, Gen. Electric.
1 200 K. W. M. P., 4, Walker.
2 111 K. W. M. P., 4, Westinghouse.
2 100 K. W. M. P., 4, Gen. Electric.
2 200 K. W. Edison.
2 150 K. W. Edison.
2 100 K. W. Edison.
4 60 K. W. Edison.
1 100 K. W. Ft. Wayne.

Railway Motors.

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Belted Dynamos. 110 Volts.

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4 60 K. W. Edison bipolar.
2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
4 25 K. W. Edison bipolar.
2 20 K. W. Edison bipolar.
2 15 K. W. Edison bipolar.
1 13½ K. W. M. P. Amer. Ball.
2 10 K. W. Edison bipolar.
1 500-ampere Onondaga.
1 25 K. W. Electro Dynamic.
1 30 K. W. Western Electric, M. P., 500 R. P. M.
1 45 K. W. General Electric, M. P., 850 R. P. M.
1 100 K. W. M. P. 6, Westinghouse.
2 45 K. W. M. P., 4, Westinghouse.
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1 75 K. W. General Electric, direct-connected to Ideal engine.

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1 100 K. W. Edison.
1 70 K. W. M. P. Siemens & Halske (new).
1 65 K. W. Siemens & Halske.
1 25 H. P. Sprague, bipolar.
1 15 H. P. Perrett, M. P.
1 10 H. P. Eddy, bipolar
1 5 H. P. Eddy, bipolar.

Direct-Current.

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2 60 K. W. Edison.
2 50 H. P. M. P., General Electric, type H.
1 15 H. P. Eddy.
1 10 H. P. Eddy.
1 2 H. P. Cent. Elect. Co.

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2 125-light multi-circuit Brush, 2000 C. P.
2 165-light, multi-circuit Brush, 1200 C. P.
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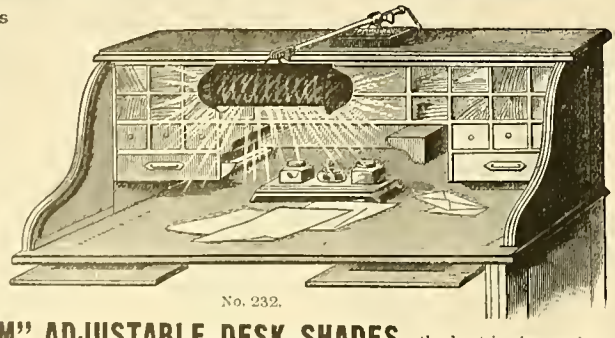

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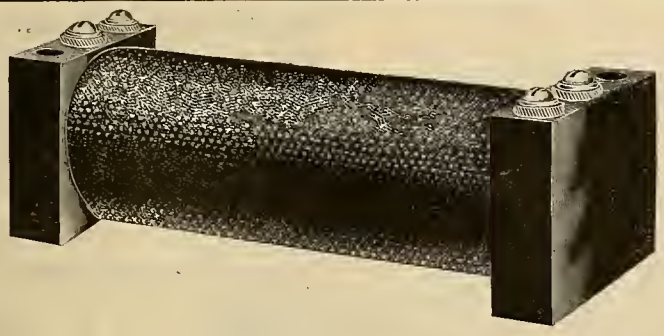

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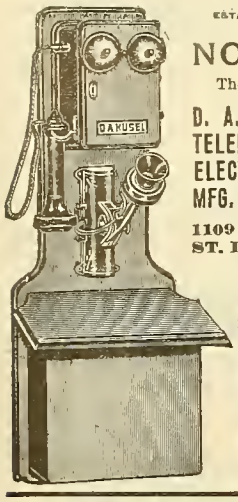

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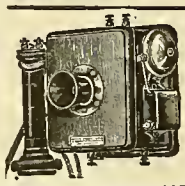

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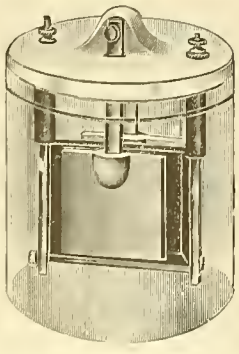

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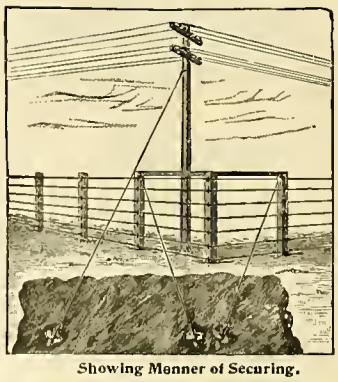

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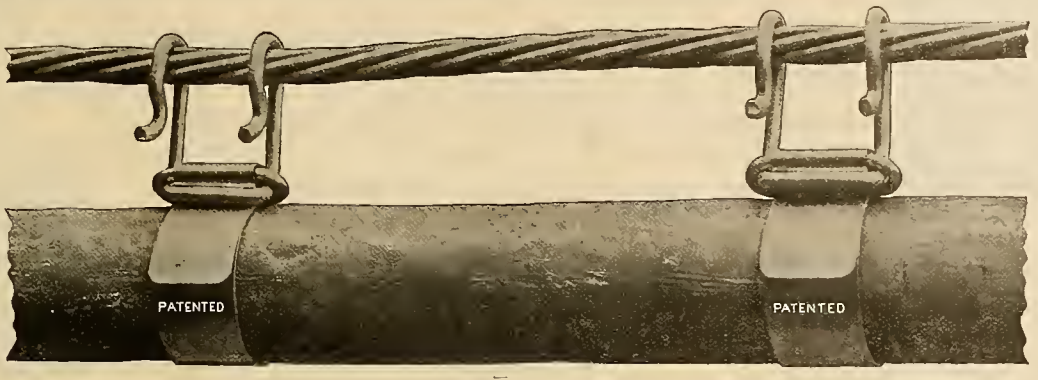

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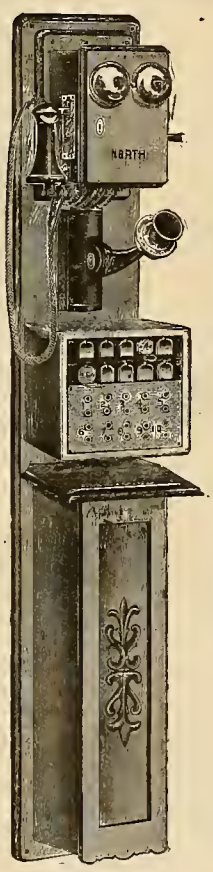

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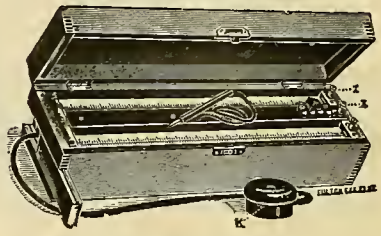

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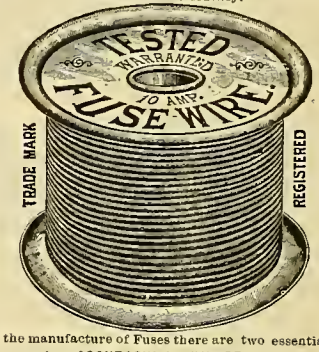

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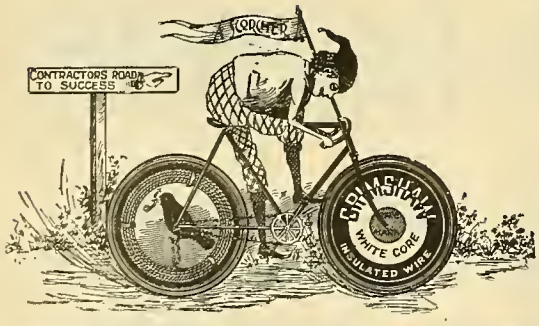

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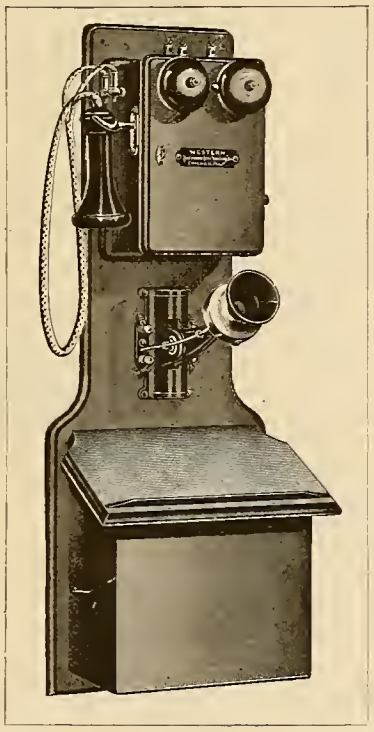

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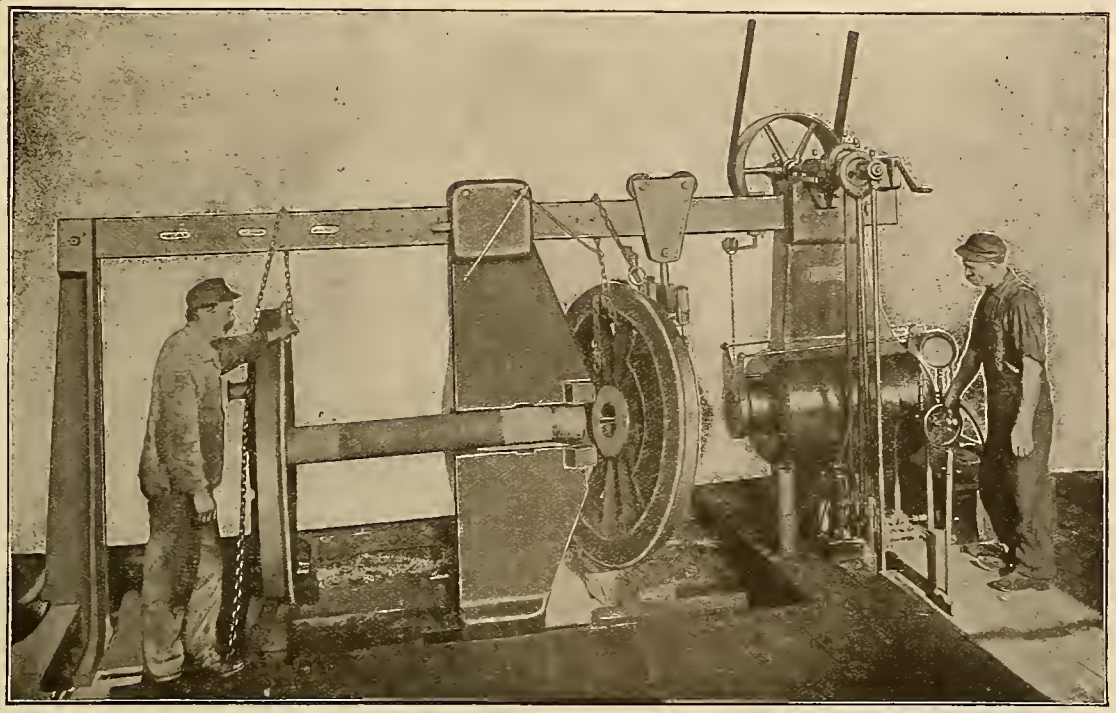

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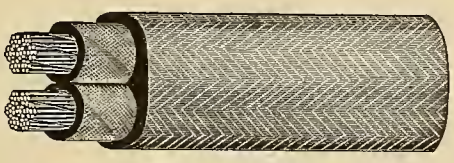

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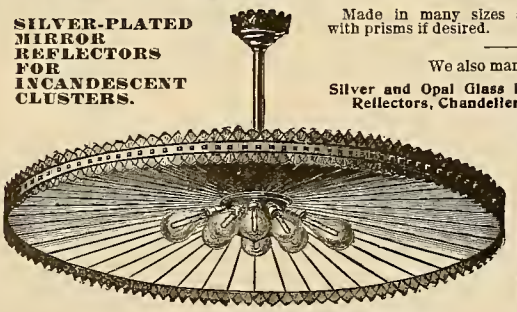

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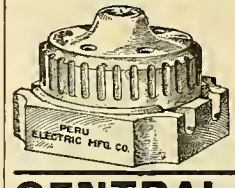

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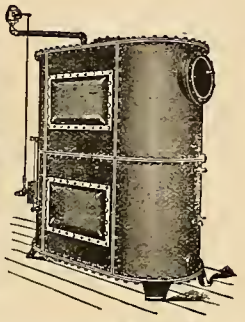

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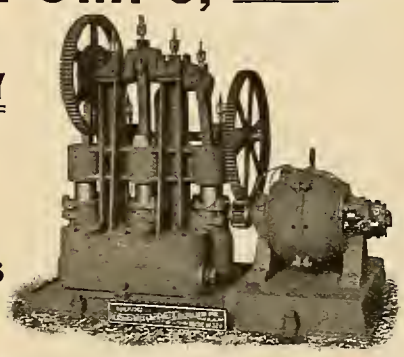

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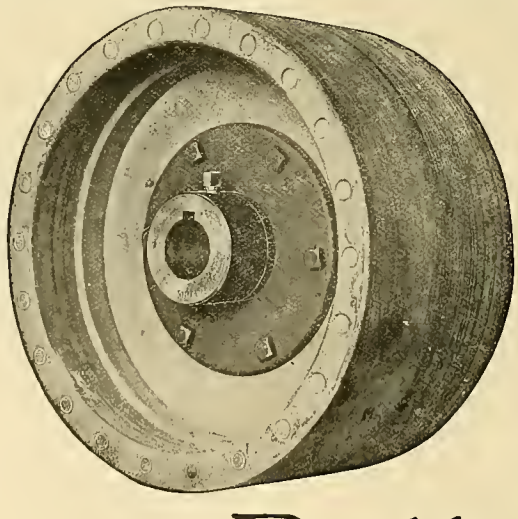

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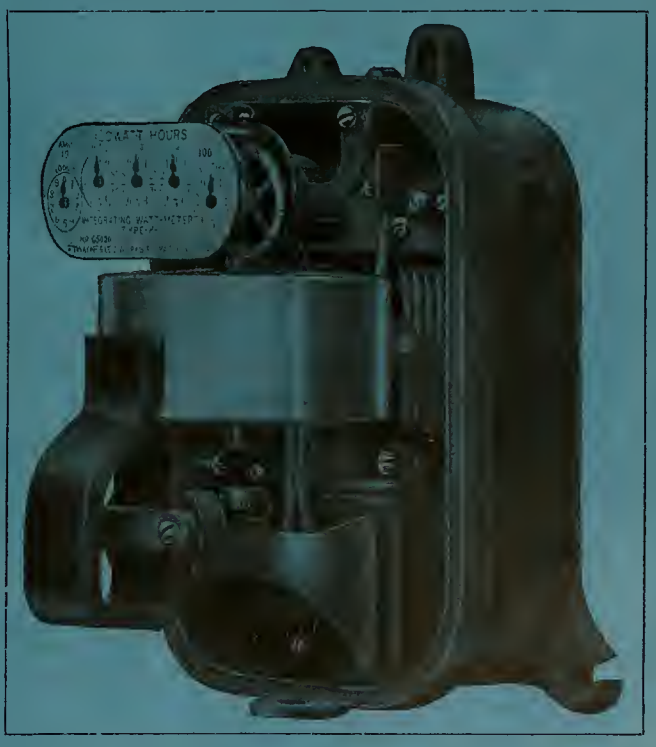

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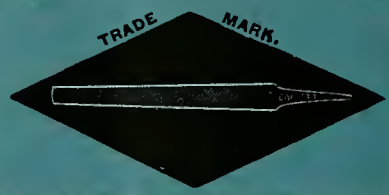

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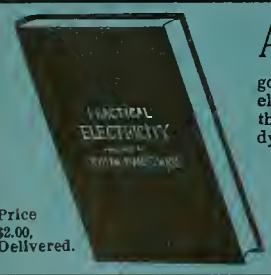

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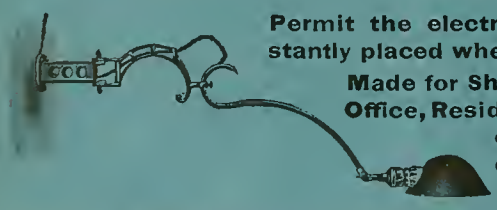

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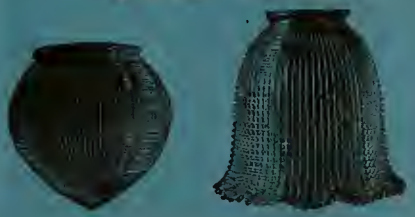
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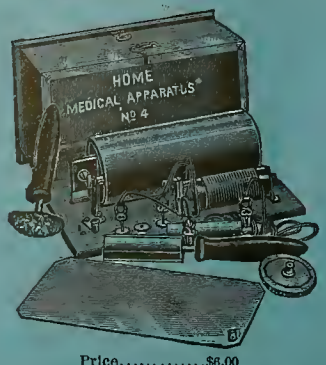

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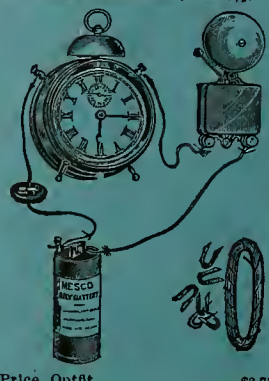

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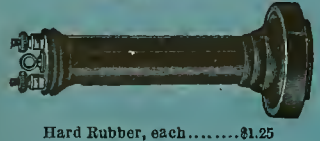

Hard Rubber, each.....$1.25

Battery Zincs.

We have purchased the plant of the Carr Metal Company and can furnish the Carr composite zincs in all forms and quality heretofore supplied by that company.

Telephone Outfit, No. 14.

With our high-grade carbon transmitter, which will be sent on approval to responsible parties.

Price, with two cells Mesco Dry Battery, $9.00.

Pony Telephone Receiver.

Retail price, 90 cents.

Desk Telephone Outfit, No. 11.

Price.....$9.00

We make a dozen different Telephone Outfits.

Iron Box Bells, No. 97.

2½, 3, 3½ and 4 inch. Special prices

OUR PRICES given above do not fairly represent quotations to the trade or to parties ordering quantities.
WE MANUFACTURE a large percentage of the goods found in our catalogue.

Catalogue No. 11—Now Ready.

MANHATTAN ELECTRICAL SUPPLY CO., 32 CORTLANDT STREET, NEW YORK.

BATTERY JARS.

Macbiee-made Battery Jars are Better and Stronger than the hand-blown, being more Uniform and of Equal Distribution.

ASK YOUR JOBBER FOR OUR JAR.

We are the only concern making Battery Jars by machinery.

THE GILCHRIST JAR CO.,

Office and Factory: . . . ELMER, N. J.

ALTERNATING-CURRENT POWER MOTORS,

1-20 TO 2 1-2 ACTUAL HORSEPOWER.

SIMPLE, RELIABLE, SATISFACTORY.

Send for bulletins just issued describing new types.

Branch Office and Warehouse: 136 Liberty St., New York City.

The Emerson Electric Mfg. Co., 714-716-718 St. Charles St., ST. LOUIS, MO.

STANLEY A. C. WATTMETERS.

Permanent Accuracy Guaranteed.

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New York: 146 Broadway.
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OUR LATEST

FRONT OF THE BOARD TYPE

Switchboard Instrument.

Type F Wattmeter, Front Connection, One-third Actual Size.

Our Indicating Wattmeters, Voltmeters and Ammeters are also built for BACK OF THE BOARD.

WRITE FOR PRICES AND BULLETIN Z 31, JUST ISSUED.

WAGNER ELECTRIC MFG. CO.,

General Offices and Factory, St. Louis, Mo., U.S.A.

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FOREIGN DEPARTMENT, Havemeyer Bldg., New York City.
CITY OF MEXICO, MEX., American Engineering Co. of Mexico, Agents.
LONDON, ENG., 47 Victoria St., C. R. Heap, Agent. YOKOHAMA, JAPAN, Bagnall & Hillies, Agents.
PARIS, FRANCE, 12 Rue St. Georges, E. H. Cadiot & Cie, Agents.

OKONITE IT NEVER DISAPPOINTS

"FACTS ARE SOMETIMES STUBBORN THINGS."

OKONITE IT NEVER DISAPPOINTS

Okonite Wires and Cables.

Having been so long and favorably known to the trade, we respectfully call to their attention the following

FACTS

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES have the indorsement of the best electrical authorities in the world.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will not deteriorate, but improve with age.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will not crack when exposed to the severest changes in temperature.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will not deteriorate when placed in lime or mortar.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES are not affected when immersed in sulphuric acid.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will stand a greater amount of kinking and torsion without permanent injury to the insulation than any other wire in the market.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES are submerged in water for three days (72 hours), and then carefully tested with Thompson's Reflecting Galvanometer.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES are tested, in addition to the Galvanometer test, with a dynamo current of not less than 2,000 volts.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES, when used in constructing telephone, telegraph, electric light and railway lines or feeders, owing to their high insulating qualities and efficiency, prove a paying investment, though the original cost may be somewhat higher than for lines constructed of cheaper material.

As General Western Agents of the OKONITE COMPANY, LIMITED, we carry in Chicago stock a complete line of their products, and thus are in position to fill all orders promptly.

CENTRAL ELECTRIC COMPANY,

OKONITE IT NEVER DISAPPOINTS

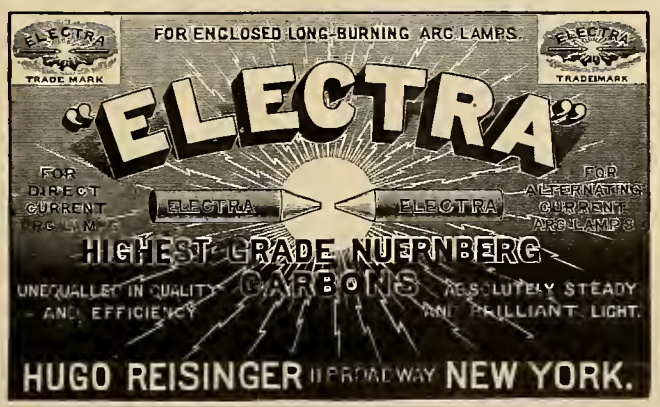
264-266-268-270 Fifth Avenue,

CHICAGO.

OKONITE IT NEVER DISAPPOINTS

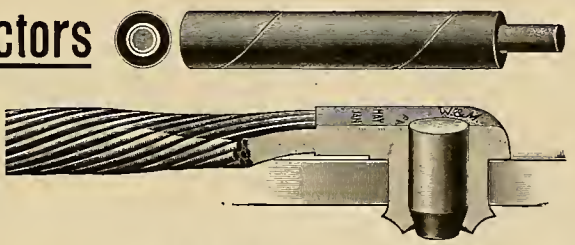
CARBONS CARBONS CARBONS

The "Electra" Carbons are the recognized standard all the world over.



There are no Carbons better than the "Electra" and none "just as good."

"CROWN" Insulated Conductors AND Rail Bonds ARE THE



Perfection of Rubber Insulation for high or low voltage, direct or alternating currents, solid or stranded conductors up to 2,500,000 circular mils' capacity.

Perfection of simplicity and economy in rail bonding, together with perfection of contact.

In "CROWN" WIRES or "CROWN" BONDS you secure the best attainable results, electrically and mechanically.

Solid or stranded bare copper conductors; also lead-encased and armored for aerial, underground and submarine work.

American Steel and Wire Co., Chicago, Ill.

NEW YORK, WORCESTER, DENVER, SAN FRANCISCO; LONDON, ENG.

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

WRITE FOR PRICES.

CHICAGO EDISON COMPANY 139 Adams St., CHICAGO.

ESTABLISHED 1878. INCORPORATED 1899.

J. H. BUNNELL & CO.,

20 PARK PLACE, Near General Postoffice, NEW YORK.

TRADE-MARK.

MANUFACTURERS, IMPORTERS AND DEALERS IN

Telegraph, Telephone, Railway and Electric-lighting Apparatus and Supplies, Instruments, Batteries, Insulated Wires & Line Equipment.

Catalogues and Circulars free on application.
Get our Special Prices before placing orders elsewhere.

We own the GOOD WILL, NAME, COPYRIGHTS, TRADE-MARKS, Patent (No. 288881) and all other assets of the old firm of J. H. BUNNELL & CO., and propose to maintain our rights in the premises.

J. H. BUNNELL & CO.,

20 Park Place, ——Near General Postoffice.—— New York.

DE DION-BOUTON "Motorette" COMPANY.

New York Office, No. 59 W. 66th St., New York, N. Y.

Boston Office, No. 268 Massachusetts Ave., Boston, Mass.

Sole Agents and Licensed Manufacturers in the United States of America for

De Dion-Bouton & Co., FRANCE.

Motors, Motorcycles, Motorettes.

Our New York Type Motorette, Weight 700 pounds. Capacity 3 Persons. Price $1,200.00.

SIMPLICITY, FLEXIBILITY, LIGHTNESS, STRENGTH, RELIABILITY, EASILY OPERATED, PERFECTLY CONTROLLED, ABSOLUTELY SAFE, ABSENCE OF ALL OIL AND DIRT, ECONOMY.

Not an EXPERIMENT, but a TRIED and PROVED SUCCESS.

Over 20,000 DE DION-BOUTON MOTORS operating Motorcycles and Motorettes.

GENERAL OFFICES AND FACTORY: CHURCH LANE AND 37TH ST., BROOKLYN, N. Y.

De Dion Motor Supplies and Batteries Always in Stock.

C. & H. SELF STARTERS for electric elevators and pumps are carefully made from the best of materials and are guaranteed to operate satisfactorily. Send for illustrated catalogue W.

The Cutler-Hammer Mfg. Co.,

Main Offices and Factory: MILWAUKEE, WIS.

EASTERN FACTORY: Westfield, N. J. NEW YORK OFFICE: 136 Liberty Street.

The largest and oldest manufacturers of Rheostats in the world.

"WITHOUT A PEER"

That's the Endorsement Given

THE "BELDEN" SYSTEM OF ARC LIGHTING.

MECHANICALLY PERFECT, ARTISTIC IN DESIGN.

If you're open to conviction send for our catalog, which tells what an Arc Lamp **should** be and what **the Belden** is.

Belden-Larwill Electric & Mfg. Co.,

FT. WAYNE, IND.

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C. E. WILSON, care Manufacturers' Club, Philadelphia, Pa.
R. N. STEWART & CO., Denver, Colo.

We are now in a position to establish desirable agencies in all principal cities in this and foreign countries.

There is No Higher-Class India-Rubber Insulation For Wires and Cables than

HABIRSHAW.

Authorized Manufacturers of the

ATTIX FLEXIBLE TUBE WIRE.

The India-Rubber and Gutta-Percha Insulating Co.,

MAIN OFFICE, Glenwood Works,

J. W. CODFREY, Manager Sales, 15 Cortlandt Street, NEW YORK.

YONKERS, N. Y.

(10928)

Code of Moral Suasion and Correct Procedure To Establish a Claim.

AMERICAN ELECTRIC COMPANY,
56 E. 6th St., St. Paul, Minn.,

vs.

JOHN DOE ET AL.

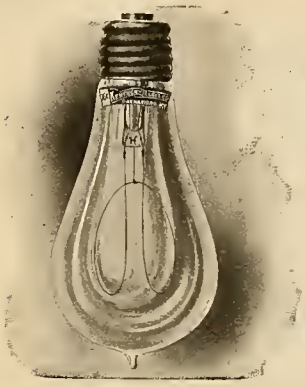
Greeting:—The purchasing agent of your plant is hereby cited and summoned to hold a conference with himself, immediately upon receipt of this document, to then and there decide and determine that the claims herein set forth are true, viz.:

That the undersigned carry the largest stock of up-to-date electrical supplies in the great Northwest; that they are the exclusive selling agents in your territory for the Western Electric Arc and Incandescent Dynamos, Fan Motors, Petite Enclosed Arc Lamps, for both direct and alternating currents, for Simplex Rubber Covered Wires and Cables and Sunbeam Incandescent Lamps; that they are prepared to furnish anything and everything electrical, promptly as the circumstances will warrant, and always at the right price; that they carry in stock at St. Paul, besides all the "knicknacks" in Supplies, a large quantity of Weather Proof and Rubber Covered Wires, Circular Loom, Iron Armored and Loricated Conduit, Cross-Arms, Cross-Arm Braces, Lag Screws, Pole Steps, Insulators, etc.; that they are out for business and want your orders; that their constantly increasing trade is evidence of the appreciation of a thoroughly equipped electrical supply house in the Northwest; that this concern is tireless in its efforts to please, and that this is being done can easily be established.

It, therefore, behooves you to get in line with others and send your orders where they will receive the best attention.

Dated this 20th day of October, 1900.

[Seal.] AMERICAN ELECTRIC COMPANY, St. Paul, Minn.



KENTUCKY INCANDESCENT LAMPS.

SAME PRICE TO ALL.

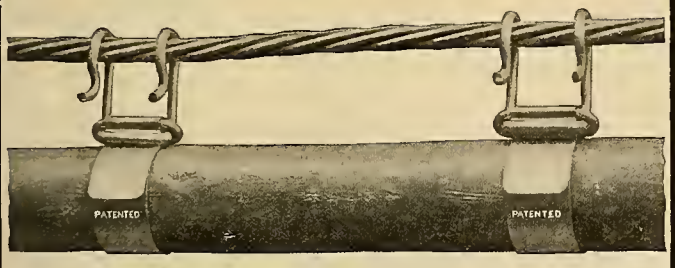
16 C. P., Barrel Lots, 17c. Each.

SPECIAL PRICES ON ANNUAL CONTRACTS.

KENTUCKY ELECTRICAL CO.,

Manufacturers KENTUCKY { INCANDESCENT LAMPS, MOTORS AND DYNAMOS. **Owensboro, Ky.**

BOSTON CABLE CLIP!



The largest telephone companies in the country are using them exclusively

BECAUSE THEY ARE:

THE BEST.
THEY WILL NOT SLIP.
THE MOST ECONOMICAL.
ADJUSTABLE TO ANY SIZE CABLE.
THE MOST DURABLE.

(Millions NOW in use.)

CHASE-SHAWMUT CO. (Sole Mfrs.)

BOSTON, MASS.

REWARD.

Any Street Railway by using

"Shawmut" Standard Fuses

will be amply rewarded and protected.

Protect your Lighting circuits and car heaters with

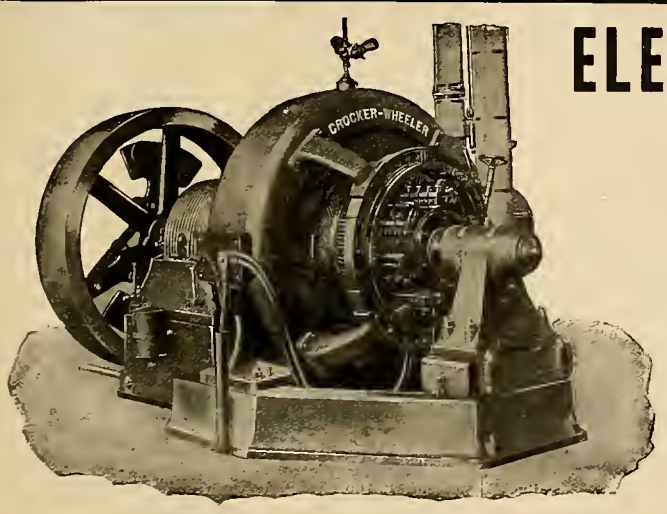
"Cartwright" Enclosed Fuses

and your troubles will cease.

Chase-Shawmut Co.,

Boston, Mass.

Western Representatives: M. B. AUSTIN & Co., 56 West Van Buren St., **Chicago, Ill.**



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FOR POWER AND LIGHTING.

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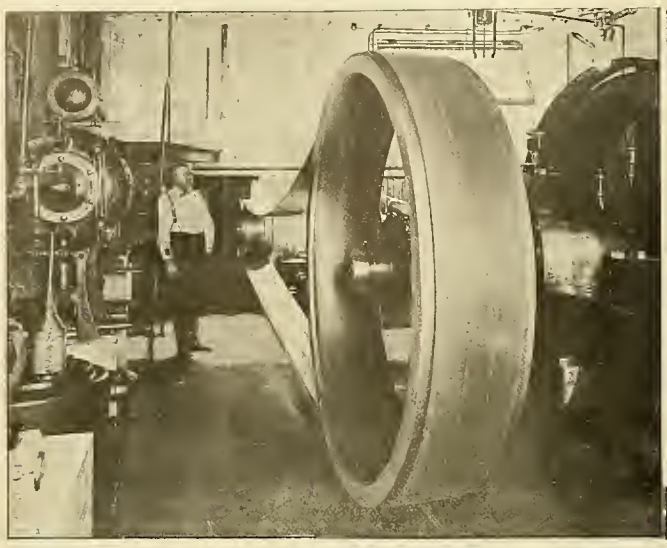
PHILADELPHIA, PA., 14 S. Broad Street.
WASHINGTON, D. C., Kellogg Building.
ST. LOUIS, MO., 642 Century Building.
CHARLOTTE, N. C., 29½ S. Tryon Street.
ATLANTA, GA., English-American Building.
DENVER, COLO., 311 Kittredge Building.
CHICAGO, ILL., Old Colony Building.

CROCKER-WHEELER COMPANY,

General Office and Works, Ampere, N. J.



CLINC-SURFACE Has allowed this belt to run slack, stopped its slipping, increased its bearing on the pulleys, increased its power, preserved the belt and saved them money all around, besides relieving the engineer and his employers from the constant trouble of a slipping belt.

CLINC-SURFACE will do all this for you. If it fails you need not pay for your order. It is worth trying when you risk nothing. Let us hear from you.

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Philadelphia, New Orleans.

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Walker, Sidney F. Electric Lighting for Marine Engineers, or How to Light a Ship by the Electric Light and How to Keep the Apparatus in Order. 134 illustrations. 12mo, cloth. London, 1892. .....$2.00

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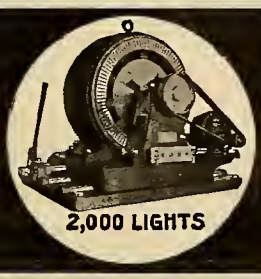

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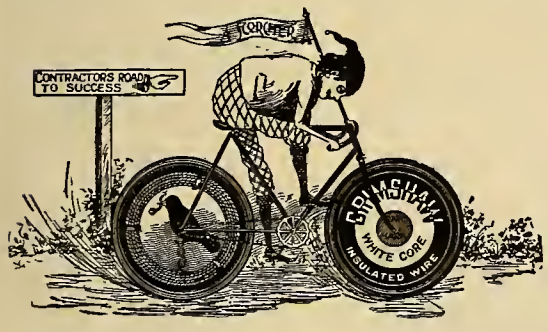

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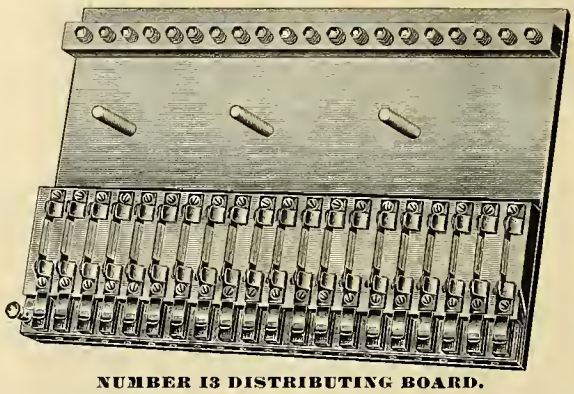

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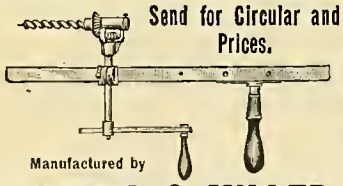

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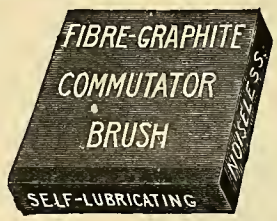

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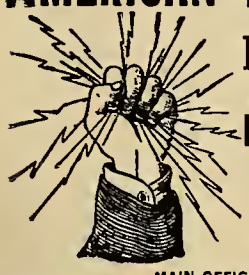

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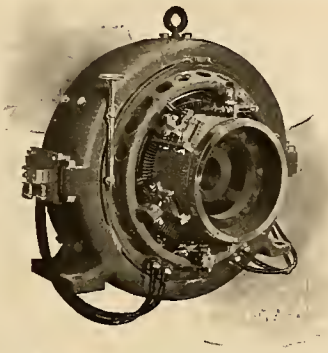

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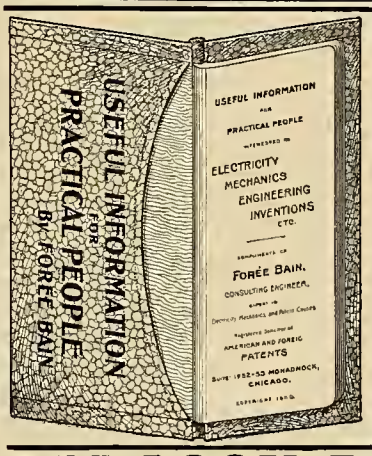

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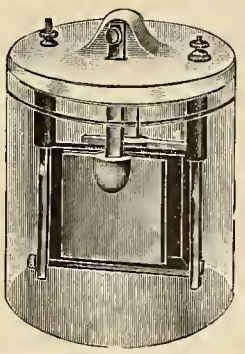

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1 25 K. W. T.-H., self-oiler, D. 25, comp.
1 25 K. W. Edison, self-oiler.
1 35 K. W. Mather, self-oiler.
2 45 K. W. Edison, compound, self-oilers.
1 75 K. W. Westinghouse, M. P., self-oiler.
1 75 K. W. Westinghouse, Kodak set, direct connected.

Alternating Generators.

1 350-light Thomson-Houston, A. 18, comp. wound.
2 600-light Thomson-Houston, A. 6, 30 K. W., self-oilers.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound, self-oiler.
2 650-light Thomson-Houston, A. 35, self-oilers, composite wound.
2 750-light Westinghouse, self-oilers, 37½ K. W.
1 1000-light Wood, 50 K. W., self-oiler, toothed armature, comp. wound.
1 1200-light Westinghouse, 60 K. W., self-oiler, toothed armature.
1 1200-light T.-H., 60 K. W., self-oiler, toothed armature.
1 1200-light General Electric, A. 60, composite wound, toothed armature, self-oiler.
2 1300-light T.-H., A. 70, 1100 volts, self-oilers, compound wound.

Alternating Generators—Continued.

1 1500-light Wood, 75 K. W., self-oiler, comp. wound, toothed armature, 16800 alternations, 1100 volts, complete with exciter.
1 2000-light Thomson-Houston, 100 K. W., toothed armature.
1 4000-light Wood, 200 K. W., self-oiler, compound wound, slotted armature.

Arc Dynamos.

1 35-light, 2000 C. P. T.-H., ring armature.
1 40-light 2000 C. P. Wood, No. 7.
2 40-light 2000 C. P. Western Electric, s. o.
1 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7, Steubenrausch commutator.
1 50-light 1200 C. P. T.-H., L. D., 12.
1 50-light 2000 C. P. T.-H., M. D., 2, self-oiler, rlog armature.
1 50-light 2000 C. P. Brush, No. 7½.
2 60-light 2000 C. P. West. Elec., self-oilers.
1 60-light 2000 C. P. Westinghouse.
2 60-light 2000 C. P. Wood, No. 8.
1 65-light 2000 C. P. Brush, No. 8, new armature.
2 75-light 1200 C. P. Wood.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. West., self-oilers.
3 125-light 2000 C. P. Excelsior, latest type, self-oilers, fine.

220-Volt Motors.

1 1 H. P. Edison, self-oiler.
2 1 H. P. E. & C., new, self-oilers. M. P., slow speed.
1 3 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 3 H. P. Gen. Elec., type I. B., self-oiler.
1 3 H. P. C. & C., self-oiler.

220 Volt Motors—Continued.

2 3 H. P. Card, slow speed, self-oilers.
1 5 H. P. Eddy, ring type, self-oiler.
1 5 H. P. Westinghouse, self-oiler.
1 7½ H. P. Roth, self-oiler.
1 7½ H. P. Eddy, self-oiler.
1 7½ H. P. Edison, self-oiler.
1 8 H. P. General Electric multipolar, self-oiler.
1 10 H. P. Keystone, self-oiler.
1 10 H. P. Eickmeyer, elevator motor, with controller.
1 10 H. P. Lundell, self-oiler.
1 12 H. P. Lundell, 10 K. W., multipolar, self-oiler, slow speed.
1 15 H. P. Eddy, self-oiler, new armature.
1 18 H. P. Edison, self-oiler.

500-Volt Motors.

1 1 H. P. Crocker-Wheeler, self-oiler, slow speed.
1 1 H. P. Lundell, self-oiler, slow speed.
1 1 H. P. C. & C., self-oiler.
1 2½ H. P. Holtzer-Cabot, self-oiler.
1 3 H. P. Toledo, self-oiler.
1 3 H. P. Hobart, self-oiler.
1 3 H. P. Jenney, self-oiler.
1 5 H. P. Westinghouse, M. P., self-oiler.
1 7½ H. P. Thomson-Houston, new arm't.
1 7½ H. P. Eddy, type C, self-oiler.
1 10 H. P. C. & C.
1 10 H. P. Commercial, self-oiler.
1 10 H. P. Card, M. P., self-oiler, slow sp.
1 10 H. P. Eddy, M. P., self-oiler, slow sp.
1 10 H. P. Westinghouse, M. P., self-oiler.
1 15 H. P. Commercial, self-oiler.
1 18 H. P. Thomson-Houston, self-oiler.
2 18 H. P. Edison, 15 K. W., self-oilers.
2 18 H. P. C. & C., self-oilers.
1 20 H. P. Commercial, self-oiler.
1 20 H. P. Card, self-oiler.
1 30 H. P. Thomson-Houston, self-oiler.
1 30 H. P. Edison, 25 K. W., self-oiler.
1 40 H. P. Mather, self-oiler.
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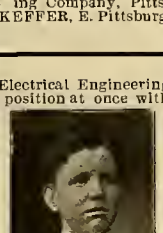

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S907 1 7x12 Rice automatic.
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S915 1 8x10 Atlas automatic, center crank.
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1 United States Weston dynamo, 150-light, 100-volt, 75-ampere, complete with sliding base, belt tightener and regulator.
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2 15 K. W. Edison bipolar.
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2 10 K. W. Edison bipolar.
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1 30 K. W. Western Electric, M. P., 500 R. P. M.
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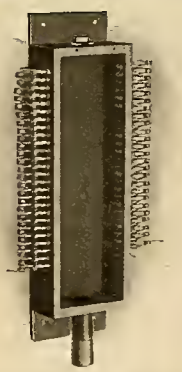

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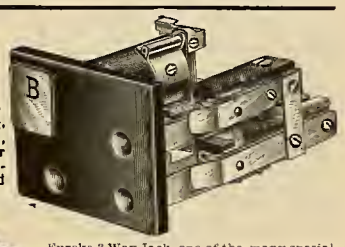

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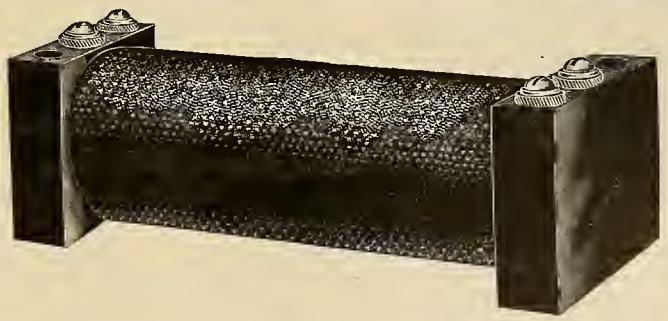

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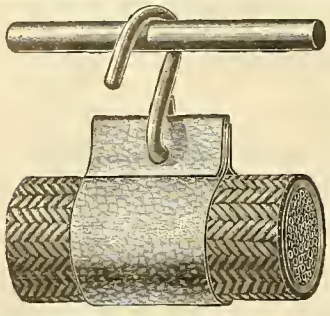

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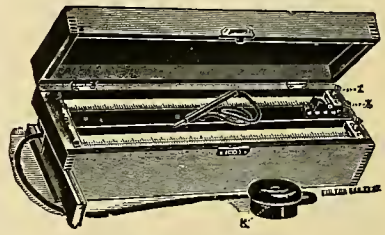

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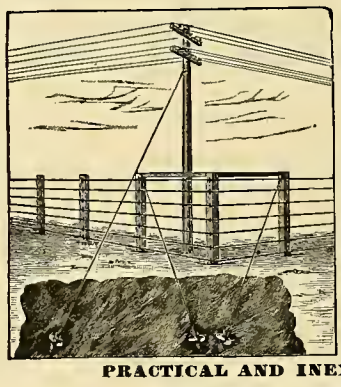

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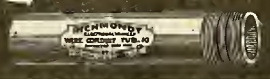

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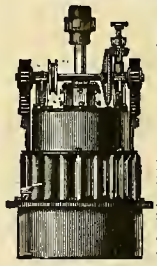

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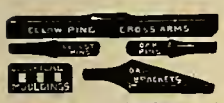

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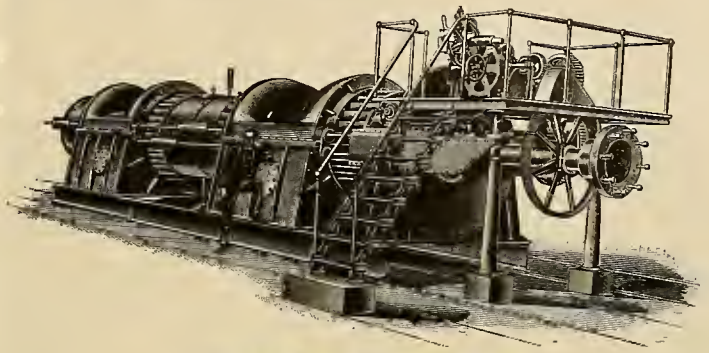

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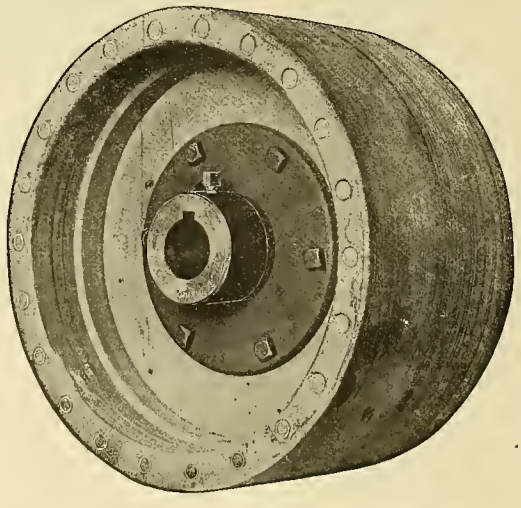

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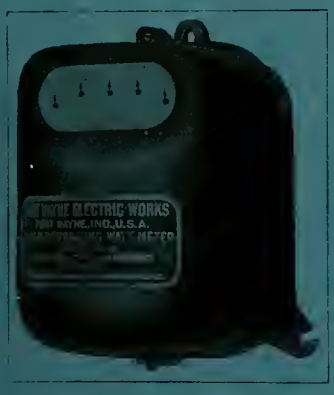

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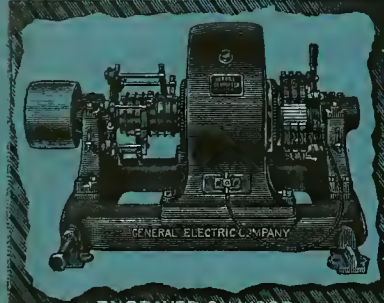

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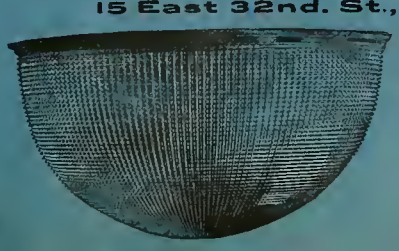
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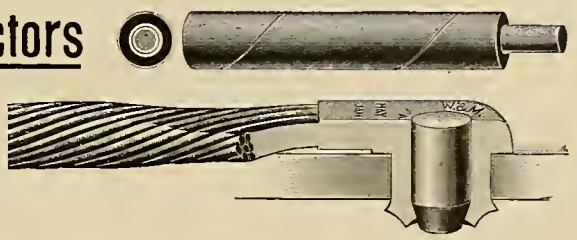

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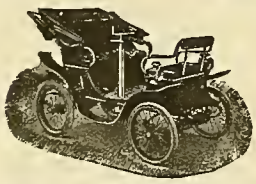

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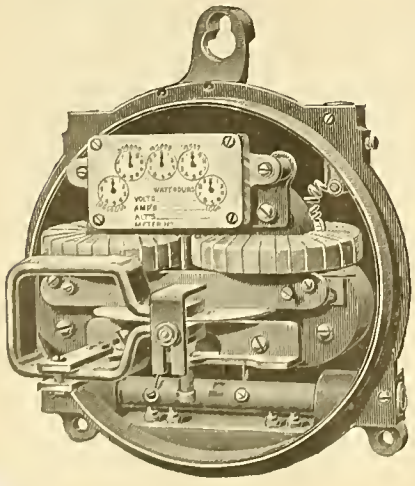

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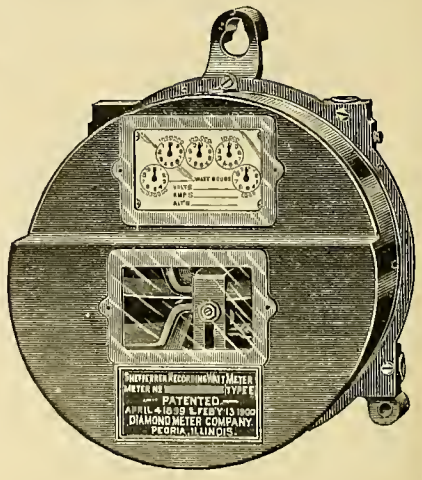

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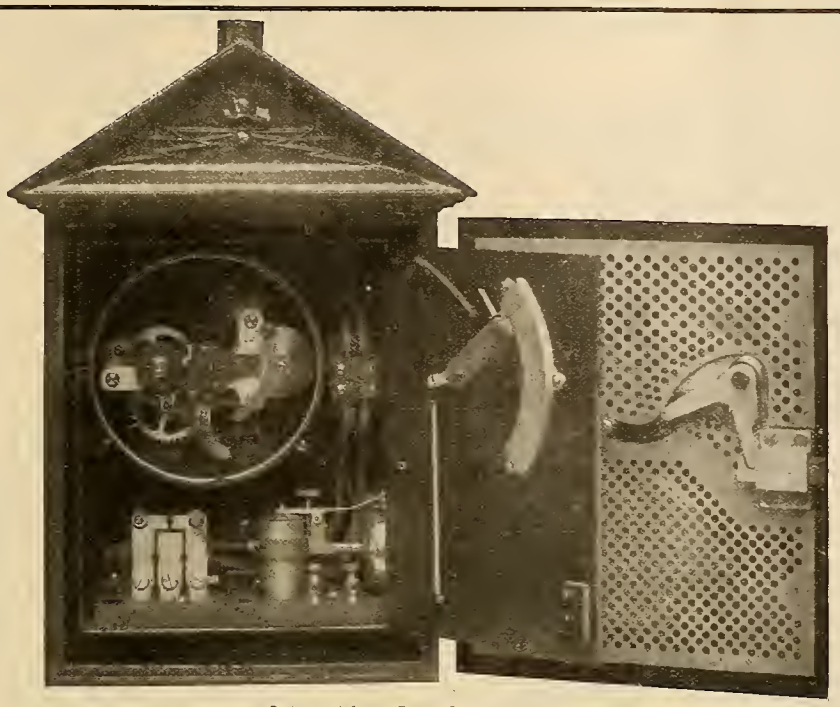

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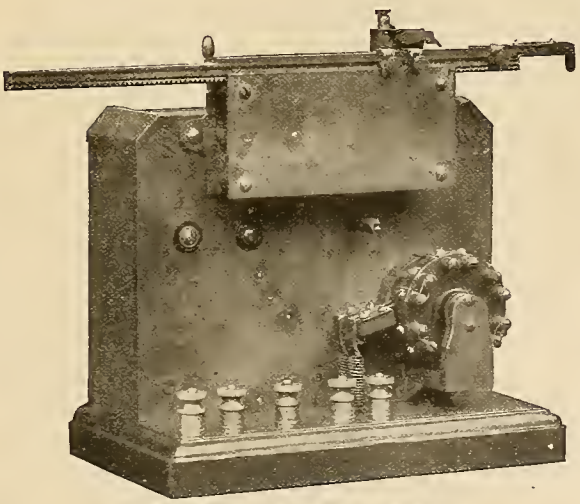

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General Electric Co.
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Siemens & Halske Electric Co. of America.
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Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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Leffel & Co., Jas.
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Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
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Noblett, E. J.

X-Ray Outfits,
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New Interchangeable Type Arc Lamps

Enclosed arc for direct current
110 volt circuits.

Enclosed arc for alternating current
110 volt circuits.

Enclosed arc for direct current
220 volt circuits.

"The Station Man's Lamp."

General Office: Schenectady, N. Y.

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Sales Offices in All Large Cities.

Siemens & Halske Electric Co. of America,

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ELECTRICAL APPARATUS,

Railway, Lighting, Power Transmission.

IMPROVED DUNCAN INTEGRATING WATTMETERS.

DISTRICT OFFICES:

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"FACTS ARE SOMETIMES STUBBORN THINGS."

Okonite Wires and Cables.

Having been so long and favorably known to the trade, we respectfully call to their attention the following

FACTS

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES have the indorsement of the best electrical authorities in the WORLD.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will not deteriorate, but improve with age.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will not crack when exposed to the severest changes in temperature.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will not deteriorate when placed in lime or mortar.

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IT IS A FACT that OKONITE INSULATED WIRES AND CABLES will stand a greater amount of kinking and torsion without permanent injury to the insulation than any other wire in the market.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES are submerged in water for three days (72 hours), and then carefully tested with Thompson's Reflecting Galvanometer.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES are tested, in addition to the Galvanometer test, with a dynamo current of not less than 2,000 volts.

IT IS A FACT that OKONITE INSULATED WIRES AND CABLES, when used in constructing telephone, telegraph, electric light and railway lines or feeders, owing to their high insulating qualities and efficiency, prove a paying investment, though the original cost may be somewhat higher than for lines constructed of cheaper material.

As General Western Agents of the OKONITE COMPANY, LIMITED, we carry in Chicago stock a complete line of their products, and thus are in position to fill all orders promptly.

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Stewart Patent Cord ADJUSTER.

(Patented August 21, 1900.)

Cuts illustrate two methods of adjustment.

A device everyone wants.
Can be used on any size of cord.
Can be adjusted easily.
Can be used after rosette and socket are connected.
Made of fiber.
Sold as cheap as common wood adjusters.
Order from your supply house or us.
Same price everywhere.

SAMPLES FREE.

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Manufacturers and dealers in
ALL ELECTRICAL SUPPLIES.
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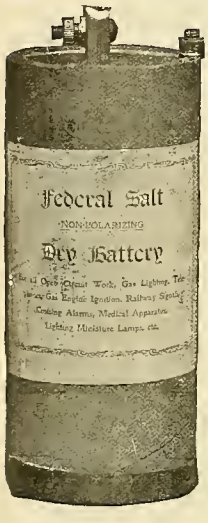

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Higher Voltage and Amperage.

Will do more Hard Work than any Dry Battery on the Market.

No more Running Down on the Shelf.

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FOR CARBON CYLINDER and CARBON-MANGANESE BATTERIES.

Gives More Current, Longer Life, Absolutely No Crystals.

Both salts have a depolarizer in the mixture. Federal Salt No. 1 has more depolarizer than Federalite, and so will last longer. That's the only difference.

It's the DEPOLARIZER that INCREASES the STRENGTH, GIVES LONGER LIFE, and DOES AWAY ABSOLUTELY WITH CRYSTALLIZATION and CREEPING SALTS.

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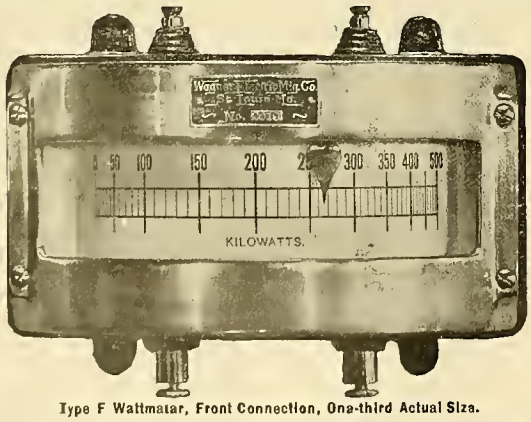
FRONT OF THE BOARD TYPE

Switchboard Instrument.



Type F Wattmeter, Front Connection, One-third Actual Size.

Our Indicating Wattmeters, Voltmeters and Ammeters are also built for BACK OF THE BOARD.

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I was getting $30 a month as assistant in an Electric Lighting Plant when I took up the Electrical Engineering Course. Since that time, I have passed four Civil Service Examinations, and have had my salary raised four times. I am now getting $87 per month, and can truthfully say that I owe my success to correspondence instruction.

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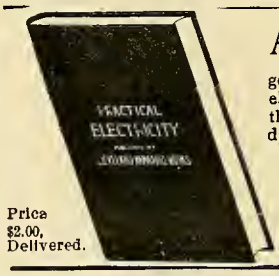

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FOR ALL CIRCUITS.

GUARANTEED TO MEET REQUIREMENTS OF ALL PRACTICAL ENGINEERS.

Designed on scientific principles and constructed of the highest grade materials.

Accessibility to working parts, which are few and absolutely interchangeable.

Positive cable contact.

Resistance cannot be short-circuited.

10-in. globe, using full length carbons.

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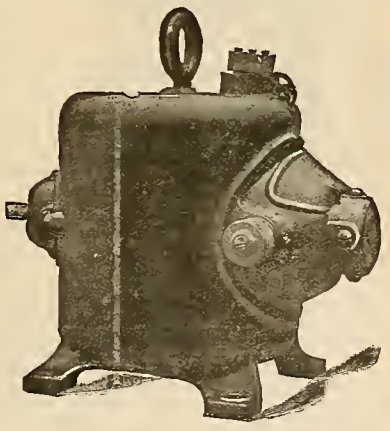

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The largest telephone companies in the country are using them exclusively

BECAUSE THEY ARE:

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THEY WILL NOT SLIP.
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(Millions NOW in use.)

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will be amply rewarded and protected.

Protect your Lighting circuits and car heaters with

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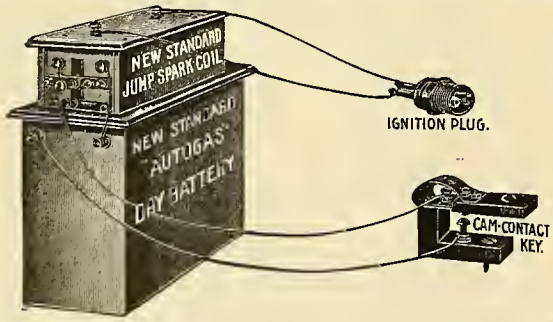

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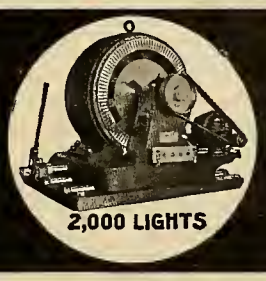

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All Lines of General Electric Supplies.

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COMPOSED OF ASPHALT AND PAPER.

An absolute non-conductor. Perfect insulation guaranteed. Water-tight joints. No scratching of cables. No deterioration. Costs less laid in complete state than any conduit on market. Quickly and easily handled. No skilled workmen required. Made in 7-foot lengths; 3-in. internal diameter; weight, 2 lb. to foot; made in desired sizes from 2 in. to 10 in. Manufacturers of Electrolysisproof Insulating Materials, Distributing Box and Post Linings, Pipe Coverings, Etc.

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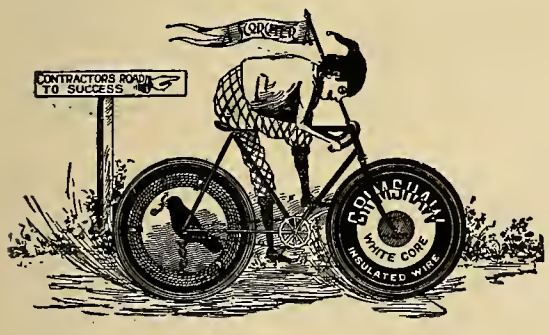

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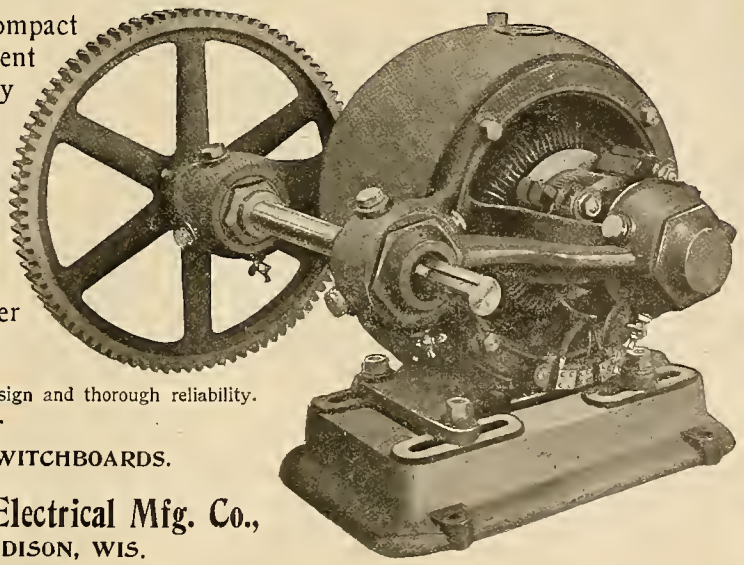

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Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

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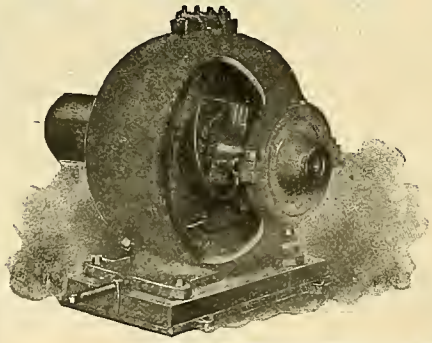

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Pleasing in Design,
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High Commercial Efficiency,
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For Floor, Wall or Ceiling.

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AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

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YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

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THE LUNDELL "SPLIT-POLE" GENERATOR

Is so named because of the peculiar construction of the pole pieces. It is the most efficient Generator on the market. Its remarkable advantages are fully described in our Catalogue No. 03100. Free on application.

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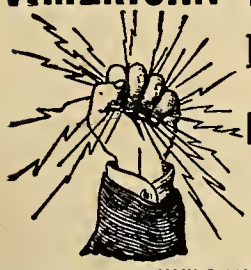

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CRYSTAL VARNISH

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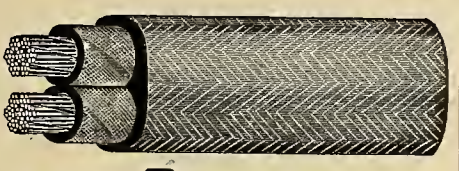
INSULATED RUBBER WIRES AND CABLES.



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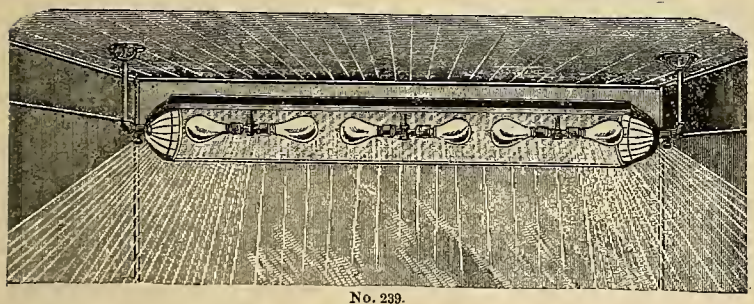
"KLEMM" PATENT ADJUSTABLE REFLECTOR, cheapest and best.
Reflector for Lighting Show Windows and Art Galleries.
"KLEMM" ADJUSTABLE DESK SHADES, the best in the market.
Send for Catalogue of Reflectors for Stores, Churches and general purposes.



No. 239.

KLEMM & CO.,

N. W. Cor. 5th and Cherry Sts., Philadelphia.
Reflectors and Shades for Electric Light.

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.

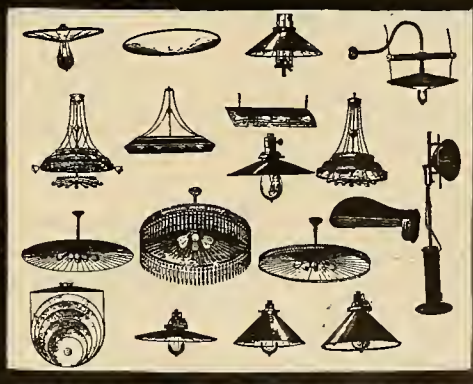
MANHATTAN SERIES

A. C. Enclosed Arc Lamp System.

Enclosed Arc Lamps for all Circuits.

MANHATTAN GENERAL CONSTRUCTION CO.,
SALES OFFICE,
11 Broadway, N. Y.
NEWARK, N. J.

WRITE FOR ILLUSTRATED CATALOGUE



AMERICAN REFLECTOR & LIGHTING CO.
CHICAGO.

ELECTRO GALVANIZED CONDUIT

INTERIOR AND UNDERGROUND CONDUIT AND ALL FITTINGS

RICHMONDT CONDUIT CO.
MILWAUKEE U.S.A.

ANY OLD THING

Suits some, but the Thinking ENGINEER wants good goods.
Send for Catalog.
JAS. L. ROBERTSON & SONS,
195 Fulton St., New York.
Branches: Boston—Philadelphia.

IMPROVED ROBERTSON-THOMPSON INDICATOR—a grand adjunct and at very moderate cost.
TIC-A-TOC GREASE CUP. Send for circular. A very successful novelty—circular.
EUREKA PACKING, with a RED DIAMOND LABEL, gives more power lasts two to three times longer and costs less than any other good packing.
ROBERTSON FEED-WATER HEATER heats water to about boiling point with exhaust steam.
HINE ELIMINATOR gives dry steam to engine, keeps oil out of the boiler.

WANTED.

Position as electrician, engineer or superintendent of a lighting or railway plant. Have good practical experience and a thorough technical training. Thoroughly familiar with construction work. Am willing to invest in well located plant or will lease. First-class references. Address "L. M. S.," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

To correspond with parties having electric-light plant or telephone exchange for sale, or knowing of good opening for either, in town of from 1,800 to 6,000 inhabitants. West preferred. Address "C 27," care Western Electrician, 510 Marquette Building, Chicago.

SITUATION WANTED

By electrician and engineer. 16 years' experience operating Lighting and Street Railway Systems. Good armature winder. References furnished. Address "ARMATURE," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Position as superintendent, electrician or assistant, in a power or lighting plant. Have had 4 years' experience in power and lighting plant. Am single, do not drink, and can give good references. Address "E. F.," care of Western Electrician, 510 Marquette Bldg., Chicago

WANTED.

Position by a man of 12 years' experience in the telephone business and familiar with duplex and selective signal systems. Married. Strictly temperate. Address "EXPERT," care Western Electrician, 510 Marquette Bldg, Chicago.

WANTED TO BUY.

We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

CAMP ENGINEERING CO.,
18 South Canal Street, Chicago, Ill.

WE BUY AND SELL

SECOND-HAND ELECTRICAL MACHINERY.
WALSH'S SONS & CO.,
150 WASHINGTON ST., NEWARK, N. J.

WANTED TO BUY.

One hundred to two hundred dynamos, from 50 to 100 lights, for export trade. Will pay spot cash. Address "EXPORTER," care Western Electrician 510 Marquette Bldg., Chicago.

FOR SALE—A BARGAIN.

Thirty 200-ampere-hour storage-battery elements, Chloride Accumulator make. Also 150 hard rubber cells, 7x7x10½ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

EXCEPTIONAL BARGAINS!

4—45-K. W., Edison, bipolar, 110-volt dynamos.
1—New 40 K. W., Stanley, two-phase, 2,000-volt alternator.
1—400-ampere-hour, Chloride Accumulator Co., storage battery.
1—15 x 14 Ideal engine.
1—14½ x 15 McIntosh & Seymour engine.
2—18½ x 18 Ideal engines.
1—20x36x18 Ball, cross-compound engine.
1—7½ x 5 x 6 Duplex feed pump.
1—1,000-H. P. Austin open heater.

Write for our latest price list No. 40.

ILLINOIS MAINTENANCE COMPANY,
E. H. CHENEY, Mgr. 204 Dearborn St., Chicago.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

NOTICE

A first-class electrical manufacturing concern making various patented specialties, whose

X-Ray Tubes

have been purchased and recommended by all of the authorities in X-Ray work, is seeking a proper representative in the eastern part of the United States. The goods have already had highly successful representation in the Western States. Address

"H. Z." 4627,
CARE OF
RUDOLF MOSSE, HAMBURG, GERMANY.

HENRY H. HUMPHREY,
Consulting
Electrical Engineer.
CENTRAL LIGHTING STATIONS,
ELECTRIC POWER TRANSMISSION.
543, 544 and 545 Century Bldg., St. Louis.

"AMERICAN" STORAGE CELLS
ARE THE BEST. Send for descriptive Circular.
Absolutely Non-Infringing. Protection Guaranteed.
AMERICAN BATTERY CO.,
ESTD 1888. 178 S. Clinton St., Chicago, Ill.

PROPOSALS FOR ELECTRIC LIGHTING.

Bids are hereby invited for the electric lighting of the city of Shreveport, La., for a period of five years, from June 1, 1901.

The system shall be the Thomson-Houston, the General Electric, or equally as good.

The number of arc lights to be not less than one hundred, and subject to be increased to two hundred.

Bids shall specify the charge for arc lights, and also for incandescent lights. Bids shall also specify the maximum charge to be made for private consumers of arc and incandescent lights.

A certified check for $2,500 to accompany each bid.

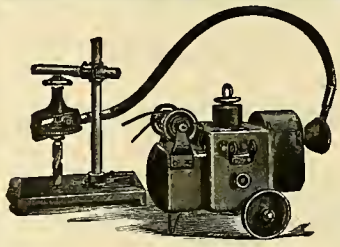
The city reserves the right to reject any and all bids

The successful bidder shall be required to give bond for faithful performance.

The arc lights for street lighting shall burn every night, and shall be at least 2,000 candlepower.

All bids shall be in the hands of the comptroller by 6 p. m. of December 1, 1900.

N. B. MURFF, Comptroller,
City of Shreveport, La.



ESTABLISHED 1875.
COMBINATION OF
Stow Flexible Shaft
—AND—
MULTI-SPEED MOTOR.

Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.

STOW MFG. CO., Binghamton, N. Y.
Gen'l European Agents, Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, England.

WANTED FOR SPOT CASH

BURNED OUT INCANDESCENT LAMPS AND BASES.
Freight Paid and Highest Prices Guaranteed.
GEO. F. SCHWALM CO., - HARRISON, N. J.

Latest Type Brand New Siemens & Halske Machines—Multipolar Generators.

1 55-light type B, 125-volt generator, self-oiler, M. P., slow speed.
2 80-light Ironclad type, 125-volt generators, self-oilers, M. P.
1 80-light bipolar type, 125-volt generator, self-oiler.
1 110-light Churchward type, slow speed, 125-volt generator, M. P., 650 R. P. M.
2 180-light Ironclad type, 125-volt generators, M. P., self-oilers.
2 210-light-type B, 12 K. W., 125-volt generators, M. P., self-oilers.
2 350-light bipolar type, 20 K. W., 125-volt generators, self-oilers.
2 500-light bipolar type, 125-volt generators, 30 K. W., self-oilers.
1 700-light Ironclad type, 125-volt generator, self-oiler, slow speed.
1 Ironclad type, 30 K. W., 250-volt, slow speed, M. P., self-oiler.
2 Churchward type, 25 K. W., 500-volt, slow speed, M. P., self-oilers, 475 R. P. M.
1 Churchward type, 50 K. W., 250-volt, slow speed, for direct connection.
1 Churchward type, 100 K. W., 250-volt, slow speed, for direct connection.
1 marble panel switchboard for same, extra.
1 type six-pole, 100 K. W., 125 volts, for direct connection.
1 Churchward, 50 K. W., 1,100 volts, 60-cycle alternator, single phase, with exciter.
1 Churchward, 50 K. W., two-phase, 60-cycle, rotary transformer, with exciter, 1,000 volts alternating to 250 volts, direct current, with one marble panel switchboard, all complete.
1 Ironclad type, booster set, 90 amp., 110 volts to 275 amp., at 25 volts. Very fine; big bargain.

Latest Type Brand New Siemens & Halske Machines—Multipolar Motors.

Less than Cost of Manufacture.

1 4 H. P. 110-volt, type B, M. P., self-oiler.
2 5 H. P. 110-volt, Ironclad type, M. P., self-oilers.
1 5 H. P. 110-volt, bipolar type, self-oiler.
2 7½ H. P. 110-volt, Churchward type, M. P., self-oilers, slow speed, 650 R. P. M.
1 12 H. P. 110-volt, Ironclad type, M. P., self-oiler.
3 15 H. P. 110-volt, type B, M. P., self-oilers.
1 50 H. P. 110-volt, Ironclad type, M. P., self-oiler, slow speed.

GREGORY ELECTRIC CO.
54-62 S. CLINTON ST. CHICAGO.

TWO GREAT PURCHASES

THE ENTIRE STOCK OF
COMPLETED MACHINES, INSTRUMENTS AND SUPPLIES
...OF THE...
SIEMENS & HALSKE ELECTRIC CO.
OF AMERICA,
Contained in Their Immense Grant Works Chicago, Ill.

This company was one of the largest manufacturers of Electrical Apparatus in the world, and built high-grade apparatus only which always sold for higher figures than almost any other make. The General Electric Co recently obtained control of these works, closed them up and sold off the entire stock to the highest bidders. It was only by our offering to take the WHOLE STOCK that our offer was accepted. All ready for immediate shipment and delivered f. o. b. Chicago.

LESS THAN COST OF MANUFACTURE.

1 25 H. P. 220-volt, Ironclad type, M. P., self-oiler.
1 7½ H. P. 500-volt, Churchward type, M. P., self-oiler, slow speed.
1 15 H. P. 500-volt, Churchward type, M. P., self-oiler, slow speed.
2 40 H. P. 500-volt, Churchward type, M. P., self-oilers, slow speed, 425 R. P. M.
1 25 H. P. 125-volt, bipolar type, self-oiler.
2 35 H. P. 125-volt, bipolar type, self-oilers.

The following are NEARLY NEW, having been but slightly used for testing, etc.

Dynamos—Siemens & Halske.

1 100 K. W. motor-generator, 125 to 600 volts, direct-coupled on same base.
4 210-light bipolar type, self-oilers, 12 K. W., 125 volts.
6 350-light bipolar type, self-oilers, 20 K. W., 125 volts.
12 500-light bipolar type, self-oilers, 30 K. W., 125 volts.
1 1,350-light type I, M. P., self-oiler, 80 K. W., 125 volts, for direct connection.
1 1,200-light bipolar type, self-oiler, 70 K. W., 125 volts.
3 1,500-light bipolar type, self-oilers, 100 K. W., 125 volts.
1 1,000-light 50 K. W., single-phase, 60-cycle, inductor alternator, 1,100 volts. Fine.

Motors—Siemens & Halske.

4 15 H. P. 110-volt, bipolar type, self oilers, 12 K. W.
8 25 H. P. 110-volt, bipolar type, self-oilers, 20 K. W.
9 35 H. P. 110-volt, bipolar type, self oilers, 30 K. W.
1 90 H. P. 110-volt, bipolar type, self-oiler, 70 K. W.
2 125 H. P. 110-volt, bipolar type, self-oilers, 100 K. W.

ANOTHER GREAT PURCHASE.

We were the highest bidders for the entire stock of completed machines of the
GIBBS ELECTRICAL MFG. CO., Milwaukee,
and secured the whole lot. All these are brand new, latest type multipolar machines, ready for immediate shipment.

110-VOLT GIBBS, M. P. DYNAMOS—brand new.

4 35-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
2 55-light Gibbs, multipolar, self-oiling bearings, moderate speed, comp. wound.
4 55-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
4 110 light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
3 150-light Gibbs, multipolar, self-oiling bearings, moderate, comp. wound.
1 160-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
4 210-light Gibbs, multipolar, self-oiling bearings, slow speed.
4 300-light Gibbs, multipolar, self-oiling bearings, slow speed.

110-VOLT MOTORS—brand new.

4 3 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 4 H. P. Gibbs, multipolar, self-oiling bearings, moderate speed.
3 4 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
1 6 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 7½ H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
3 10 H. P. Gibbs, multipolar, self-oiling bearings, moderate speed.
2 10 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
3 15 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 20 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.

220-VOLT MOTORS—slightly used—excellent condition fully guaranteed.

25 5 H. P. Gibbs, multipolar, self-oiling bearings.

Special Sale of Fine Testing Instruments From the Engineering Department of Siemens & Halske.

Probably the Finest Equipment of Testing Apparatus Ever Installed in Any Factory.

Most of these instruments were purchased just prior to the absorption of this company by the General Electric company, and have never been used. This exceptional lot of instruments should appeal especially to colleges and schools desiring to increase their equipment with the finest instruments at a small expenditure.

Send for our MONTHLY BARGAIN SHEET containing complete list of machines in stock with lowest net cash prices.

BARGAINS in ELECTRICAL MACHINES.

The following list of thoroughly overhauled machines are in stock and ready for prompt delivery.

DYNAMOS—

110-Volt Incandescent.

One 12-light Elbridge.
One 50-light Nowotny, new.
One 100-light Daft.
One 250-light U. S.
One 350-light Davis.
One 800-light G. E.
One 1,800-light Ft. Wayne, new.

DYNAMOS—ARC.

One Brush, 1-light, 3,000 c. p.
One Brush, 3-light, 2,000 c. p.
One Amer. Wood, 20-light, 2,000 c. p.
One West. Elec., 30-light, 2,000 c. p.
One Ft. Wayne Wood, 35-light, 1,200 c. p.
One T. H. L. D., 35-light, 2,000 c p.

ALTERNATORS.

One 3A Slattery.
One A60 G. E.

STEWART ELECTRICAL CO.,
S. E. Cor. Fifth and Sycamore,
CINCINNATI, O.

GENERATORS.

One Wood b. p., 500 v., 45 k. w.
One T.-H. m.p. 75,500 v., 75 k.w.
One Edison b.p., 500 v., 100 k.w.

110-VOLT MOTORS.

One Diehl, ½ h. p.
One Edison, ¾ h. p.
One Elbridge, ¾ h. p.
One Card, 1 h. p.
One Sprague, 1 h. p.
One Nowotny, 3 h. p.
One Daft, 10 h. p.
One U. S., 20 h. p.
One Q. C., 28 h. p.

220-VOLT MOTORS.

One Nowotny, 1 h. p., new.
One Nowotny, 1 h. p.
One Davis, 5 h. p.
One Daft, 10 h. p.
One E. R. & C. C., 10 h. p.
One Edison b. p., 15 h. p.

500-VOLT MOTORS.

One Davis, 20 h. p.
One Brush, 25 h. p.
One Wood b. p., 60 h. p.
One T.-H. m. p. 15, 90 h. p.
One Edison, 100 k. w., 120 h. p.

WE EXCEL AND UNDERSELL ALL.

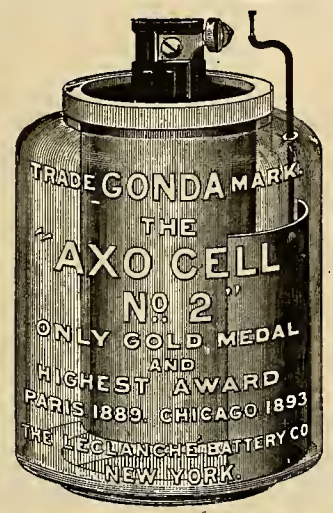
WE ARE SELLING

Battery Hanging Lamps	$10.00
Telephone, complete,	5.95
Electric Door Bells,	1.00
Electric Carriage Lights,	5.00
Battery Fan Motor,	5.95
Electric Hand Lanterns,	2.00
Pocket Flash Lights,	1.50
Miniature Electric Lamps,	.40
$8 Medical Batteries,	3.95
Genuine Electric Belts,	1.00
$12 Belt with Suspensory,	2.50
Genuine Electric Insoles,	.25
Telegraph Outfits,	2.75
Battery Motors from $1 to	12.00
Battery Table Lamps,	3.00
Necktie Lights, 75 cts. to	3.00
Bicycle Electric Lights,	2.25
Electric Cap Lights,	2.00
Electric Railway,	3.50
Battery Student Lamp,	4.00
Dry Batteries, per dozen,	2.25
Electric Books at low prices.	

We undersell all on Everything Electrical.

OHIO ELECTRIC WORKS
CLEVELAND, O.
Headquarters for Electric Novelties and Supplies.
Agents wanted. Send for New Catalogue, just out.

WRITE FOR CATALOGUE AND DISCOUNT SHEET.



The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,
111 to 117 East 131st St., N. Y.

New Dynamo Tenders' Hand-Book.

By F. B. BADT.

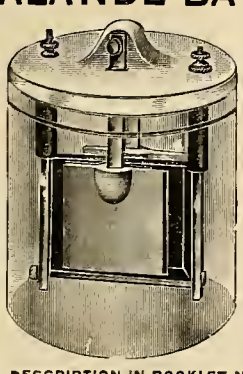
226 Pages, 140 Illustrations. Flexible Cloth Binding. Size of Type Page 5 1-2x3 inches. Price $1.00.

This is, as the name indicates, a NEW BOOK, much more complete than the old one, with all the information, instructions and rules which are required by practical men, as Dynamo Tenders, Linemen, Stationary Engineers and owners and operators of all kinds of Electric Plants. It is the only book of the kind published in the English language. 9,000 copies of the old Dynamo Tenders' Hand-Book sold, and over 10,000 of the new.

Electrician Publishing Co.,
510 Marquette Building, CHICAGO.

EDISON LALANDE BATTERIES.

FOR GAS ENGINES,
SLOT MACHINES,
AUTOMOBILES,
RAILROAD SIGNALS,
CROSSING BELLS,
SMALL MOTORS,
ETC.



CONSTANT CURRENT.
NO LOCAL ACTION.
WILL NOT FREEZE.
LIQUID TIGHT
CELLS FOR PORTABLE WORK.

FULL DESCRIPTION IN BOOKLET NO. 4.

EDISON MANUFACTURING COMPANY,
135 FIFTH AVENUE, NEW YORK.

INFORMATION

FOR MACHINERY USERS.

We are headquarters for Rebuilt Motive Power. Our machinery is absolutely warranted in every way. We cover all sales by a binding guarantee. Our stock is the most extensive in the land.

WE OFFER THE FOLLOWING, SUBJECT TO PRIOR SALE.

ENGINES.

S900 1 E. P. Allis Company tandem compound condensing engine.
H. P., nominal, 500.
Flywheel, 2 feet diameter by 40-inch face.
Cylinders, 22 and 42x48.
Guaranteed to operate on 15 pounds of steam per indicated horsepower.
This engine is in excellent condition. It is at present installed at Omaha, Neb.

S901 1 pair Williams automatic engines, coupled together.
Size, 17¾x24.
Revolutions, 200; builders' rating, 200; H. P., 200.

S902 2 Westinghouse compound engines, 13x22x13.
Revolutions, 290; H. P., 125.

S903—1 horizontal tangye bed, side crank automatic steam engine, made by Russel & Co.
Steam cylinder, 13x18.

S904 1 Wright automatic Corliss, 23x36.
S905 1 10x9 Westinghouse.
S906 1 8x12 Lansing automatic.
S907 1 7x12 Rice automatic.
S908 1 16x24 horizontal box bed, side crank.
S909 1 12x16 F. C. Wells horizontal tangye bed, side crank.
S910 10 9x12 engines, manufactured by George W. Tifft & Sons of Buffalo, N. Y.
S911 1 10x22 box bed, right hand, side crank.
S912 1 16x36-inch Corliss, left hand.
S913 1 9x16 Rice automatic.
S914 1 11x16x16 McEwen tandem compound.
S915 1 8x10 Atlas automatic, center crank.
S916 1 11x18 Sinker, Davis & Co.
S917 1 12x16 horizontal, box bed, side crank.
S918 1 10x14 automatic Wright & Adams.
S919 1 12x12 high-speed automatic Ideal.
S920 1 20x24 box bed, balance valve.

In addition to the above, we have on hand at all times a complete assortment of all size engines, ranging in power from 1 to 500 horsepower. Ask for our complete list.

BOILERS.

We still have on hand a few of Armour's 54x16, 60x16, 66x16, 66x18 and 72x18 horizontal tubular boilers. They are in excellent condition.

AIR COMPRESSORS.

S921 1 Duplex straight-line Clayton, 9x9.
S922 1 4½x6-inch Clayton.
S923 2 12x16. Will compress air up to 60 pounds' pressure, with 80 to 100 pounds' steam.

BELTING.

We carry at all times a complete stock of short-lap, double-thick leather belting, both new and second-hand. Our quotations are always 30 per cent. below lowest market values.

SHAFTING.

We carry a stock of all sizes of shafting.

STEAM PUMPS.

Ask for our complete list of steam pumps. We have all kinds.

Electrical Apparatus.

See our list of supplies in the Western Electrician of October 27.

A COMPLETE OUTFIT.

We purchased the following outfit:

S924 1 McEwen tandem compound engine, 8½x14x12, with a direct-connected multipolar compound-wound dynamo, capacity, 50 K. W. Included in this outfit is a 100-horsepower Sterling water-tube boiler, with full front grate bars, etc. Also a Duplex steam pump and a copper-tube heater.
It was used about 2½ years and replaced, owing to a necessary increase in power.

DYNAMOS, ETC.

1 500-light National, 1000 volts, alternating exciter, attached to shaft, complete with sliding base regulator and pulley, in first-class condition. Full description on application; also photograph.
1 Thomson-Houston, 400-light, compound-wound dynamo, new, 110 volts, 200 amperes, complete with sliding base, belt tightener and regulator.
1 Thomson-Houston, 500-light, compound-wound dynamo, 110-volt, 200-ampere, complete with sliding base, belt tightener and regulator.
1 United States Weston dynamo, 150-light, 100-volt, 75-ampere, complete with sliding base, belt tightener and regulator.
2 generators, 80 K. W. type, U. S. Westinghouse bipolar, 350 revolutions per minute, 550 volts, size of pulley, 54x18 inches; paper rim; side rails complete.
2 Field Rheostats Westinghouse three-jaw switches for throwing generators in multiple.
1 voltmeter Westinghouse, 0 to 600.
2 amp.-meters Westinghouse, capacity 0 to 160.
1 amp.-meter Westinghouse, capacity 0 to 300.
2 Westinghouse circuit-breakers.
3 Westinghouse lightning arresters.
3 Westinghouse switches, double throw.
1 electric elevator, manufactured by Keystone Electric company of Erie, Pa.; self-oiler, 60-ampere, No. 324, 220-volt, 1,025 revolutions; worm gear and cog are solid brass; 53 grooves for ⅝-inch cable on drum; drum 30-inch diameter by 22-inch face; the motor and gearing set on a cast-iron base; this outfit cost $1,400; the worm screw and shaft are cut from solid forging and are steel; the motor is 15 horsepower; the machine is geared to give a speed to the car of 150 feet per minute; was only in operation about four months.
1 Baxter 110-volt motor, 2-horsepower, good as new; complete and starting box base and tightener. Price.....$50.00
1 1000-light Slattery alternating-current dynamo, 1000-volt, complete with exciter and instrument. Practically as good as new.
1 2-horsepower Baxter motor, 100-volt, complete with starting box, base with belt tightener and pulley. First-class condition.

Our Machinery Hall is 200 X 360 feet.

Our complete list of items is contained in CATALOGUE No. 156.

CHICAGO HOUSE WRECKING CO.,
W. 35th and Iron Sts., Chicago.

LIGHTING—POWER—RAILWAY ELECTRICAL MACHINERY.

The following is but a small portion of our immense stock, which is constantly changing. We carry at our Brooklyn Works all the modern types of the best manufactures, such as GENERAL ELECTRIC, WESTINGHOUSE and other Standard Makes. ***SEND FOR LATEST CATALOG.***

Arc Dynamos.

2 125-light multi-circuit Brush, 2000 C. P.
2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, latest type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P., $1,500 each.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush, $575 each.

Direct-Current Dynamos. 110 Volts.

(Direct-Connected.)

2 100 K. W. Westinghouse, 8-pole, 225 R. P. M., direct-connected to McIntosh & Seymour compound engines.
1 75 K. W. Siemens & Halske, direct-connected to 12x14-inch straight line engine, 278 R. P. M.

Belted Dynamos. 110 Volts.

2 150 K. W. Edison bipolar.
4 60 K. W. Edison bipolar.
2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
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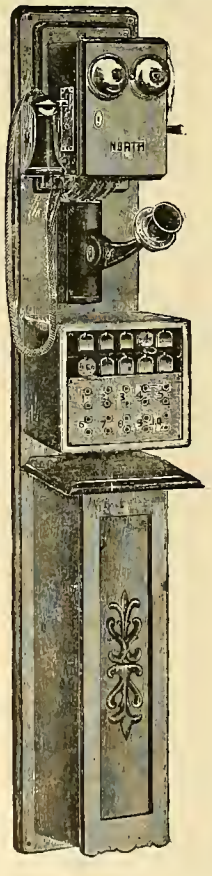

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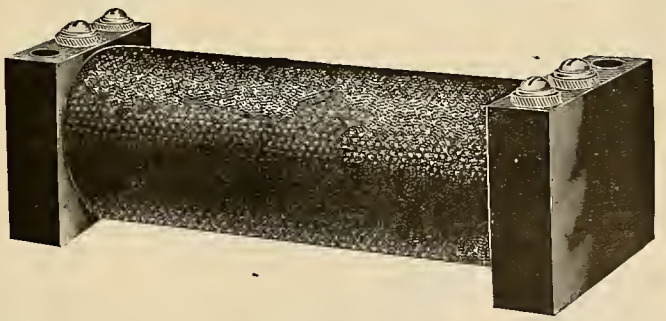

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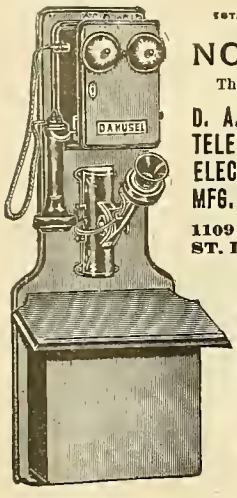

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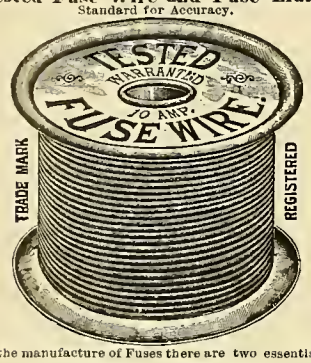

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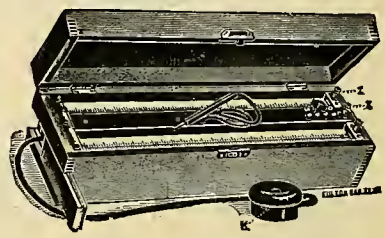

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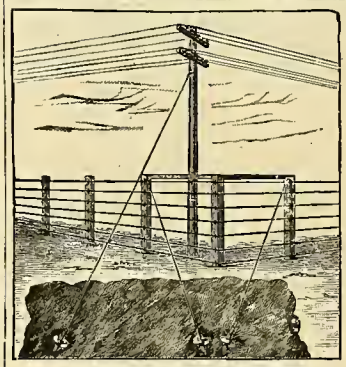

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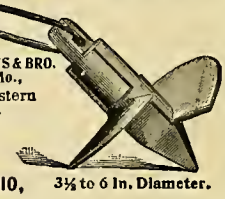

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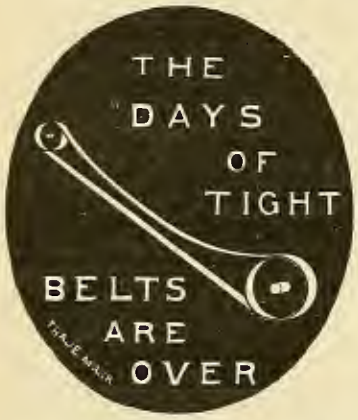

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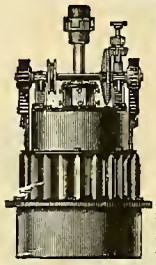
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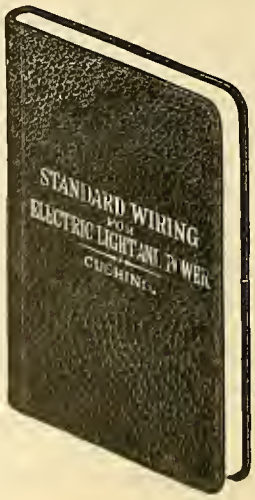

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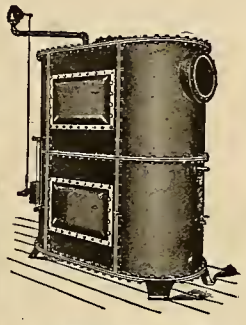

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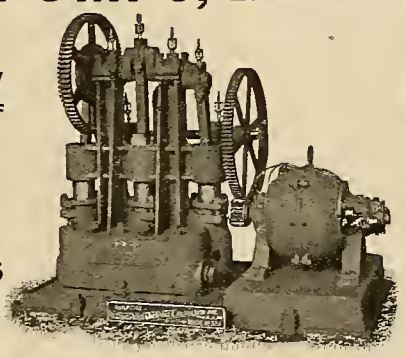

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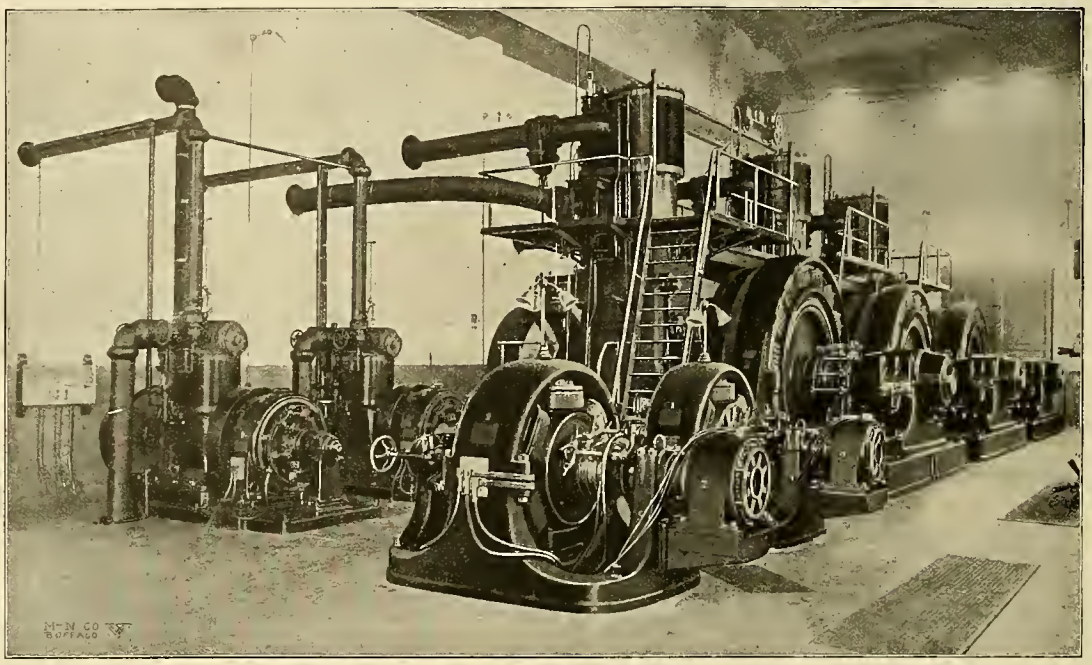

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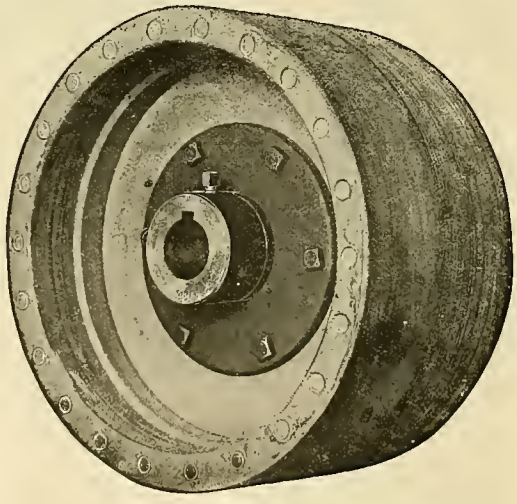

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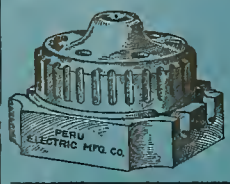

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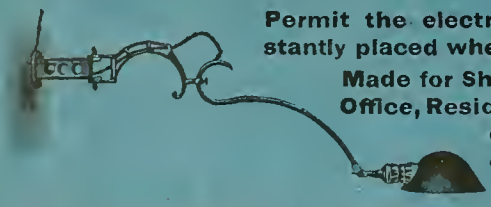

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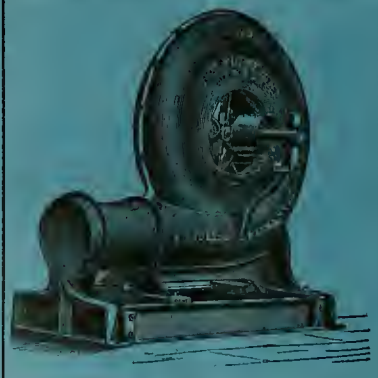

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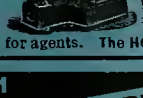

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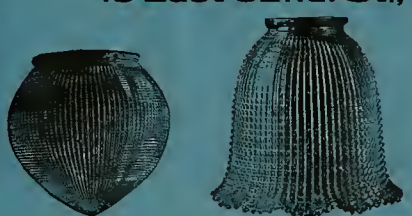

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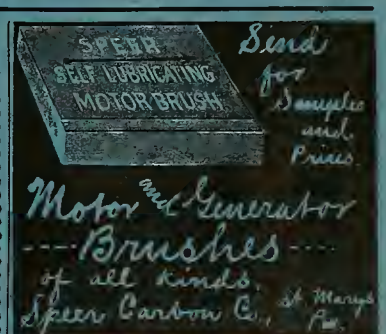

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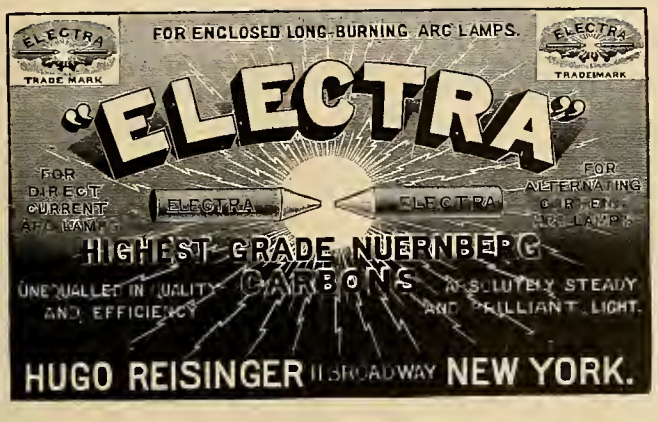

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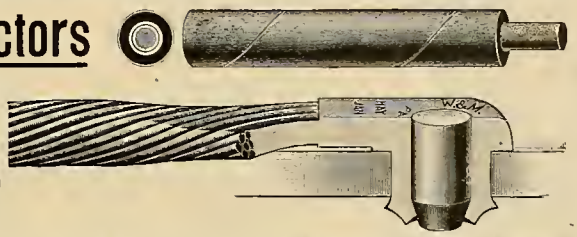

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

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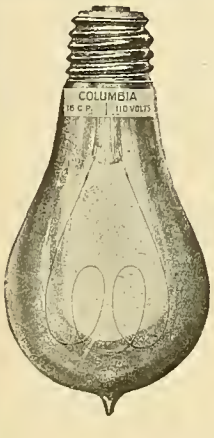

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(10923)

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FRONT OF THE BOARD TYPE

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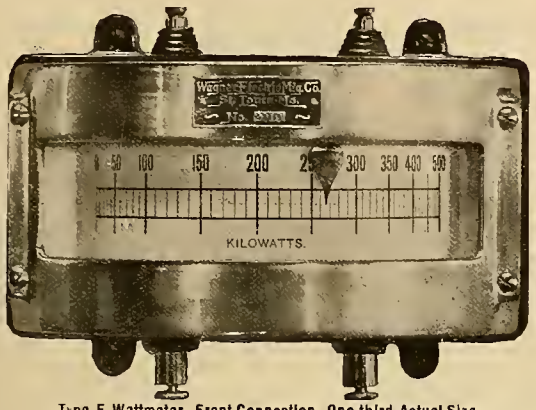

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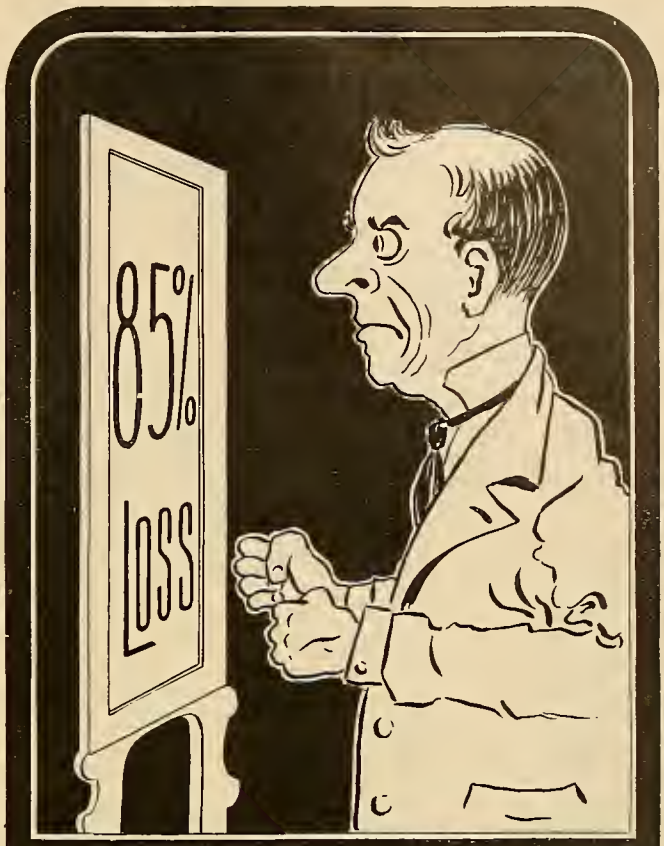

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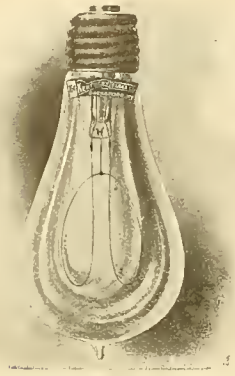

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Kartavert Mfg. Co.
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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
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American Electric Co.
American Elec Fuse Co.
American Electrical Works.
American Steel & Wire Co.
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Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
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Miller-Knoblock El. Mfg. Co.
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Phillips, Eugene F.
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Simplex Electrical Co.
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Western Elect. Supply Co.
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Central Electric Co.
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Klein & Son, Mathias.
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Mechanical Machinery.
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Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.
Meters.
Diamond Meter Co.
Fort Wayne Elec. Wrks, Inc.
General Inc. Arc Light Co.
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Mica
Chicago Mica Co.
Munsell & Co., Eugene.
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Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co
Siemens & Halske Electric Co of America.
Stanley Electrical Mfg. Co.
Westinghouse El. & Mfg. Co.
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Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.
Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G.
Phosphor Bronze.
Besly & Co., Chas. H.
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Gt. West. Sm. and RefiningCo.
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Davis & Stitt Co.
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Pittsburg & L. S. Iron Co.
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Stilwell-Bierce Smith-Vaile.
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Garl Electric Co.
Refiners.
Gt. West. Sm. and Refining Co.
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Amer. Reflector & Ltg. Co.
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Queen & Co.
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New York Insulated Wire Co.
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General Electric Co.
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Rossiter, Mac Govern & Co.
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Stilwell-Bierce Smith-Vaile.
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Vulcanized Fibre.
Vulcanized Fibre Co.
Wire, Bare.
American Electric Co.
American Steel & Wire Co.
Besly & Co., Chas. H.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
Independent Tel. Supply Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co.
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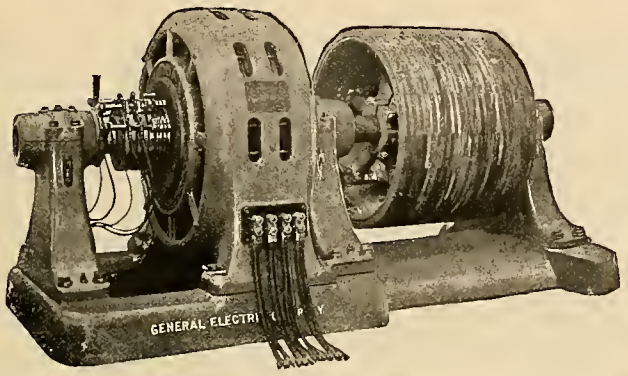
Western Electrical Sup. Co.
Woodwork, Electrical.
Noblett, E. J.
X-Ray Outfits.
Queen & Co.

For Alphabetical Index of Advertisements See Page III.

THE GENERAL ELECTRIC COMPANY'S

Compensated Alternator



500-kw. G E Compensated Revolving Field Combined Alternator and Direct Coupled Exciter.

Automatically maintains accurate voltage regulation under all the varying conditions of incandescent and arc lighting and power service : : : : : : : : : : :

WRITE FOR BULLETIN No. 4206.

GENERAL OFFICE: SCHENECTADY, N. Y.

CHICAGO OFFICE, MONADNOCK BUILDING. SALES OFFICES IN ALL LARGE CITIES.

YOU CAN OPERATE YOUR

Series Alternating Arc Lamps

DIRECT ON YOUR MAINS.

No regulator or automatic transformer required.
Constant current at all loads. Lamps are protected against short circuits.
Minimum cost of installation—Minimum cost of maintenance.
3 lamps in series on 220 to 240 volts.
7 lamps in series on 500 to 550 volts. 13 lamps in series on 1,000 volts.
Any number of lamps in series by using step-up or step-down transformer.
Write for our bulletin 7007.

WESTERN ELECTRIC COMPANY,

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LONDON: Bridge Chambers, 171 Queen Victoria Street, E. C. and North Woolwich, E.

ANTWERP: 32 Rue Boudewyns. PARIS: 46 Avenue de Breteuil.

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FOR

CENTRAL STATIONS,
STREET RAILWAYS
AND
ISOLATED PLANTS.

NO CAST PLATES. NO PERFORATIONS.

NO APPLIED PASTE. NO INFRINGEMENT.

STORAGE BATTERY PLANT OF THE KANSAS CITY ELECTRIC LIGHT COMPANY.

ONE OF THE LARGEST AND MOST SUCCESSFUL INSTALLATIONS WEST OF THE MISSISSIPPI RIVER.

HIGH EFFICIENCY. GREAT CAPACITY.

SUPERIOR ELECTRICAL CHEMICAL FORMATION.

HELIOS-UPTON COMPANY,

PHILADELPHIA, PA.

CHICAGO, ILL. PEABODY, MASS.

THE HELIOS-UPTON STORAGE BATTERY IS NO EXPERIMENT.

KANSAS CITY Electric Light Company.
GENERAL OFFICE.
KANSAS CITY, MO.

Nov 9 1900

Helios-Upton Company
Chicago ILL

Mr King Upton,

My dear Sir:

Your favor of recent date received and in answer would say that up to date the battery installed by your company for the Kansas City Electric Light Company has worked in an entirely satisfactory manner and is of the greatest assistance to us on the peaks of our load . While it has not been in operation but a comparatively short time, the general construction of the battery, the manner in which it has been installed and workmanship would indicate that we have an equipment second to none in the country.

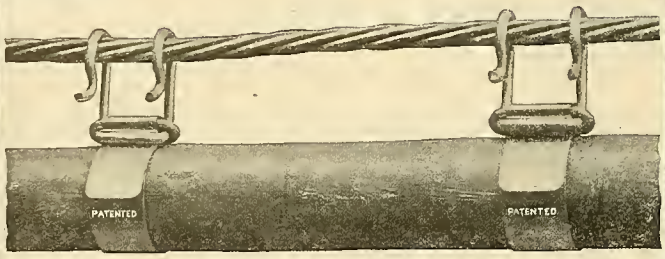
Very truly yours,

Kansas City Electric Light Company

C. B. Richardson
General Manager

IT IS AN ACCOMPLISHED FACT, AS THE ABOVE LETTER SHOWS.

BOSTON CABLE CLIP!



The largest telephone companies in the country are using them exclusively

BECAUSE THEY ARE:

THE BEST.
THEY WILL NOT SLIP.
THE MOST ECONOMICAL.
ADJUSTABLE TO ANY SIZE CABLE.
THE MOST DURABLE.

(Millions NOW in use.)

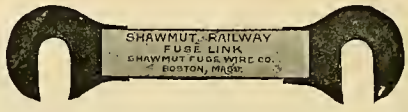
CHASE-SHAWMUT CO. (Sole Mfrs.)
BOSTON, MASS.

REWARD.

Any Street Railway by using

"Shawmut" Standard Fuses

will be amply rewarded and protected.



Protect your Lighting circuits and car heaters with

"Cartwright" Enclosed Fuses

and your troubles will cease.

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AMERICAN BRIDGE CO.

GENERAL OFFICES:
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DESIGNERS AND BUILDERS OF

ALL CLASSES OF METALLIC STRUCTURES.

We have decided to carry at all our plants a large stock of raw material from which we can furnish with great promptness any ordinary order for Steel Bridges, Roofs, Buildings, Columns, Girders, Beams, Channels, Angles, Plates, etc., etc.

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A TESTIMONIAL OF MERIT.

(Taken from the Army and Navy Magazine.)

An exhibit at the Paris Exposition showing ingenuity and skill in its compilation was that of the Pacific Electric Company of La Crosse, Wisconsin, in group V, class 25, consisting of incandescent desk lamps. There they showed goods of this character in the many different patterns and designs for which their products are noted – in fact, they far surpassed many similar kinds of foreign manufacture shown in the same group.

Americans who saw this display could not but feel proud of the display of the company, for it showed to all visitors what an enterprising firm can do when it tries and what kind of products they can produce for their patrons. As a result of this fine exhibit, the above company is now the recipient of increased orders from abroad and at home. Government officials should write for prices.

Send for Catalogue and Discount.

DEARBORN

Drug and Chemical Works,
Laboratories---Water Chemists.
Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

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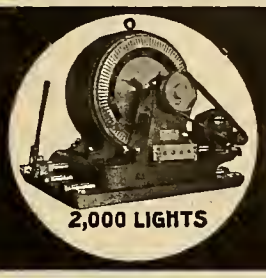

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Alden Electric Co.

(Formerly Alden & Co.)

WILL OCCUPY THEIR BUILDING AT

52 and 54 W. Van Buren St., Chicago,

on and after October 1st and will have in stock

All Lines of General Electric Supplies.

"Crescent" Rubber Covered. Insulated Wires and Cables, "Index Brand" Weatherproof.

PITTSBURG TRANSFORMERS. "L.-H." ENCLOSED ARC LAMPS.

UP-TO-DATE ELECTRICAL GOODS.

This Trade-Mark on Sockets, Receptacles, Rosettes, Maine and Branches, Edison Cut-Outs Knife Switches, Jenkins Snap Switches, etc. Guarantees Satisfaction

PHILADELPHIA. H. T. PAISTE CO. CHICAGO.

ELECTROLYSISPROOF CONDUITS.

Electrolysisproof Linings and Coverings.

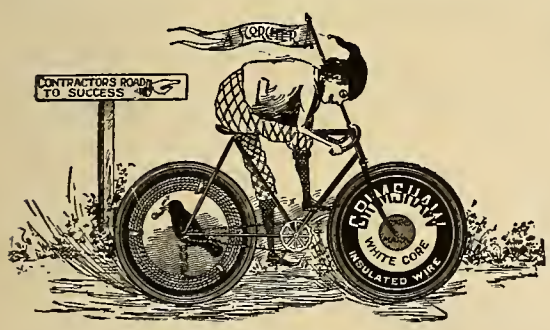
Two of the best known non-conductors of the electric age combined.

An absolute non-conductor. Perfect insulation guaranteed. Water-tight joints. No scratching of cables. No deterioration. Costs less laid in complete state than any conduit on market. Quickly and easily handled. No skilled workmen required. Made in 7-foot lengths; 3-in. internal diameter; weight, 21b. to foot; made in desired sizes from 2 in. to 10 in. Manufacturers of Electrolysisproof Insulating Materials, Distributing Box and Post Linings, Pipe Coverings, Etc.

ASPHALT PAPER CONDUIT

COMPOSED OF ASPHALT AND PAPER.

ELECTROLYSISPROOF CONDUIT MFG. CO., OFFICE, 605 Manhattan Building, CHICAGO, ILL. FACTORY, BLUE ISLAND.



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RAVEN WHITE CORE, RAVEN BLACK CORE, COMPETITION LINE WIRE, GRIMSHAW AND COMPETITION TAPES AND SPLICING COMPOUNDS.

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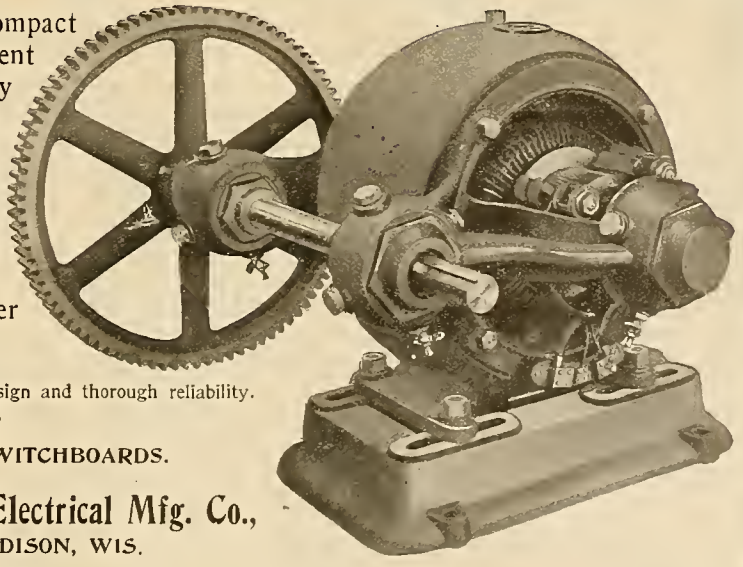
Northern Motors are of such compact and convenient design that they are easily adapted to work in any situation or combination. The type shown in the illustration can be used with or without the base; fastened to side post or inverted against ceiling and used as a shaft hanger, passing the line shaft through the back gear bearings or coupling to the short shaft.

We build all sizes of **Generators** and **Motors** for either

Alternating or Direct Current.



The "S. K. C." and Northern systems are unequaled for simplicity of design and thorough reliability. Inquiries promptly and carefully answered.

TRANSFORMERS. INSTRUMENTS. SWITCHBOARDS.

Stanley Electrical Mfg. Co., PITTSFIELD, MASS. | Northern Electrical Mfg. Co., MADISON, WIS.

THEY ARE SIMPLE.

SIMPLE TO MAKE,
For they have but few parts.

SIMPLE TO CARE FOR,
For the very same reason.

SIMPLE TO SELL,
For the very same reason again.

The only arc lamps built especially to burn on street railway circuits.

They are made for all circuits.

THOUSANDS IN USE. - ALWAYS SATISFACTORY.

We are speaking, of course, of the A-B Arc Lamp.

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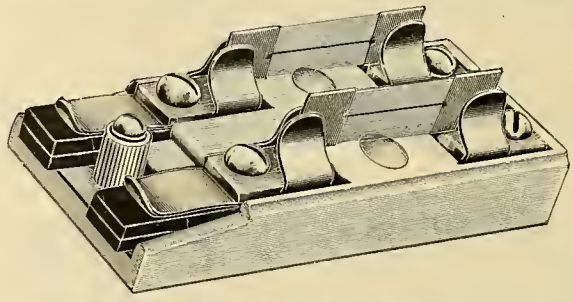
FUSES. FUSE BLOCKS.

FUSE WIRE



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AMERICAN ELECTRIC FUSE CO.,
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INDIA & AMBER **MICA** IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.
EMPIRE INSULATED Cloths and Papers.
M·I·C· COMPOUND UNEQUALED.
Eugene Munsell & Co. Mica Insulator Co.
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WRITE FOR SAMPLES AND PRICES.

PERFECT **MICANITE** INSULATOR REGISTERED

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HERBERT A. WAGNER,
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Permanent Accuracy Guaranteed.
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Consulting Electrical Engineer.
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ELECTRIC POWER TRANSMISSION.
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YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
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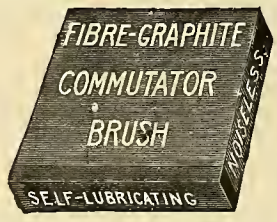
The Fibre-Graphite Commutator Brush.
(U. S. and Foreign Patents.)
No Sparking Under Varying Load.
No Wear on Commutator.
No Shifting of Quadrant.
80 per cent. Pure Graphite.
For Sample Order, and Prices, write to
Holmes Fibre-Graphite Mfg. Co.,
5155 Wakefield St., Germantown, PHILADELPHIA.



Happiness and Satisfaction always attend the burying of McRoy conduits.

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COAL AND ASHES HANDLING
MACHINERY, SHAFTING, PULLEYS, CLUTCHES, PATENT MACHINE-MOULDED ROPE SHEAVES, ETC.
CATALOGUE UPON APPLICATION.
LINK-BELT MACHINERY CO.,
Engineers, Founders, Machinists.
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CREAM FLUX

AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

ENDORSED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS AND ALL USERS.

YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

THIS IS WHAT ONE USER HAS TO SAY OF IT:

"AFTER having tried the various soldering salts on the market, and after giving your Cream Flux severe tests on heavy cable connections, and on the finest stranded flexible drop cord work, we can safely say it meets all claims you make for it. I consider it one of the best ever offered for sale. Very truly,
"Per J. H. Goebel, Constr. Supt. CHICAGO EDISON CO."

FOR SALE BY ALL SUPPLY HOUSES OR

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THOMSON'S

New Double Focus Tubes have been designed for use with heavy transformer sets, giving more than 12-inch spark, and are equipped with our new adjuster, by means of which the proper degree of vacuum can be maintained.

Send for Catalogue No. 9050.

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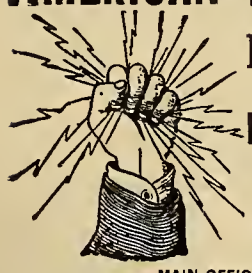
PROVIDENCE, R. I.



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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

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CHAS. G. PAGE,

PATENT ATTORNEY,

185 Dearborn Street, Chicago, Ill.,

Has attended to all of our patent matters continuously since 1891. Morgan & Wright, Chicago.

Six Years with General Electric Company.

THOMAS J. JOHNSTON,

Counsellor at Law,

No. 66 Broadway, - NEW YORK CITY.

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STEEL OUTLET AND JUNCTION BOXES, SWITCHBOARDS, PANEL BOARDS, SWITCHES, ETC.

UTICA, NEW YORK.

WE EXCEL AND UNDERSELL ALL.

WE ARE SELLING

Battery Hanging Lamps	$10.00
Telephone, complete, -	5.95
Electric Door Bells, - -	1.00
Electric Carriage Lights,	5.00
Battery Fan Motor, - -	5.95
Electric Hand Lanterns,	2.00
Pocket Flash Lights, -	1.50
Miniature Electric Lamps,	.40
$8 Medical Batteries, -	3.95
Genuine Electric Belts,	1.00
$12 Belt with Suspensory,	2.60
Genuine Electric Insoles,	.25
Telegraph Outfits, - -	2.75
Battery Motors from $1 to	12.00
Battery Table Lamps, -	3.00
Necktie Lights, 75 cts. to	8.00
Bicycle Electric Lights,	2.25
Electric Cap Lights, -	2.00
Electric Railway, - -	3.50
Battery Student Lamp, -	4.00
Dry Batteries, per dozen,	2.25
Electric Books at low prices.	

We undersell all on Everything Electrical.

OHIO ELECTRIC WORKS
CLEVELAND, O.
Headquarters for Electric Novelties and Supplies. Agents wanted. Send for New Catalogue, just out.

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Through Sleeping and Dining Car service via NICKEL PLATE or WABASH from Chicago. Passengers via this favorite route arrive in New York at Up Town Station, 42d Street, the center of the Hotel and Shopping District, or Down Town at Franklin Street Station, in close proximity to all Ocean Steamship Docks, Jersey City and Brooklyn.

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GENERAL INCANDESCENT ARC LIGHT CO.,

Factory and General Offices: 572-578 FIRST AVENUE, NEW YORK.

TRADE G. I. MARK.

Manufacturers of HIGH-GRADE ELECTRICAL SUPPLIES.

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

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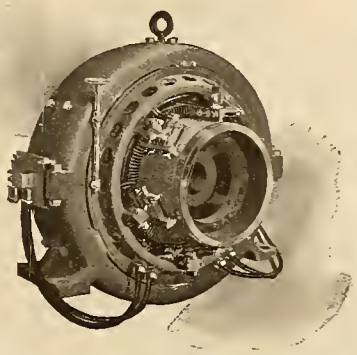

THE LUNDELL "SPLIT-POLE" GENERATOR

Is so named because of the peculiar construction of the pole pieces. It is the most efficient Generator on the market. Its remarkable advantages are fully described in our Catalogue No. 03100. Free on application.

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General Offices: 527-531 West 34th Street, NEW YORK.

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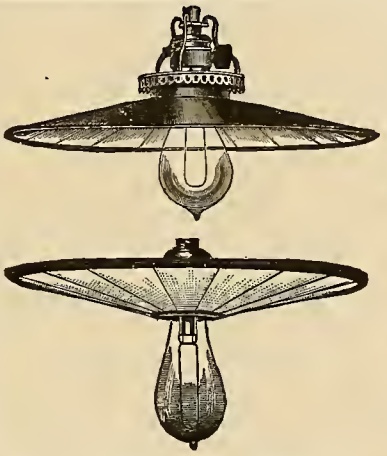

SILVER-PLATED MIRROR REFLECTORS.

A flat Reflector, for use with any system of incandescent electric light, where it is desired to spread the light considerably. Its silver-plated mirror plate lining makes it most effective and pleasing, and always as good as new.

Convex, reflecting slightly below the horizontal in all directions. Used in stores, etc., for general illumination.

GET OUR PRICES.

American Reflector & Lighting Co.,

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EDISON LALANDE BATTERIES.

FOR GAS ENGINES,
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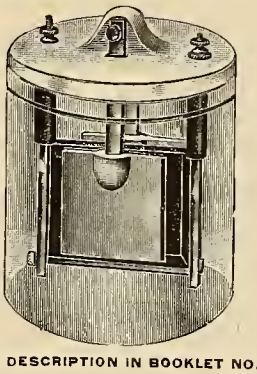

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NO LOCAL ACTION.
WILL NOT FREEZE.
LIQUID TIGHT
CELLS FOR PORTABLE WORK.

FULL DESCRIPTION IN BOOKLET NO. 4.

EDISON MANUFACTURING COMPANY,
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TRADE MARK CRYSTAL

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MANUFACTURERS
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WANTED.

A FIRST-CLASS ELECTRICIAN.

WRITE

A. G. WHITNEY,

ST. CLOUD, MINN.

WANTED.

Position as electrician, engineer or superintendent of a lighting or railway plant. Have good practical experience and a thorough technical training. Thoroughly familiar with construction work. Am willing to invest in well located plant or will lease. First-class references. Address "L. M. S.," care Western Electrician, 510 Marquette Bldg., Chicago.

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By electrician and engineer. 16 years' experience operating Lighting and Street Railway Systems. Good armature winder. References furnished. Address "ARMATURE," care Western Electrician, 510 Marquette Bldg., Chicago.

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Position as superintendent, electrician or assistant, in a power or lighting plant. Have had 4 years' experience in power and lighting plant. Am single, do not drink, and can give good references. Address "E. F.," care of Western Electrician. 510 Marquette Bldg., Chicago

WANTED TO BUY.

We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

CAMP ENGINEERING CO.,

18 South Canal Street, Chicago, Ill.

FOR SALE.

Ninety second-hand telephone instruments of best make. Are comparatively new and in good condition. Would consider proposition to place them in new exchange for part interest. W. C. DUGAN, Searcy, Ark.

WE BUY AND SELL

SECOND-HAND ELECTRICAL MACHINERY.

WALSH'S SONS & CO.,

150 WASHINGTON ST., NEWARK, N. J.

WANTED TO BUY.

One hundred to two hundred dynamos, from 50 to 100 lights, for export trade. Will pay spot cash. Address "EXPORTER," care Western Electrician 510 Marquette Bldg., Chicago.

FOR SALE—A BARGAIN.

Thirty 200-ampere-hour storage-battery elements, Chloride Accumulator make. Also 150 hard rubber cells, 7x7x10½ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

EXCEPTIONAL BARGAINS!

4—45-K. W., Edison, bipolar, 110-volt dynamos.
1—New 40-K. W., Stanley, two-phase, 2,000-volt alternator.
1—400-ampere-hour, Chloride Accumulator Co., storage battery.
1—15 x 14 Ideal engine.
1—14½ x 15 McIntosh & Seymour engine.
2—18½ x 18 Ideal engines.
1—20x36x18 Ball, cross-compound engine.
1—7½ x 5 x 6 Duplex feed pump.
1—1,000-H. P. Austin open heater.

Write for our latest price list No. 40.

ILLINOIS MAINTENANCE COMPANY,
E. H. CHENEY, Mgr. 204 Dearborn St., Chicago.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

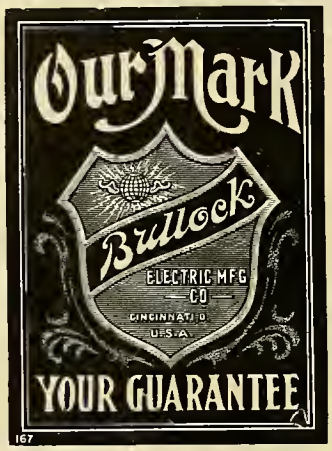
SCHUREMAN & HAYDEN,

140 S. Clinton St., Chicago.

BIDS FOR LIGHTING.

The City of Big Rapids will receive bids to and including December 3d next, at seven o'clock P. M., for the furnishing of not less than fifty street lights. Bids to be made for twelve hundred and two thousand candlepower lights. Bids to be made upon the midnight, moonlight and all-night schedules, and for one, three or five year contract. All bids to be accompanied by certified check for $300 00. The right is reserved to reject any or all bids.

Address correspondence to City Clerk,
Dated Oct. 25, 1900. Big Rapids, Mich.



PROPOSALS FOR ELECTRIC LIGHTING.

Bids are hereby invited for the electric lighting of the city of Shreveport, La., for a period of five years, from June 1, 1901.

The system shall be the Thomson-Houston, the General Electric, or equally as good.

The number of arc lights to be not less than one hundred, and subject to be increased to two hundred.

Bids shall specify the charge for arc lights, and also for incandescent lights. Bids shall also specify the maximum charge to be made for private consumers of arc and incandescent lights.

A certified check for $2,500 to accompany each bid.

The city reserves the right to reject any and all bids.

The successful bidder shall be required to give bond for faithful performance.

The arc lights for street lighting shall burn every night, and shall be at least 2,000 candlepower.

All bids shall be in the hands of the comptroller by 6 p. m. of December 1, 1900.

N. B. MURFF, Comptroller,
City of Shreveport, La.

BUY YOUR BOOKS

FROM THE

Electrician Pub. Co., 510 Marquette Bldg., Chicago.

BECKER BROTHERS

39-43 W. WASHINGTON ST., CHICAGO.

REPAIRS

For Everything Electrical, including NATIONAL ELECTRIC CO.'S MACHINES.

Manufacturers of the Celebrated "Perfection" Brushes for Dynamos and Motors.

Latest Type Brand New Siemens & Halske Machines—Multipolar Generators.

1 65-light type B, 125-volt generator, self-oiler, M. P., slow speed.
2 80-light Ironclad type, 125-volt generators, self-oilers, M. P.
1 80-light bipolar type, 125-volt generator, self-oiler.
1 110-light Churchward type, slow speed, 125-volt generator, M. P., 650 R. P. M.
2 180-light Ironclad type, 125-volt generators, M. P., self-oilers.
2 210-light-type B, 12 K. W., 125-volt generators, M. P., self-oilers.
2 350-light bipolar type, 20 K. W., 125-volt generators, self-oilers.
2 500-light bipolar type, 125-volt generators, 30 K. W., self-oilers.
1 700-light Ironclad type, 125-volt generator, self-oiler, slow speed.
1 Ironclad type, 30 K. W., 250-volt, slow speed, M. P., self-oiler.
2 Churchward type, 35 K. W., 500-volt, slow speed, M. P., self-oilers, 475 R. P. M.
1 Churchward type, 50 K. W., 250-volt, slow speed, for direct connection.
1 Churchward type, 100 K. W., 250-volt, slow speed, for direct connection.
1 marble panel switchboard for same, extra.
1 type six-pole, 100 K. W., 125 volts, for direct connection.
1 Churchward, 50 K. W., 1,100 volts, 60-cycle alternator, single phase, with exciter.
1 Churchward, 50 K. W., two-phase, 60-cycle, rotary transformer, with exciter, 1,000 volts alternating to 250 volts, direct current, with one marble panel switchboard, all complete.
1 Ironclad type, booster set, 90 amp., 110 volts to 275 amp., at 26 volts. Very fine; big bargain.

Latest Type Brand New Siemens & Halske Machines—Multipolar Motors.

Less than Cost of Manufacture.

1 4 H. P. 110-volt, type B, M. P., self-oiler.
2 5 H. P. 110-volt, Ironclad type, M. P., self-oilers.
1 5 H. P. 110-volt, bipolar type, self-oiler.
2 7½ H. P. 110-volt, Churchward type, M. P., self-oilers, slow speed, 650 R. P. M.
1 12 H. P. 110-volt, Ironclad type, M. P., self-oiler.
3 15 H. P. 110-volt, type B, M. P., self-oilers.
1 50 H. P. 110-volt, Ironclad type, M. P., self-oiler, slow speed.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO.

TWO GREAT PURCHASES

THE ENTIRE STOCK OF

COMPLETED MACHINES, INSTRUMENTS AND SUPPLIES

...OF THE...

SIEMENS & HALSKE ELECTRIC CO.

OF AMERICA,

Contained in Their Immense Grant Works Chicago, Ill.

This company was one of the largest manufacturers of Electrical Apparatus in the world, and built high-grade apparatus only which always sold for higher figures than almost any other make. The General Electric Co recently obtained control of these works, closed them up and sold off the entire stock to the highest bidders. It was only by our offering to take the WHOLE STOCK that our offer was accepted. All ready for immediate shipment and delivered f. o. b. Chicago.

LESS THAN COST OF MANUFACTURE.

1 35 H. P. 220-volt, Ironclad type, M. P., self-oiler.
1 7½ H. P. 500-volt, Churchward type, M. P., self-oiler, slow speed.
1 15 H. P. 500-volt, Churchward type, M. P., self-oiler, slow speed.
2 40 H. P. 500-volt, Churchward type, M. P., self-oilers, slow speed, 425 R. P. M.
1 25 H. P. 125-volt, bipolar type, self-oiler.
2 35 H. P. 125-volt, bipolar type, self-oilers.

The following are NEARLY NEW, having been but slightly used for testing, etc.

Dynamos—Siemens & Halske.

1 100 K. W. motor-generator, 125 to 500 volts, direct-coupled on same base.
4 210-light bipolar type, self-oilers, 12 K. W., 125 volts.
6 350-light bipolar type, self-oilers, 20 K. W., 125 volts.
12 500-light bipolar type, self-oilers, 30 K. W., 125 volts.
1 1,350-light type I. M. P., self-oiler, 80 K. W., 125 volts, for direct connection.
1 1,200-light bipolar type, self-oiler, 70 K. W., 125 volts.
3 1,500-light bipolar type, self-oilers, 100 K. W., 125 volts.
1 1,000-light 50 K. W., single-phase, 60-cycle, inductor alternator, 1,100 volts. Fine.

Motors—Siemens & Halske.

4 15 H. P. 110-volt, bipolar type, self-oilers, 12 K. W.
8 25 H. P. 110-volt, bipolar type, self-oilers, 20 K. W.
9 35 H. P. 110-volt, bipolar type, self-oilers, 30 K. W.
1 90 H. P. 110-volt, bipolar type, self-oiler, 70 K. W.
2 125 H. P. 110-volt, bipolar type, self-oilers, 100 K. W.

ANOTHER GREAT PURCHASE.

We were the highest bidders for the entire stock of completed machines of the

GIBBS ELECTRICAL MFG. CO., Milwaukee,

and secured the whole lot. All these are brand new, latest type multipolar machines, ready for immediate shipment.

110-VOLT GIBBS, M. P. DYNAMOS—brand new.

4 25-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
2 55-light Gibbs, multipolar, self-oiling bearings, moderate speed, comp. wound.
4 55-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
4 110 light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
3 150-light Gibbs, multipolar, self-oiling bearings, moderate, comp. wound.
1 150-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
4 210-light Gibbs, multipolar, self-oiling bearings, slow speed.
4 300-light Gibbs, multipolar, self-oiling bearings, slow speed.

110-VOLT MOTORS—brand new.

4 3 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 4 H. P. Gibbs, multipolar, self-oiling bearings, moderate speed.
3 4 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
1 6 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 7½ H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
3 10 H. P. Gibbs, multipolar, self-oiling bearings, moderate speed.
2 10 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
3 15 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 20 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.

220-VOLT MOTORS—slightly used—excellen condition fully guaranteed.

25 5 H. P. Gibbs, multipolar, self-oiling bearings.

Special Sale of Fine Testing Instruments From the Engineering Department of Siemens & Halske.

Probably the Finest Equipment of Testing Apparatus Ever Installed in Any Factory.

Most of these instruments were purchased just prior to the absorption of this company by the General Electric company, and have never been used. This exceptional lot of instruments should appeal especially to colleges and schools desiring to increase their equipment with the finest instruments at a small expenditure.

Send for our MONTHLY BARGAIN SHEET containing complete list of machines in stock with lowest net cash prices.

WANTED FOR SPOT CASH
BURNED OUT INCANDESCENT LAMPS AND BASES.
Freight Paid and Highest Prices Guaranteed.
GEO. F. SCHWALM CO., - HARRISON, N. J.

WE DO REPAIRING.
The satisfactory kind that brings your second order.

Armatures, transformers and fields rewound. Commutators refilled. Machines rebuilt. All work guaranteed. Low prices. Write us.

GENERAL ELECTRICAL REPAIR CO.,
L. D. Telephone, Main 5114. 141 S. Clinton Street, CHICAGO.

OUR STUDENTS SUCCEED

Hundreds of students in the electrical courses are receiving more salary for fewer hours' work than when they enrolled. The instruction given by these schools qualifies students for advanced positions in all branches of engineering.

When I enrolled, I was employed as repairman on electric cars. Owing to your thorough instruction, I was advanced in succession to wireman, dynamo tender and general electrician, and afterward was foreman of the electric shop of the Brooklyn Rapid Transit Company. I now hold an excellent position with the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. H. EDW. KEFFER, E. Pittsburg, Pa.

I enrolled in the Electrical Engineering Course and secured a position at once with the Commonwealth Electric Co., at wiping machines, but was soon promoted to South Chicago Electric-Light Plant, as night dynamo tender. Through the assistance of the Schools, I secured my present position as night dynamo tender for the Pullman Company. My salary averages three times what I was getting in my first position.
ANDREW A. STEWART,
135 77th St., Sta. S, Chicago, Ill

ELECTRICAL COURSES:

ELECTRICAL ENGINEERING,
ELECTRICAL,
ELECTRIC POWER AND LIGHTING,
ELECTRIC RAILWAYS,
ELECTRIC LIGHTING,
ELECTRIC CAR RUNNING,
TELEGRAPHY,
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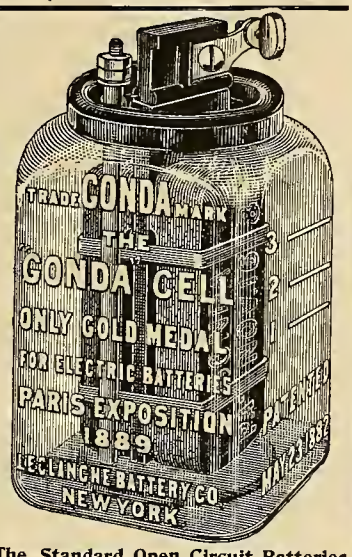
Also courses in Steam, Mechanical, Civil and Mining Engineering, Architecture, Drawing and Designing, Chemistry, English and Commercial Branches.

When writing state subject in which interested.

International Correspondence Schools,
Box 1002, Scranton, Pa.



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SEND FOR CIRCULAR AND PRICES.
THE LECLANCHÉ BATTERY CO.,
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AMERICA'S MOST POPULAR RAILROAD
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PERFECT PASSENGER SERVICE BETWEEN

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Through Pullman service between Chicago and

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If you are contemplating a trip, any portion of which can be made over the Chicago & Alton, it will pay you to write to the undersigned for maps, pamphlets, rates, time tables, etc.
GEO. J. CHARLTON,
General Passenger and Ticket Agent,
CHICAGO, ILLINOIS.

ELECTRO GALVANIZED CONDUIT
INTERIOR AND UNDERGROUND CONDUIT AND ALL FITTINGS
RICHMONDT CONDUIT CO.
MILWAUKEE U.S.A.

INFORMATION

FOR MACHINERY USERS.

We are headquarters for Rebuilt Motive Power. Our machinery is absolutely warranted in every way. We cover all sales by a binding guarantee. Our stock is the most extensive in the land.

WE OFFER THE FOLLOWING, SUBJECT TO PRIOR SALE.

ENGINES.

S900 1 E. P. Allis Company tandem compound condensing engine.
H. P., nominal, 500.
Flywheel, 2 feet diameter by 40-inch face.
Cylinders, 22 and 42x48.
Guaranteed to operate on 15 pounds of steam per indicated horsepower.
This engine is in excellent condition. It is at present installed at Omaha, Neb.

S901 1 pair Williams automatic engines, coupled together.
Size, 17¾x24.
Revolutions, 200; builders' rating, 200; H. P., 200.

S902 2 Westinghouse compound engines, 13x22x13.
Revolutions, 290; H. P., 125.

S903—1 horizontal tangye bed, side crank automatic steam engine, made by Russel & Co.
Steam cylinder, 13x18.

S904 1 Wright automatic Corliss, 23x36.

S905 1 10x9 Westinghouse.

S906 1 8x12 Lansing automatic.

S907 1 7x12 Rice automatic.

S908 1 16x24 horizontal box bed, side crank.

S909 1 12x16 F. C. Wells horizontal tangye bed, side crank.

S910 10 9x12 engines, manufactured by George W. Tifft & Sons of Buffalo, N. Y.

S911 1 10x22 box bed, right hand, side crank.

S912 1 16x36-inch Corliss, left hand.

S913 1 9x16 Rice automatic.

S914 1 11x16x16 McEwen tandem compound.

S915 1 8x10 Atlas automatic, center crank.

S916 1 11x18 Sinker, Davis & Co.

S917 1 12x16 horizontal, box bed, side crank.

S918 1 10x14 automatic Wright & Adams.

S919 1 12x12 high-speed automatic Ideal.

S920 1 20x24 box bed, balance valve.

In addition to the above, we have on hand at all times a complete assortment of all size engines, ranging in power from 1 to 500 horsepower. Ask for our complete list.

BOILERS.

We still have on hand a few of Armour's 54x16, 60x16, 66x16, 66x18 and 72x18 horizontal tubular boilers. They are in excellent condition.

AIR COMPRESSORS.

S921 1 Duplex straight-line Clayton, 9x9.

S922 1 4½x6-inch Clayton.

S923 2 12x16. Will compress air up to 60 pounds' pressure, with 80 to 100 pounds' steam.

BELTING.

We carry at all times a complete stock of short-lap, double-thick leather belting, both new and second-hand. Our quotations are always 30 per cent. below lowest market values.

SHAFTING.

We carry a stock of all sizes of shafting.

STEAM PUMPS.

Ask for our complete list of steam pumps. We have all kinds.

Electrical Apparatus.

See our list of supplies in the Western Electrician of October 27.

A COMPLETE OUTFIT.

We purchased the following outfit:

S924 1 McEwen tandem compound engine, 8½x14x12, with a direct-connected multipolar compound-wound dynamo, capacity, 50 K. W. Included in this outfit is a 100-horsepower Sterling water-tube boiler, with full front grate bars, etc. Also a Duplex steam pump and a copper-tube heater. It was used about 2½ years and replaced, owing to a necessary increase in power.

DYNAMOS, ETC.

1 500-light National, 1000 volts, alternating exciter, attached to shaft, complete with sliding base regulator and pulley, in first-class condition. Full description on application; also photograph.

1 Thomson-Houston, 400-light, compound-wound dynamo, new, 110 volts, 200 amperes, complete with sliding base, belt tightener and regulator.

1 Thomson-Houston, 500-light, compound-wound dynamo, 110-volt, 200-ampere, complete with sliding base, belt tightener and regulator.

1 United States Weston dynamo, 150-light, 100-volt, 75-ampere, complete with sliding base, belt tightener and regulator.

2 generators, 80 K. W. type, U. S. Westinghouse bipolar, 350 revolutions per minute, 550 volts, size of pulley, 54x18 inches; paper rim; side rails complete.

2 Field Rheostats Westinghouse three-jaw switches for throwing generators in multiple.

1 voltmeter Westinghouse, 0 to 600.

2 amp.-meters Westinghouse, capacity 0 to 160.

1 amp.-meter Westinghouse, capacity 0 to 300.

2 Westinghouse circuit-breakers.

3 Westinghouse lightning arresters.

3 Westinghouse switches, double throw.

1 electric elevator, manufactured by Keystone Electric company of Erie, Pa.; self-oiler, 60-ampere, No. 324, 220-volt, 1,025 revolutions; worm gear and cog are solid brass; 53 grooves for ¾-inch cable on drum; drum 30-inch diameter by 22-inch face; the motor and gearing set on a cast-iron base; this outfit cost $1,400; the worm screw and shaft are cut from solid forging and are steel; the motor is 15 horsepower; the machine is geared to give a speed to the car of 150 feet per minute; was only in operation about four months.

1 Baxter 110-volt motor, 2-horsepower, good as new; complete and starting 60x base and tightener. Price.....$50.00

1 1000-light Slattery alternating-current dynamo, 1000-volt, complete with exciter and instrument. Practically as good as new.

1 2-horsepower Baxter motor, 100-volt, complete with starting box, base with belt tightener and pulley. First-class condition.

Our Machinery Hall is 200 X 360 feet.

Our complete list of items is contained in CATALOGUE No. 156.

CHICAGO HOUSE WRECKING CO.,
W. 35th and Iron Sts., Chicago.

LIGHTING—POWER—RAILWAY ELECTRICAL MACHINERY.

The following is but a small portion of our immense stock, which is constantly changing. We carry at our Brooklyn Works all the modern types of the best manufactures, such as GENERAL ELECTRIC, WESTINGHOUSE and other Standard Makes. *SEND FOR LATEST CATALOG.*

Arc Dynamos.

2 125-light multi-circuit Brush, 2000 C. P.
2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, latest type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P., $1,500 each.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush, $575 each.

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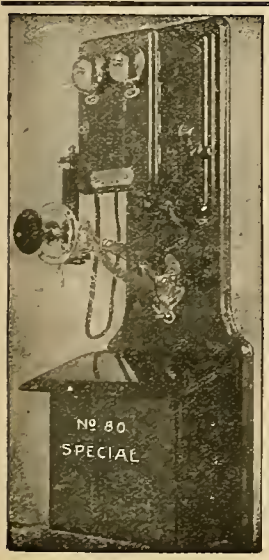

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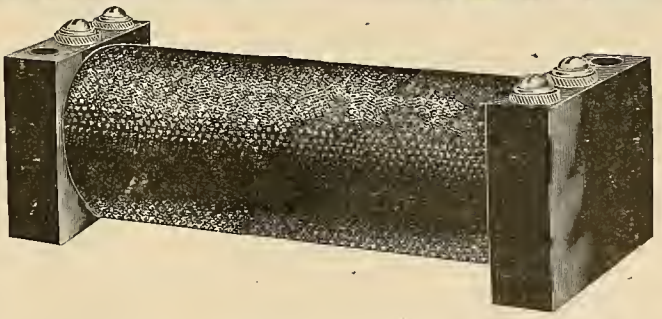

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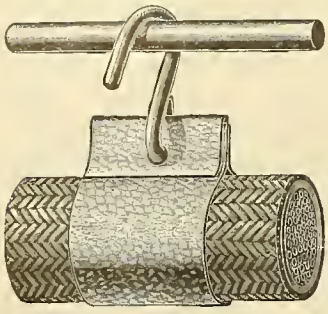

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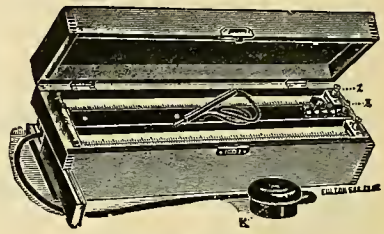

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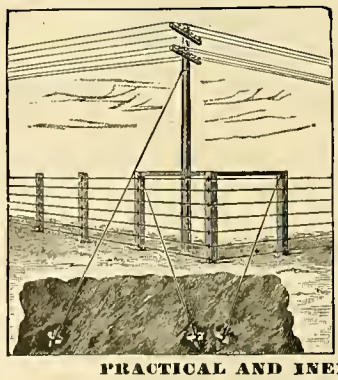

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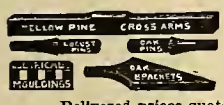

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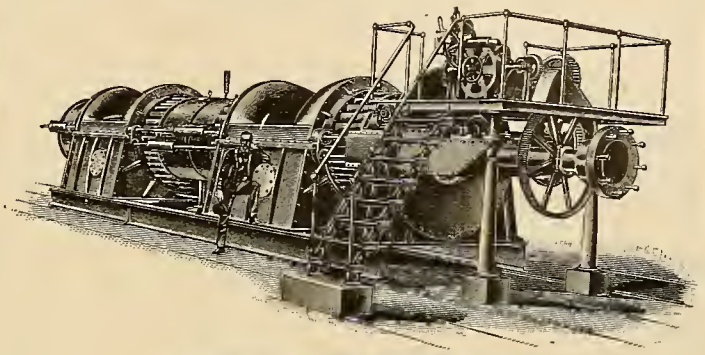

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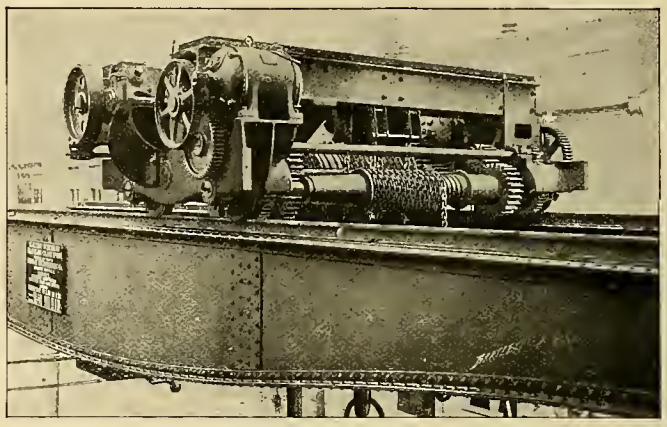

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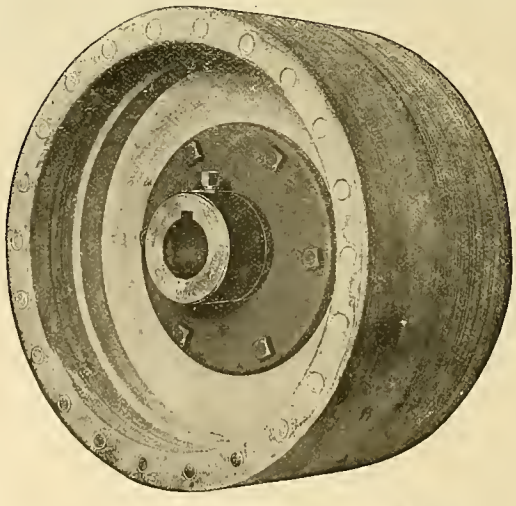

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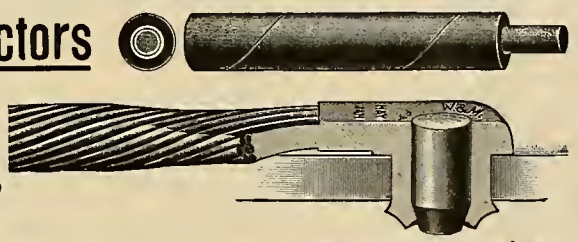

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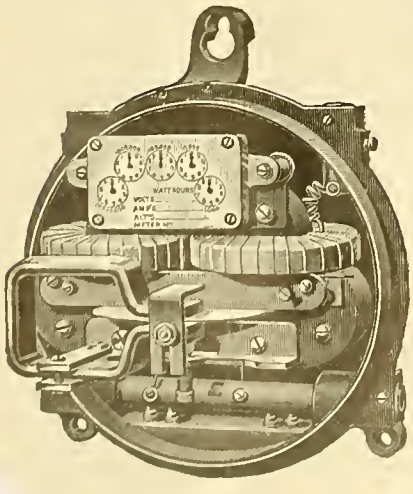

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An Accurate and Sensitive Meter.
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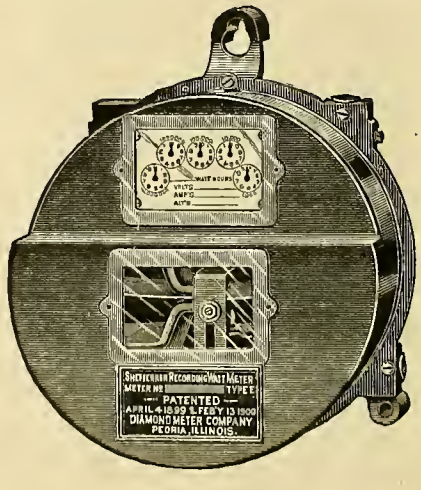

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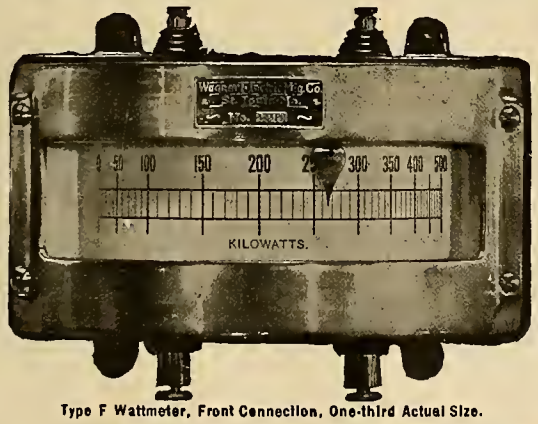

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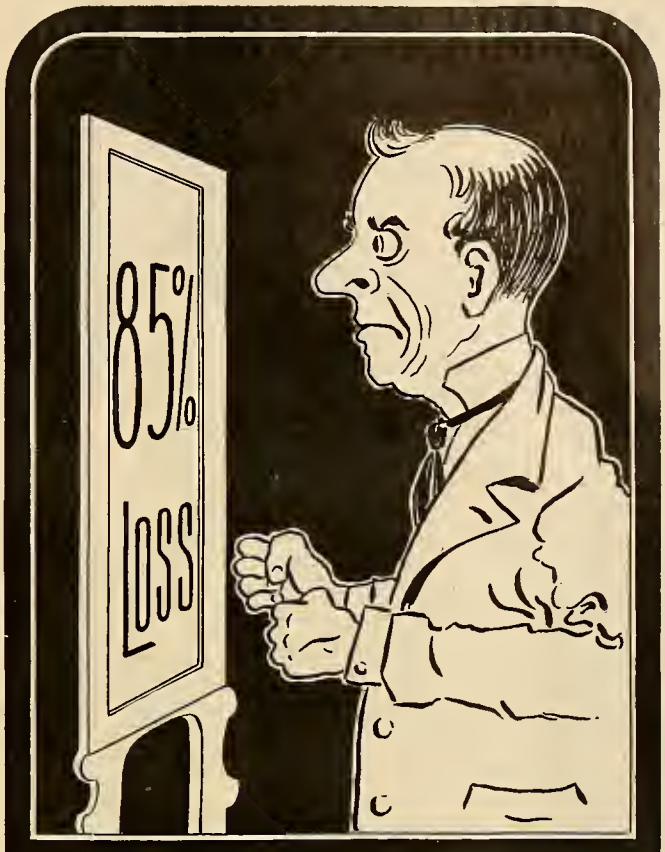

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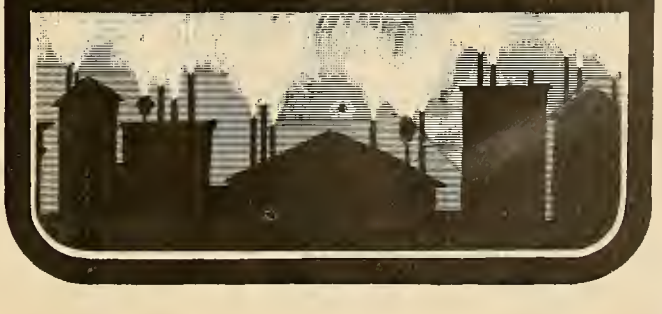

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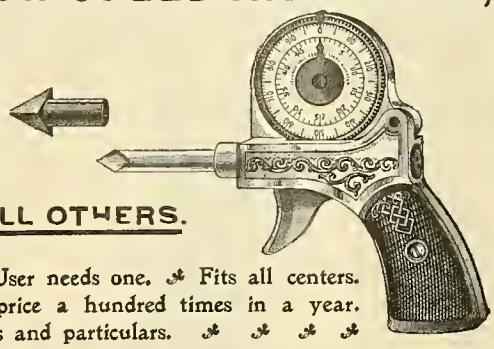

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Represents the greatest experience.
Therefore the highest quality.
The lamp makes the light—not the dynamo. Quality in lamps, therefore, tells.

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All kinds. Any quantity. Prompt shipments.

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Ceiling, Bracket, Portable and Adjustable Fixtures.

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CENTRAL STATIONS, STREET RAILWAYS

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NO CAST PLATES. NO PERFORATIONS. NO APPLIED PASTE. NO INFRINGEMENT.

HIGH EFFICIENCY. GREAT CAPACITY.

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FOR ALL CIRCUITS.

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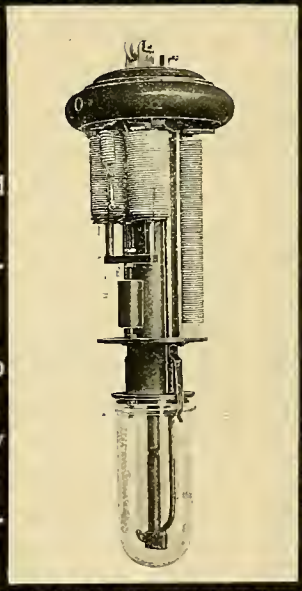
Designed on scientific principles and constructed of the highest grade materials.

Accessibility to working parts, which are few and absolutely interchangeable.



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Resistance cannot be short-circuited.

10-in. globe, using full length carbons.

Solid copper or aluminum case.

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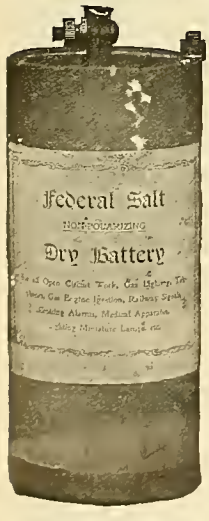

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No more Running Down on the Shelf.

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Gives More Current, Longer Life, Absolutely No Crystals.

Both salts have a depolarizer in the mixture. Federal Salt No. 1 has more depolarizer than Federalite, and so will last longer. That's the only difference.

It's the DEPOLARIZER that INCREASES the STRENGTH, GIVES LONGER LIFE, and DOES AWAY ABSOLUTELY WITH CRYSTALLIZATION and CREEPING SALTS.

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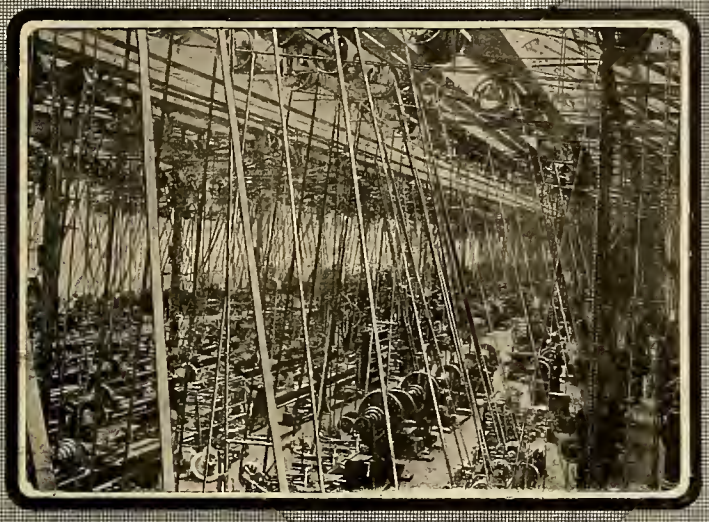

A large Railroad Shop driven by Shafts and Belts.

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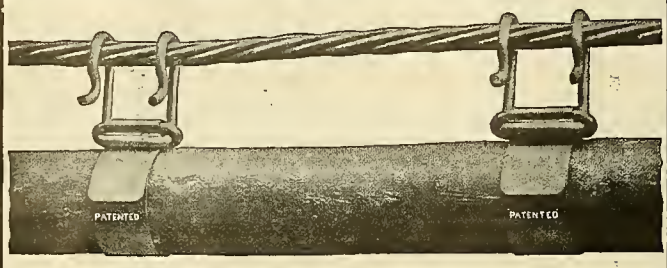

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Any Street Railway by using

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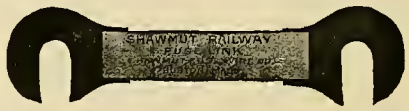

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SIMPLICITY, FLEXIBILITY, LIGHTNESS, STRENGTH, RELIABILITY, EASILY OPERATED, PERFECTLY CONTROLLED, ABSOLUTELY SAFE, ABSENCE OF ALL OIL AND DIRT, ECONOMY.

Not an EXPERIMENT, but a TRIED and PROVED SUCCESS.

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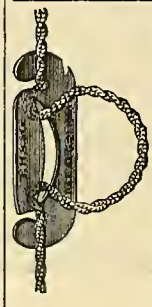

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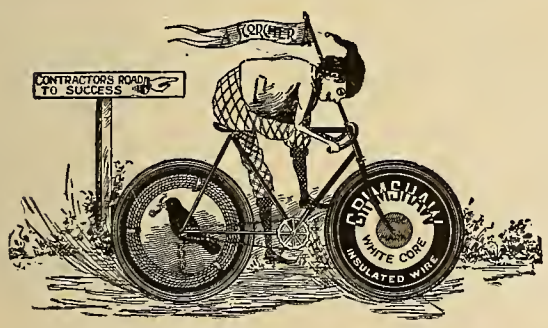

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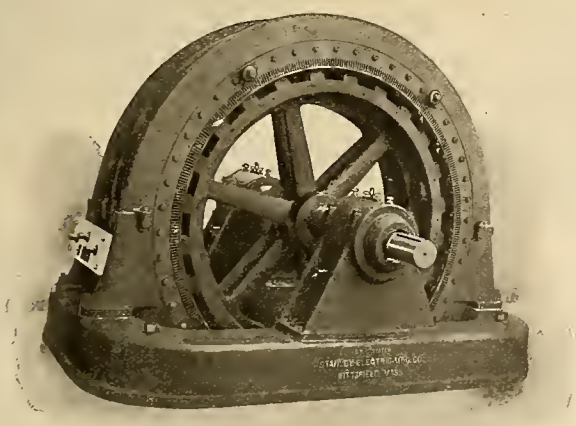

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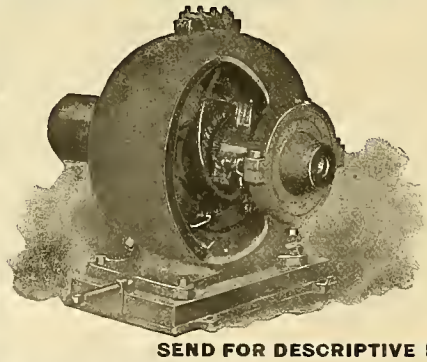

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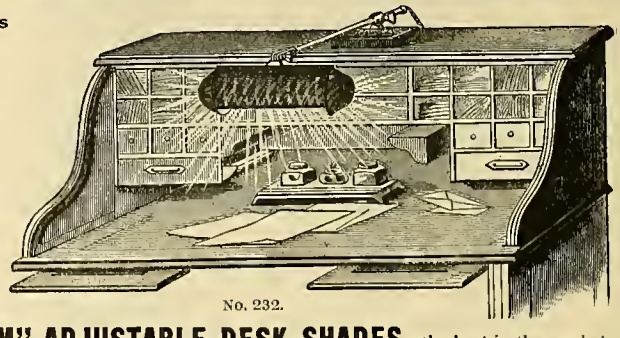

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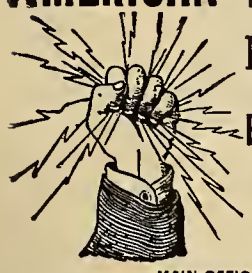

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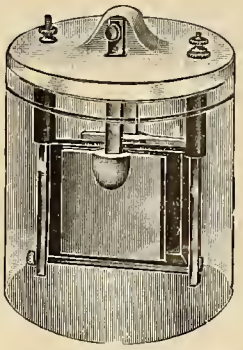

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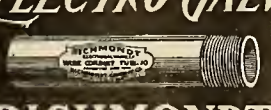

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Young man, 33 years of age, now superintendent of modern, combined, three-phase electric-light, power and street-railway plant which he installed and successfully operated for past six years, would change position providing suitable place is found. Technical graduate, member A. I. E. E. Best references. Address "C. E.," care Western Electrician, 510 Marquette Building, Chicago.

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1	20-light Brush, 10 ampere	60.00
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The system shall be the Thomson-Houston, the General Electric, or equally as good.

The number of arc lights to be not less than one hundred, and subject to be increased to two hundred.

Bids shall specify the charge for arc lights, and also for incandescent lights. Bids shall also specify the maximum charge to be made for private consumers of arc and incandescent lights.

A certified check for $2,500 to accompany each bid.

The city reserves the right to reject any and all bids

The successful bidder shall be required to give bond for faithful performance.

The arc lights for street lighting shall burn every night, and shall be at least 2,000 candlepower.

All bids shall be in the hands of the comptroller by 6 p. m., of December 1, 1900.

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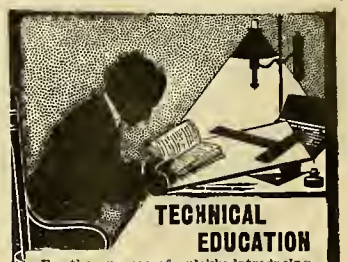

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1 80-light bipolar type, 125-volt generator, self-oiler.
1 110-light Churchward type, slow speed, 125-volt generator, M. P., 650 R. P. M.
2 180-light Ironclad type, 125-volt generators, M. P., self-oilers.
2 210-light-type B, 12 K. W., 125-volt generators, M. P., self-oilers.
2 350-light bipolar type, 20 K. W., 125-volt generators, self-oilers.
2 500-light bipolar type, 125-volt generators, 30 K. W., self-oilers.
1 700-light Ironclad type, 125-volt generator, self-oiler, slow speed.
1 Ironclad type, 30 K. W., 250-volt, slow speed, M. P., self-oiler.
1 Churchward type, 35 K. W., 500-volt, slow speed, M. P., self-oilers, 475 R. P. M.
1 Churchward type, 50 K. W., 250-volt, slow speed, for direct connection.
1 Churchward type, 100 K. W., 250-volt, slow speed, for direct connection.
1 marble panel switchboard for same, extra.
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1 Churchward, 50 K. W., 1,100 volts, 60-cycle alternator, single phase, with exciter.
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1 Ironclad type, booster set, 90 amp., 110 volts to 275 amp., at 26 volts. Very fine; big bargain.

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1 5 H. P. 110-volt, bipolar type, self-oiler.
2 7½ H. P. 110-volt, Churchward type, M. P., self-oilers, slow speed, 650 R. P. M.
1 12 H. P. 110-volt, Ironclad type, M. P., self-oiler.
3 15 H. P. 110-volt, type B, M. P., self-oilers.
1 60 H. P. 110-volt, Ironclad type, M. P., self-oiler, slow speed.

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1 25 H. P. 125-volt, bipolar type, self-oiler.
2 35 H. P. 125-volt, bipolar type, self-oilers.

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1 100 K. W. motor-generator, 125 to 500 volts, direct-coupled on same base.
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12 500-light bipolar type, self-oilers, 30 K. W., 125 volts.
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1 1,000-light 50 K. W., single-phase, 60-cycle, inductor alternator, 1,100 volts. Fine.

Motors—Siemens & Halske.

4 15 H. P. 110-volt, bipolar type, self-oilers, 12 K. W.
3 25 H. P. 110-volt, bipolar type, self-oilers, 20 K. W.
9 35 H. P. 110-volt, bipolar type, self-oilers, 30 K. W.
1 90 H. P. 110-volt, bipolar type, self-oiler, 70 K. W.
2 125 H. P. 110-volt, bipolar type, self-oilers, 100 K. W.

ANOTHER GREAT PURCHASE.

We were the highest bidders for the entire stock of completed machines of the

GIBBS ELECTRICAL MFG. CO., Milwaukee,

and secured the whole lot. All these are brand new, latest type multipolar machines, ready for immediate shipment.

110-VOLT GIBBS, M. P. DYNAMOS—brand new.

4 35-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
2 55-light Gibbs, multipolar, self-oiling bearings, moderate speed, comp. wound.
4 55-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
4 110 light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
3 150-light Gibbs, multipolar, self-oiling bearings, moderate, comp. wound.
1 150-light Gibbs, multipolar, self-oiling bearings, slow speed, comp. wound.
4 210-light Gibbs, multipolar, self-oiling bearings, slow speed.
4 300-light Gibbs, multipolar, self-oiling bearings, slow speed.

110-VOLT MOTORS—brand new.

4 3 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 4 H. P. Gibbs, multipolar, self-oiling bearings, moderate speed.
3 4 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
1 6 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 7½ H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
3 10 H. P. Gibbs, multipolar, self-oiling bearings, moderate speed.
2 10 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
3 15 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.
2 20 H. P. Gibbs, multipolar, self-oiling bearings, slow speed.

220-VOLT MOTORS—slightly used—excellent condition fully guaranteed.

25 5 H. P. Gibbs, multipolar, self-oiling bearings.

Special Sale of Fine Testing Instruments From the Engineering Department of Siemens & Halske.

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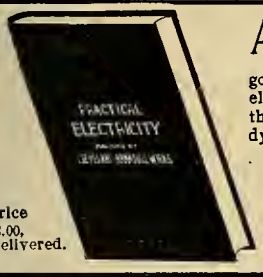

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INFORMATION

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We are headquarters for Rebuilt Motive Power. Our machinery is absolutely warranted in every way. We cover all sales by a binding guarantee. Our stock is the most extensive in the land.

WE OFFER THE FOLLOWING, SUBJECT TO PRIOR SALE.

ENGINES.

S900 1 E. P. Allis Company tandem compound condensing engine.
H. P., nominal, 500.
Flywheel, 2 feet diameter by 40-inch face.
Cylinders, 22 and 42x48.
Guaranteed to operate on 15 pounds of steam per indicated horsepower.
This engine is in excellent condition. It is at present installed at Omaha, Neb.

S901 1 pair Williams automatic engines, coupled together.
Size, 17¾x24.
Revolutions, 200; builders' rating, 200; H. P., 200.

S902 2 Westinghouse compound engines, 13x22x13.
Revolutions, 290; H. P., 125.

S903—1 horizontal tangye bed, side crank automatic steam engine, made by Russel & Co.
Steam cylinder, 13x18.

S904 1 Wright automatic Corliss, 23x36.

S905 1 10x9 Westinghouse.

S906 1 8x12 Lansing automatic.

S907 1 7x12 Rice automatic.

S908 1 16x24 horizontal box bed, side crank.

S909 1 12x16 F. C. Wells horizontal tangye bed, side crank.

S910 10 9x12 engines, manufactured by George W. Tifft & Sons of Buffalo, N. Y.

S911 1 10x22 box bed, right hand, side crank.

S912 1 16x36-inch Corliss, left hand.

S913 1 9x16 Rice automatic.

S914 1 11x16x16 McEwen tandem compound.

S915 1 8x10 Atlas automatic, center crank.

S916 1 11x18 Sinker, Davis & Co.

S917 1 12x16 horizontal, box bed, side crank.

S918 1 10x14 automatic Wright & Adams.

S919 1 12x12 high-speed automatic Ideal.

S920 1 20x24 box bed, balance valve.

In addition to the above, we have on hand at all times a complete assortment of all size engines, ranging in power from 1 to 500 horsepower. Ask for our complete list.

BOILERS.

We still have on hand a few of Armour's 54x16, 60x16, 66x16, 66x18 and 72x18 horizontal tubular boilers. They are in excellent condition.

AIR COMPRESSORS.

S921 1 Duplex straight-line Clayton, 9x9.

S922 1 4½x6-inch Clayton.

S923 2 12x16. Will compress air up to 60 pounds' pressure, with 80 to 100 pounds' steam.

BELTING.

We carry at all times a complete stock of short-lap, double-thick leather belting, both new and second-hand. Our quotations are always 30 per cent. below lowest market values.

SHAFTING.

We carry a stock of all sizes of shafting.

STEAM PUMPS.

Ask for our complete list of steam pumps. We have all kinds.

Electrical Apparatus.

See our list of supplies in the Western Electrician of October 27.

A COMPLETE OUTFIT.

We purchased the following outfit:

S924 1 McEwen tandem compound engine, 8½x14x12, with a direct-connected multipolar compound-wound dynamo, capacity, 50 K. W. Included in this outfit is a 100-horsepower Sterling water-tube boiler, with full front grate bars, etc. Also a Duplex steam pump and a copper-tube heater.
It was used about 2½ years and replaced, owing to a necessary increase in power.

DYNAMOS, ETC.

1 500-light National, 1000 volts, alternating exciter, attached to shaft, complete with sliding base regulator and pulley, in first-class condition. Full description on application; also photograph.

1 Thomson-Houston, 400-light, compound-wound dynamo, new, 110 volts, 200 amperes, complete with sliding base, belt tightener and regulator.

1 Thomson-Houston, 500-light, compound-wound dynamo, 110-volt, 200-ampere, complete with sliding base, belt tightener and regulator.

1 United States Weston dynamo, 150-light, 100-volt, 75-ampere, complete with sliding base, belt tightener and regulator.

2 generators, 80 K. W. type, U. S. Westinghouse bipolar, 350 revolutions per minute, 550 volts, size of pulley, 54x18 inches; paper rim; side rails complete.

2 Field Rheostats Westinghouse three-jaw switches for throwing generators in multiple.

1 voltmeter Westinghouse, 0 to 600.

2 amp.-meters Westinghouse, capacity 0 to 160.

1 amp.-meter Westinghouse, capacity 0 to 300.

2 Westinghouse circuit-breakers.

3 Westinghouse lightning arresters.

3 Westinghouse switches, double throw.

1 electric elevator, manufactured by Keystone Electric company of Erie, Pa.; self-oiler, 60-ampere, No. 324, 220-volt, 1,025 revolutions; worm gear and cog are solid brass; 53 grooves for ⅝-inch cable on drum; drum 30-inch diameter by 22-inch face; the motor and gearing set on a cast-iron base; this outfit cost $1,400; the worm screw and shaft are cut from solid forging and are steel; the motor is 15 horsepower; the machine is geared to give a speed to the car of 150 feet per minute; was only in operation about four months.

1 Baxter 110-volt motor, 2-horsepower, good as new; complete and starting box and tightener. Price.....$50.00

1 1000-light Slattery alternating-current dynamo, 1000-volt, complete with exciter and instrument. Practically as good as new.

1 2-horsepower Baxter motor, 100-volt, complete with starting box, base with belt tightener and pulley. First-class condition.

Our Machinery Hall is 200 X 360 feet.

Our complete list of items is contained in CATALOGUE No. 156.

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LIGHTING—POWER—RAILWAY ELECTRICAL MACHINERY.

The following is but a small portion of our immense stock, which is constantly changing. We carry at our Brooklyn Works all the modern types of the best manufactures, such as GENERAL ELECTRIC, WESTINGHOUSE and other Standard Makes. *SEND FOR LATEST CATALOG.*

Arc Dynamos.

2 125-light multi-circuit Brush, 2000 C. P.
2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, lateat type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P., $1,500 each.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush, $575 each.

Direct-Current Dynamos. 110 Volts.

(Direct-Connected.)

2 100 K. W. Westinghouse, 8-pole, 225 R. P. M., direct-connected to McIntosh & Seymour compound engines.
1 75 K. W. Siemens & Halske, direct-connected to 12x14-inch straight line engine, 278 R. P. M.

Belted Dynamos. 110 Volts.

2 150 K. W. Edison bipolar.
4 60 K. W. Edison bipolar.
2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
4 25 K. W. Edison bipolar.
2 20 K. W. Edison bipolar.
1 13½ K. W. M. P. Amer. Ball.
2 10 K. W. Edison bipolar.
1 500-ampere Onondaga.
1 25 K. W. Electro Dynamic.
1 30 K. W. Western Electric, M. P., 500 R. P. M.
1 45 K. W. General Electric, M. P., 850 R. P. M.
1 100 K. W. M. P. 6, Westinghouse.
2 45 K. W. M. P., 4, Westinghouse.
1 30 H. P. M. P. Westinghouse.

Direct-Current Motors and Generators. 220 Volts.

(Direct-Connected.)

1 75 K. W. General Electric, direct-connected to Ideal engine.

(Belt-Driven.)

1 70 K. W. M. P. Siemens & Halske (new).
1 65 K. W. Siemens & Halske.
1 25 H. P. Sprague, bipolar.
1 10 H. P. Eddy, bipolar
1 6 H. P. Eddy, bipolar.

Direct-Current. 500 Volts.

2 60 K. W. Edison.
1 50 H. P. M. P., General Electric, type H.
1 15 H. P. Eddy.
1 10 H. P. Eddy.
1 2 H. P. Cent. Elect. Co.

Railway Motors.

G. E. 800 S. R. G., 30.
G. E. 1000 W. P., 30.
G. E. 1200, W. P., 50.
Westinghouse 3.
Westinghouse 12A.
Westinghouse 38B.
K, K2 and K12 G. E. Controllers.
Westinghouse 38 and 49 Controllers, and a constantly changing stock of everything pertaining to street car equipment.

Railway Generators. 500 Volts.

1 500 K. W. M. P., 4, Gen. Electric.
1 300 K. W. M. P., 4, Gen. Electric.
1 200 K. W. M. P., 4, Walker.
2 111 K. W. M. P., 4, Westinghouse.
2 100 K. W. M. P., 4, Gen. Electric.
2 200 K. W. Edison.
2 150 K. W. Edison.
2 100 K. W. Edison.
4 60 K. W. Edison.
1 100 K. W. Ft. Wayne.

Alternators.

1 325 K. W. Siemens & Halske, 2000 volts, 7200 alternations, single-phase, 115 R. P. M.
1 300 K. W. Fort Wayne, 2000 volts, 7200 alternations, single-phase.
1 240 K. W. Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 240 K. W. Stanley, two-phase, 330 R. P. M., with engines direct-connected.
2 300 K. W. Westinghouse, single-phase, toothed armatures.
1 150 K. W. Westinghouse, two-phase, 1100 volts, 600 R. P. M., 7200 alternations.
2 A-120 General Electric, single-phase, 1000 volts, 16000 alternations.
2 90 K. W. General Electric, single-phase, 1000 volts, 16000 alternations.
2 120 Westinghouse, single-phase, 1100 volts, 16000 alternations.
2 100 K. W. monocylic General Electric, 1050 volts, 7200 alternations, with exciters.
1 60 K. W. General Electric, single-phase, 2000 volts, 16000 alternations.
1 60 K. W. Stanley, 2000-1000 volts, two-phase, 7200 alternations.
1 75 K. W. Stanley, 2000-1000 volts, two-phase, 16000 alternations.
1 200 H. P. Westinghouse motor, two-phase, 3000 alternations, 400 volts, shaft 4⅞-inch diameter, pulley 25-inch face, 30-inch diameter.
1 45 K. W. Westinghouse, 2200 volts, 16000 alternations.
1 110 K. W. Fort Wayne, 2200 volts, 16000 alternations.

Engines.

40x72 Corliss (1 right, 1 left).
26x48 Allis.
16x25x15 Armington & Sims.
18½x18 McIntosh & Seymour.
16x16 Erie Ball.
15x15 McIntosh & Seymour.
13x14 McIntosh & Seymour.
14x13 Armington & Sims.
10x12 Watertown.
11x19x24 Tandem Buckeye.

Boilers.

2 375 H. P. Sterling boilers.
2 175 H. P. Sterling boilers.
Boilers of various styles and sizes at low rates.

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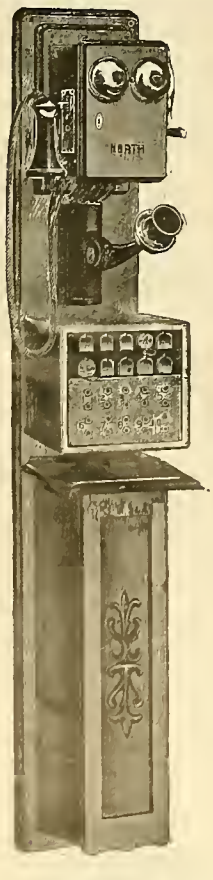

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It is always ready for duty.

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Every outfit is thoroughly tested and fully guaranteed. This machine is in use in some of the largest exchanges, both in this country and abroad. The net price for the complete outfit is

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Nothing at subscriber's station to get out of repair.

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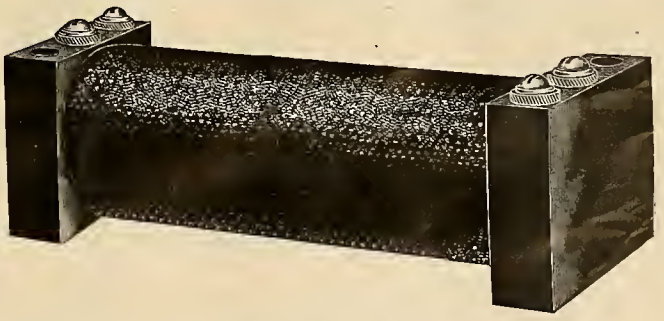

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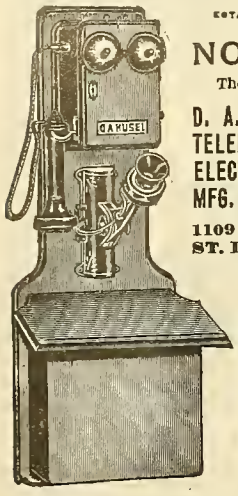

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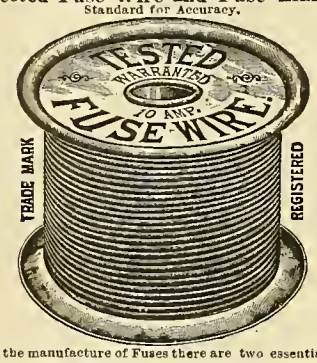

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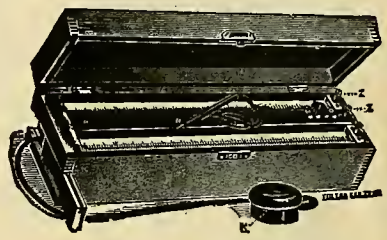

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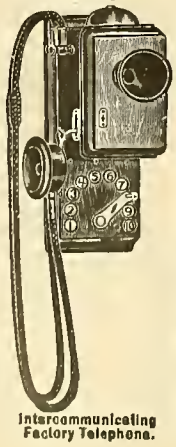

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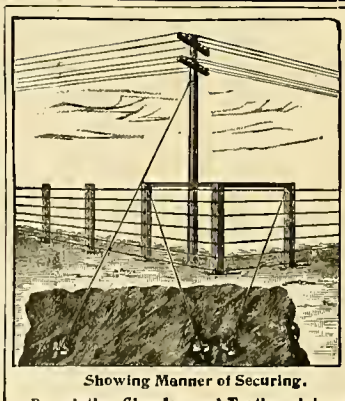

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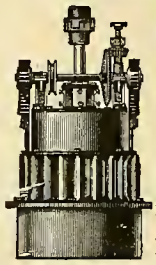

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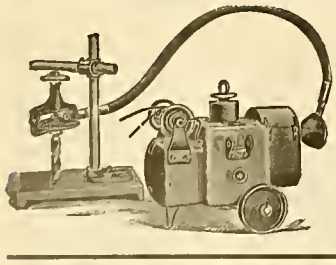

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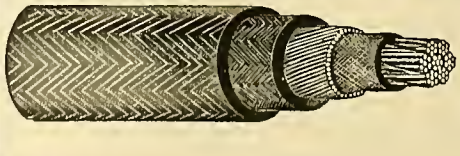

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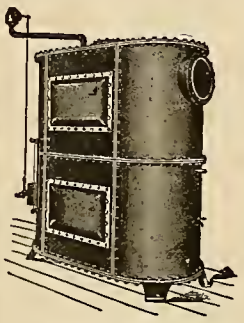

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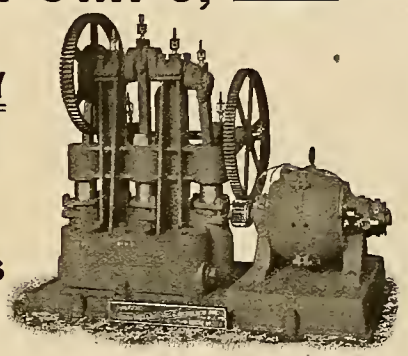

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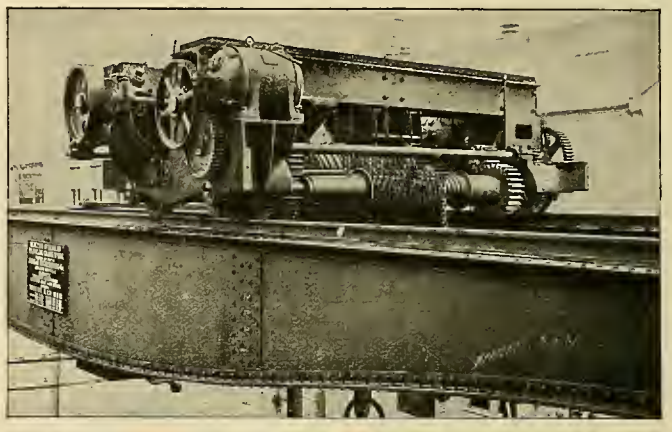

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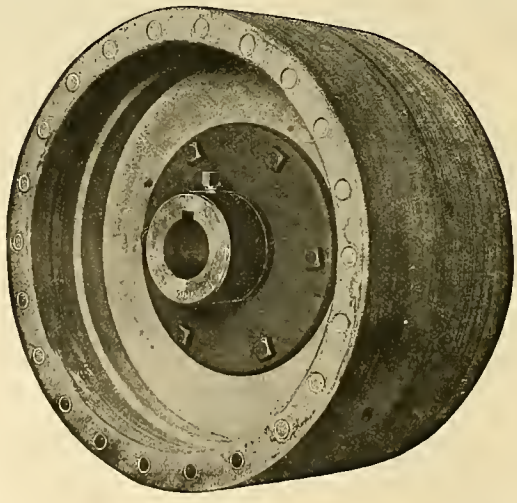

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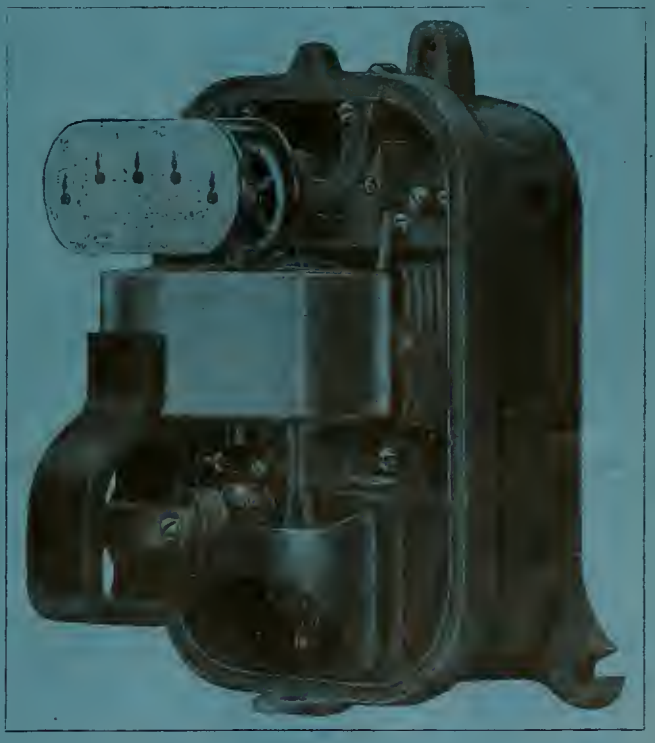

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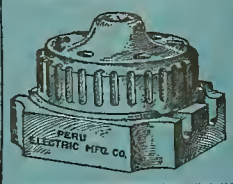

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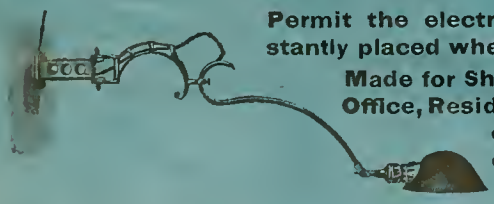

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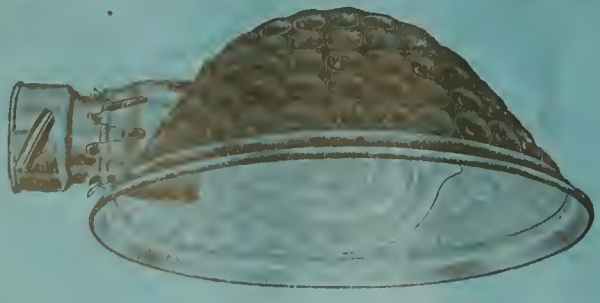

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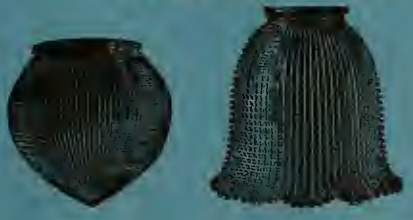

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Price each, 40c.

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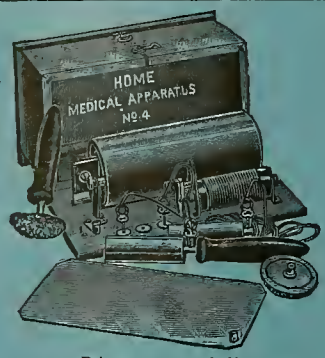

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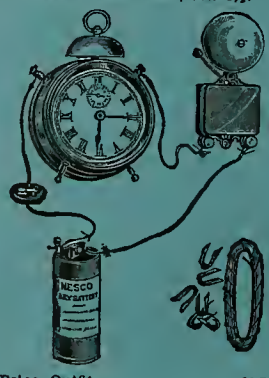

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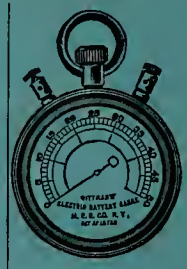

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Will register the strength of open or closed circuit batteries.

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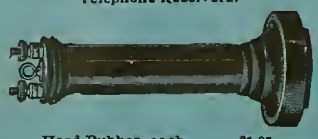

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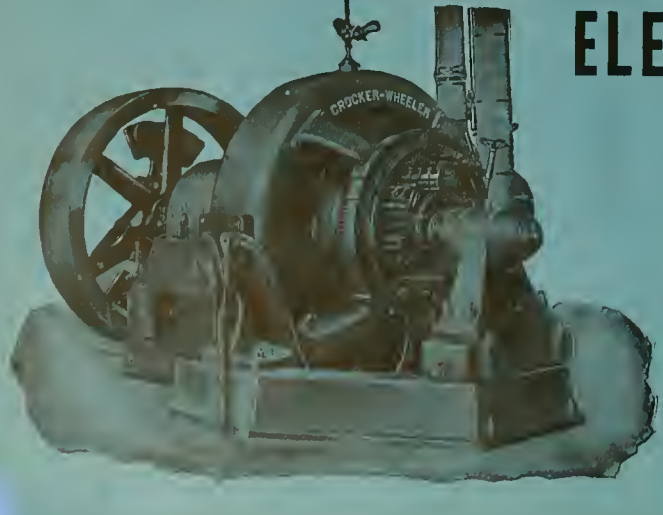

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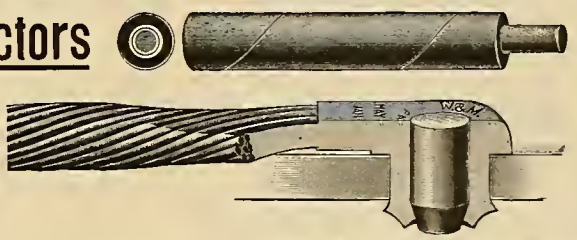

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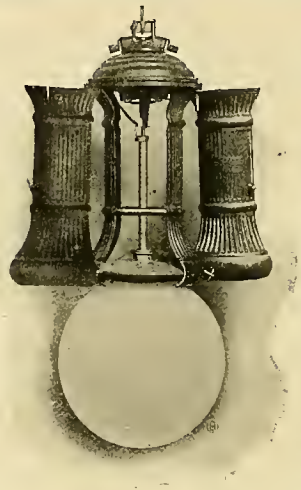

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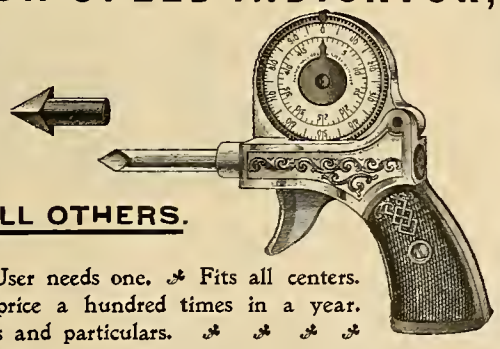

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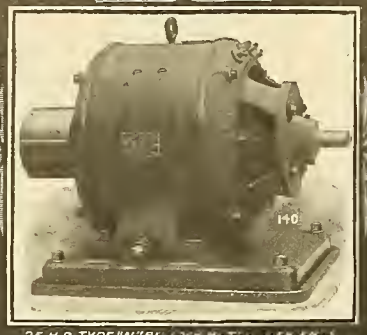

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MAKE A SPECIALTY OF CUT-OUTS FOR

HIGH-TENSION WORK.

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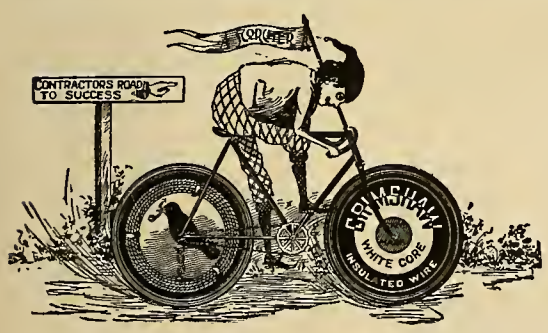

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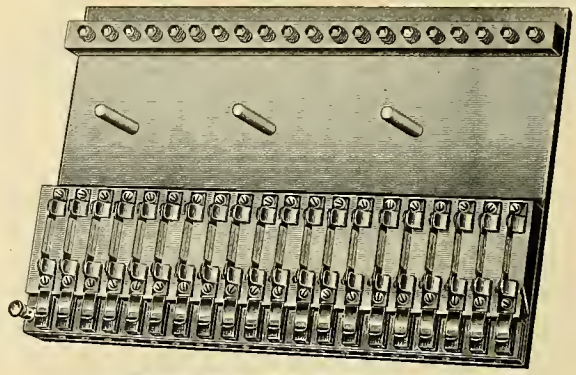

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Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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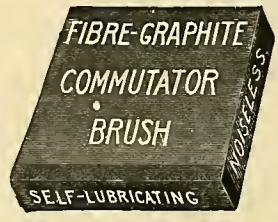

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Contains no acid or any element injurious to electrical connections.

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YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

THIS IS WHAT ONE USER HAS TO SAY OF IT:

"AFTER having tried the various soldering salts on the market, and after giving your Cream Flux severe tests on heavy cable connections, and on the finest stranded flexible drop cord work, we can safely say it meets all claims you make for it. I consider it one of the best ever offered for sale. Very truly,
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Single and Double Focus X-Ray Tubes are used with great success for all kinds of radiographic and fluoroscopic work.

They have higher efficiency and longer life than any tubes in the market.

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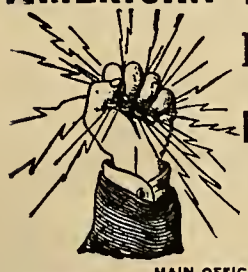

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THE LUNDELL "SPLIT-POLE" GENERATOR

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Silver-Plated Mirror Reflectors.

A deep cone, for use with any system of incandescent electric light, where it is desired to concentrate a very powerful light on a small space. Lined with silver-plated mirror-plate glass. Increases the light from twelve to fifteen times. Most valuable in show windows and over machines, work-benches, type cases, etc., etc.

Thousands of this style used in show windows. Get our Catalogue and Prices.

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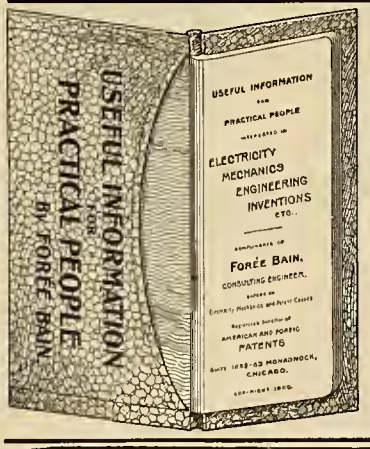

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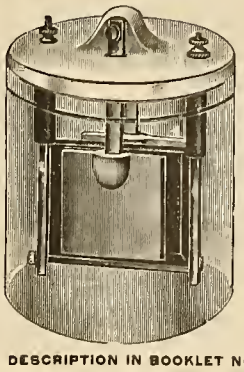

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Party owning two electric-light plants now earning 6% interest on $100,000 desires partner with $100,000 cash to build waterworks in same towns. Have promise of good waterworks franchise with city contracts in both cities. References required with answer. Address "WATERWORKS," care Western Electrician, 510 Marquette Building, Chicago.

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After January 1, 1901, a position paying $125 per month with opportunity for advancement by young man with experience in managing city commercial lighting company: extensive Chicago acquaintance. Address "J. K.," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Two lamp salesmen, with or without an established trade. Permanent positions to competent men with leading incandescent lamp manufacturer. State experience and salary expected. All communications treated strictly confidential. Address "INCANDESCENT," care Western Electrician, 510 Marquette Building, Chicago.

FOR SALE.

Electric-light plant in town of 5,000. No bonds, no competition. Good contract for five years, cheap fuel. Now earning $350 per month. Net price $4,500. If certain improvements are made this could be doubled. Will bear close investigation. References required with answer. Address "PLANT," care Western Electrician, 510 Marquette Building, Chicago.

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Huron County Telephone Co. capital stock, $12,000, full paid, 240 shares. Three exchanges, excellent toll connections. I offer my 63 shares for $3,000. This proposition will bear the closest investigation and I invite correspondence.

E. W. ARMSTRONG,
Monroeville, Huron Co., Ohio.

WANTED.

Position as superintendent, electrician or assistant, in a power or lighting plant. Have had 4 years' experience in power and lighting plant. A n single, do not drink, and can give good references. Address "E. F.," care of Western Electrician, 510 Marquette Bldg., Chicago

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2 60-light Western Electric, 10 ampere, each	$150.00
1 45-light Excelsior, 8 ampere	75.00
1 30-light Excelsior, 10 ampere	75.00
1 25-light Excelsior, 12 ampere	60.00
1 35-light Thomson-Houston, 10 ampere, ring type	125.00
1 20-light Brush, 10 ampere	60.00
2 30-light Brush, 10 ampere, each	75.00
1 500-light Westinghouse, 1000 volt, brand new	100.00
1 120 K. W. General Electric, 2,000 volt	300.00

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WE OFFER FOR IMMEDIATE SHIPMENT

2 100 K W., 500-volt Edison bipolars.
1 75 K. W., General Electric, 500-volt, 4 pole.
1 120 K. W., A. S. type, General Electric Alternator.
3 120 K. W., A. type, General Electric Alternators.
1 240 K. W., Stanley two-phase, 1,000 or 2,000 volts.
1 50 K. W., 2,000-volt, Siemens & Halske, 60 cycle.
1 65 Light, Brush Arc, 10 amperes.
1 40 Light, Western Electric Brush Arc.
1 600 H. P., Ball cross-compound engine, 20x 36x18.
1 200 H. P., Ball, 12x22x16 Tandem compound, with condenser.
1 175 H. P., Ideal, 12x20x14 Tandem compound.
2 18½x18 Ideal engines.
1 14½x15 McIntosh & Seymour engine.

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Write for our latest price-list No. 40.

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FOR SALE—A BARGAIN.

Thirty 200-ampere-hour storage-battery elements, Chloride Accumulator make. Also 150 hard rubber cells, 7x7x10½ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
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AUCTION SALE.

Postponed Till Dec. 10.——Bankrupt Sale.

Entire Property of the Suburban Electric Co., Covington, Ky., Offered For Sale.

Notice is hereby given that pursuant to an order in bankruptcy, in the matter of the Suburban Electric Company, a corporation organized under the laws of the state of Kentucky, bankrupt, No. 276, in the District Court of the United States for the District of Kentucky, I will, on the 10th day of December, 1900, at 10 o'clock a. m., at the Scott street entrance of the United States Court in Covington, Ky., sell at public auction to the highest bidder, all the property, real and personal, of every kind and description belonging to the Suburban Electric Company, bankrupt, including all the rights privileges and franchises, except the franchise to be a corporation, and also its electric lighting plant, power station, machinery, engines, boilers, dynamos, electric machine, electric lamps and other appliances and appurtenances, poles, lines, wires and all contracts, claims and demands, and all other property of every kind and description, also the following described real estate belonging to the said bankrupt, situated in the city of Covington, Kenton County, Kentucky, and bounded as follows:

1. Beginning at a point on the east line of Madison avenue at the northeast corner of Madison avenue and an alley running parallel to and between Fourth and Fifth streets; thence northwardly along the east line of said Madison avenue toward Fourth street ninety (90) feet; thence at right angles to Madison avenue one hundred and ninety (190) feet to another alley; thence with said other alley and at right angles to said first-named alley ninety (90) feet to said first-named alley; thence westwardly along the same one hundred and ninety (190) feet to the place of beginning.

And also the following described piece of real estate belonging to said bankrupt, situated in the city of Newport, Campbell County, Kentucky, to wit:

2. Lot No. 260 in the Cote Brilliant Lot & Home Company's subdivision, fronting thirty (30) feet on the west side of Park avenue, and extending back one hundred and twenty (120) feet to an alley.

The first tract of real estate above described will be sold subject to such lien as Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, or either of them, may have upon said real estate, which lien is as yet undetermined in amount.

The property above described will be sold free from any and all liens or encumbrances, except the lien or encumbrance in favor of Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, upon the said first described real estate aforesaid.

The second piece of real estate described aforesaid will be sold separately.

All the balance of the real estate, and all the other property and assets of every kind, and the rights, privileges and franchises of the Suburban Electric Company will be sold as an entirety and as a going concern.

The terms of the sale will be one-third (⅓) cash, to be paid upon the confirmation of the sale, the balance in equal installments of six and twelve months from date of sale, deferred payments to draw six (6) per cent interest and to be secured by lien upon the property sold and also by bond with sureties satisfactory to the referee in bankruptcy herein; or purchaser may pay cash for said property upon the confirmation of the sale. No bid for said property will be received from any bidder who shall not place in the hands of the undersigned at the time of making said bid, as a pledge that said bidder will make good his bid if the sale is confirmed, the sum of fifteen thousand ($15,000) dollars, which sum of fifteen thousand dollars will be credited upon the first payment of the purchase money for said sale.

Inspection of property invited. Full information given upon application at the office of the bankrupt in Covington, Ky.

CHARLES H. SHAW,
Trustee in Bankruptcy of the Suburban Electric Company.

SIMRALL & GALVIN,
Attorneys for Trustee in Bankruptcy.

WANTED TO BUY.

We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

CAMP ENGINEERING CO.,
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We desire to correspond with parties having articles requiring a high conductivity and very tough copper, either with the idea of buying rights in the article or manufacturing under contract.

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Electrical Engineer.
CENTRAL LIGHTING STATIONS,
ELECTRIC POWER TRANSMISSION.
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THE CUTLER-HAMMER MFG. CO.,
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The Largest and Oldest Manufacturers of Rheostats in the World.

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BARGAINS--FOR SALE.

110-Volt Incandescent Dynamos.

2 12-light Edison, ¾ K. W., self-oilers.
1 25-light Wenstrom.
4 35-light Gibbs, M. P., slow speed, comp., brand new.
1 50-light Hawkeye.
1 50-light Nowotny, self-oiler.
1 50-light Card, multipolar, self-oiler, slow speed, 1150 R. P. M.
1 50-light Crocker-Wheeler, slow speed, self-oiler.
2 55-light Gibbs, M. P., compound, brand new, moderate speed.
4 55-light Gibbs, M. P., compound, brand new, slow speed, 1100 R. P. M.
1 55-light Siemens & Halske, type B., M. P., slow speed, self-oiler, brand new.
1 60-light Thomson-Houston.
1 60-light Westinghouse.
1 80-light Siemens & Halske, type L. H., self-oiler, brand new.
2 80-light Siemens & Halske, ironclad type, M. P., self-oilers, brand new.
1 100-light Bain, compound, self-oiler.
1 100-light J. & C., self-oiler.
4 110-light Gibbs, M. P., compound, self-oilers, slow speed, brand new, 1000 R. P. M.
1 110-light Siemens & Halske, M. P., Churchward type, compound, extra slow speed, brand new, 650 R. P. M.
3 150-light Gibbs, M. P., compound, self-oilers, speed 1650.
1 150-light Gibbs, M. P., shunt, self-oiler, slow speed, 825 R. P. M.
1 160-light Card, self-oiler.
2 180-light Siemens & Halske, M. P., self-oilers, brand new.
1 200-light Western Electric, self-oiler, comp.
2 210-light Edison, self-oilers, 12 K. W.
4 210-light Siemens & Halske, 12 K. W.
2 210-light Siemens & Halske, M. P., brand new, type B., self-oilers.
4 210-light Gibbs, M. P., self-oilers, very slow speed, 725 R. P. M., brand new.
1 250-light Westinghouse.

110-Volt Incandescent Dynamos.—Continued.

1 250-light Commercial, comp., self-oiler.
1 250-light Eddy, self-oiler.
1 270-light General Electric, 15 K. W., M. P., direct-connected to Case engine, compound.
2 270-light Westinghouse, M. P., slow speed, 15 K. W.
1 300-light Columbian, multipolar, comp., self-oiler, slow speed.
4 300-light Gibbs, M. P., self-oilers, slow speed, 725 R. P. M., brand new.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 350-light National, self-oiler, compound.
1 350-light Edison, 20 K. W., self-oiler.
6 350-light Siemens & Halske, type L. H., self-oilers.
1 360-light Duplex, multipolar, self-oiler, compound, slow speed.
3 500-light Siemens & Halske, type L. H., self-oilers, brand new.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Eickmeyer.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers, 575 R. P. M., brand new.
2 800-light Edison, 45 K. W., self-oilers.
1 1200-light Siemens & Halske, type L. H., 70 K. W., self-oiler.
1 1350-light Siemens & Halske, Type I, 80 K. W., for direct connection, 8 pole.
3 1500-light Siemens & Halske, type L. H., self-oilers, 100 K. W.
1 1500-light Siemens & Halske, 100 K. W., type L, 6 pole, for direct connection, brand new.

220-Volt Generators.

Rheostat, base-frame and pulley accompany each machine.

1 8½ K. W. Westinghouse, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Edison, self-oiler.
1 15 K. W. Edison, compound, self-oiler.
1 30 K. W. Siemens & Halske, M. P., ironclad type, self-oiler, brand new.
1 45 K. W. Edison, compound, self-oiler, new armature.
1 50 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.
1 marble panel switchboard for above.
1 100 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 35 K. W. Mather, self-oiler.
2 35 K. W. Siemens & Halske, brand new, M. P., Churchward type, self-oilers, very slow speed, 475 R. P. M.
1 45 K. W. Edison, compound, self-oiler.
1 75 K. W. Westinghouse, Kodak set, Westinghouse generator and Westinghouse compound engine, 14 x 24 x 14, all complete, fine.

Alternating Generators.

1 350-light Thomson-Houston, A. 18.
1 600-light Thomson-Houston, A. 6.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light Thomson-Houston, 30 K. W., slotted armature.
2 600-light General Electric, A. 30, toothed armature.
2 650-light Thomson-Houston, A. 35.
2 750-light Westinghouse, 37½ K. W.
1 900-light Warren, 45 K. W., 1100 volts.
1 1000-light Wood, 50 K. W., self-oiler.
1 1000-light Siemens & Halske, 50 K. W., self-oiler, 60 cycle.
1 1200-light National, with exciter.
1 1200-light Siemens & Halske, 60 K. W., Churchward type, brand new, 60 cycle, single-phase, 1100 volts, with exciter.
1 50 K. W. Siemens & Halske, Churchward type, brand new, 60 cycle, two-phase, rotary transformer, 1100 volts, alt. to 250 volts direct, complete, with marble panel switchboard.
1 1200-light Westinghouse, 60 K. W.
1 1200-light Thomson-Houston, 60 K. W.
1 1200-light Warren, 60 K. W., self-oiler.
1 1200-light General Electric, A. 60.
2 1300-light Thomson-Houston, A. 70, 1100 or 2200 volts.
1 1500-light Wood, 75 K. W., self-oiler.
1 1500-light General Electric, monocyclic, 75 K. W., self-oiler, 60 cycle.
1 1800-light National, 90 K. W.
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S906 1 8x12 Lansing automatic.

S907 1 7x12 Rice automatic.

S908 1 16x24 horizontal box bed, side crank.

S909 1 12x16 F. C. Wells horizontal tangye bed, side crank.

S910 10 9x12 engines, manufactured by George W. Tifft & Sons of Buffalo, N. Y.

S911 1 10x22 box bed, right hand, side crank.

S912 1 16x36-inch Corliss, left hand.

S913 1 9x16 Rice automatic.

S914 1 11x16x16 McEwen tandem compound.

S915 1 8x10 Atlas automatic, center crank.

S916 1 11x18 Sinker, Davis & Co.

S917 1 12x16 horizontal, box bed, side crank.

S918 1 10x14 automatic Wright & Adams.

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Electrical Apparatus.

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1 Thomson-Houston, 400-light, compound-wound dynamo, new, 110 volts, 200 amperes, complete with sliding base, belt tightener and regulator.

1 Thomson-Houston, 500-light, compound-wound dynamo, 110-volt, 200-ampere, complete with sliding base, belt tightener and regulator.

1 United States Weston dynamo, 150-light, 100-volt, 75-ampere, complete with sliding base, belt tightener and regulator.

2 generators, 80 K. W. type, U. S. Westinghouse bipolar, 350 revolutions per minute, 550 volts, size of pulley, 54x18 inches; paper rim; side rails complete.

2 Field Rheostats Westinghouse three-jaw switches for throwing generators in multiple.

1 voltmeter Westinghouse, 0 to 600.

2 amp.-meters Westinghouse, capacity 0 to 160.

1 amp.-meter Westinghouse, capacity 0 to 300.

2 Westinghouse circuit-breakers.

3 Westinghouse lightning arresters.

3 Westinghouse switches, double throw.

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2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
4 25 K. W. Edison bipolar.
2 20 K. W. Edison bipolar.
1 100 K. W. M. P., 4, Westinghouse.
2 45 K. W. M. P., 4 Westinghouse.
1 30 H. P. Westinghouse.
1 13½ K. W. M. P. Amer. Ball.
2 10 K. W. Edison bipolar.
1 500-ampere Onondaga.
1 25 K. W. Electro Dynamic.
1 45 K. W. General Electric, M. P., 850 R. P. M.

Arc Dynamos.
2 125-light, multi-circuit Brush, 2000 C. P.
2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, latest type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush.
10 50-light, 2000 C. P., T.-H., with ring armatures.

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1 300 K. W. Fort Wayne, 2000 volts, 7200 alternations, single-phase.
1 240 K. W. Westinghouse, single-phase, 1100 volts, 16000 alternations.
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2 90 K. W. General Electric, single-phase, 1000 volts, 16000 alternations.
2 120 Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 110 K. W. Fort Wayne, 2200 volts, 16000 alternations.
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1 60 K. W. General Electric, single-phase, 2000 volts, 16000 alternations.
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2 100 K. W. M. P., 4, Gen. Electric.
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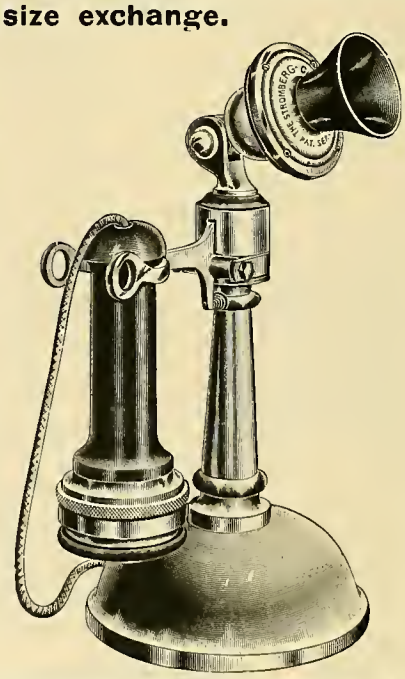

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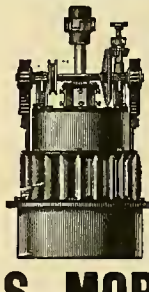

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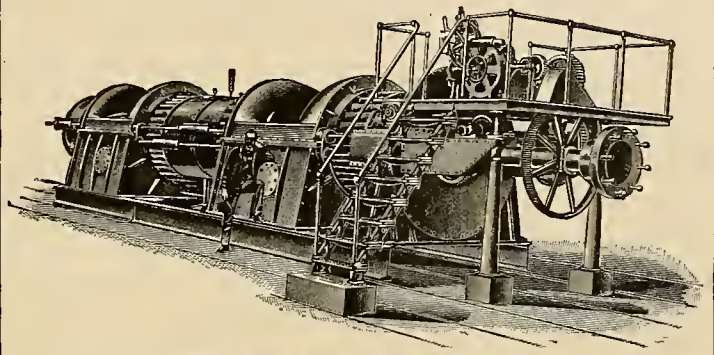

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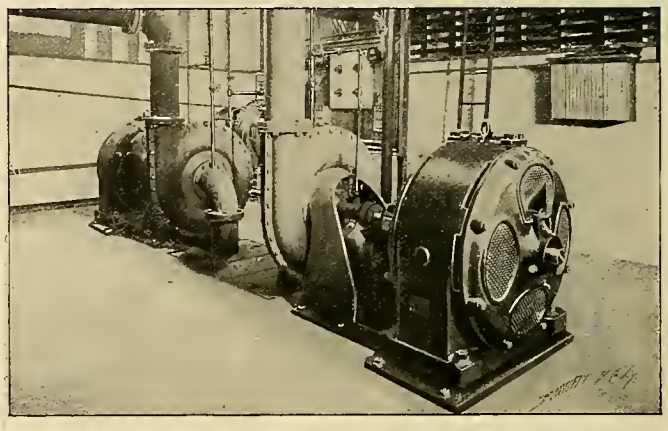

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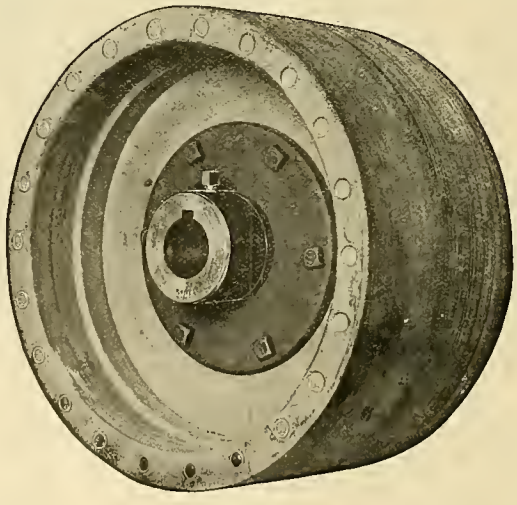

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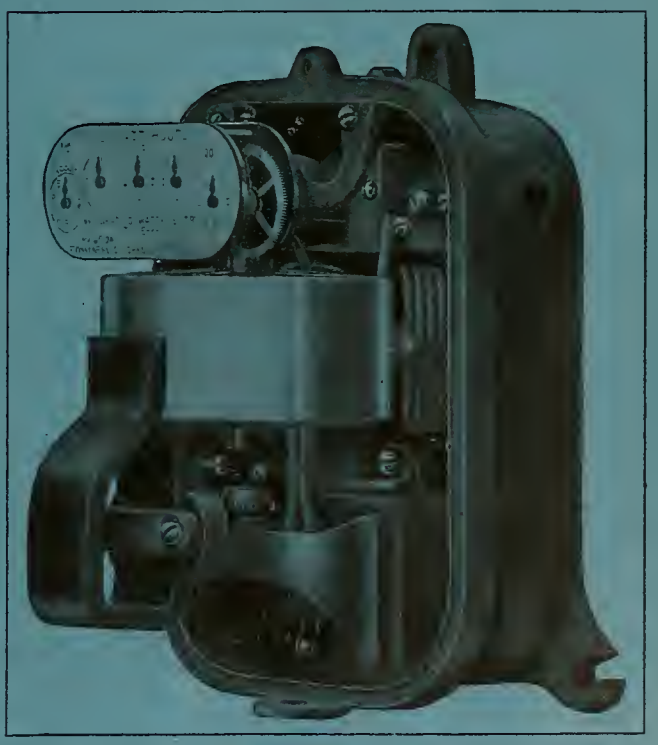

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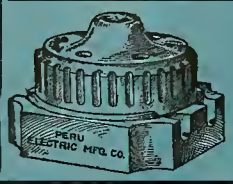

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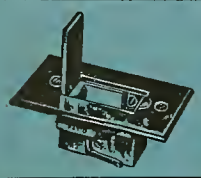

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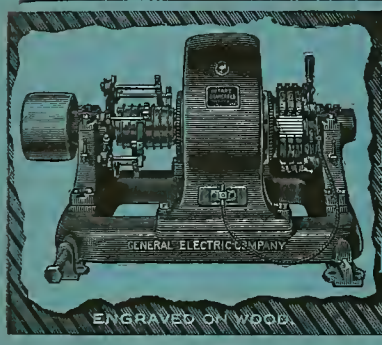

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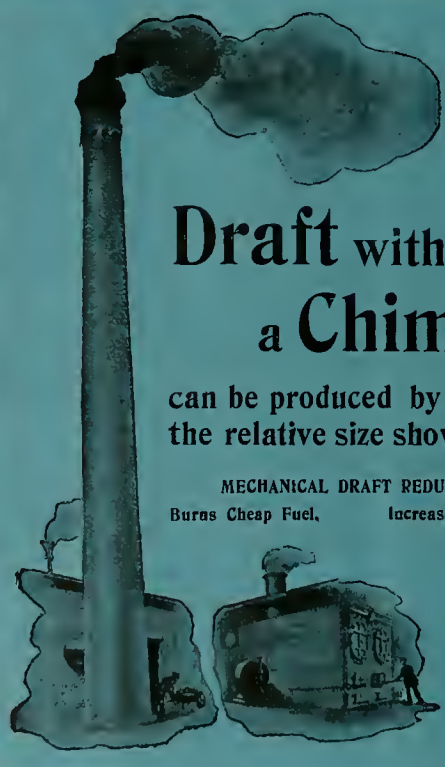

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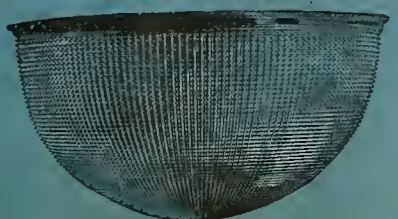

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Pressed Steel Case Arc Lamps

FOR ALL CIRCUITS.

Twenty-Five Different Types.

Perfect in Regulation, Long Life, Easy Accessibility to Mechanism.

In all competitive tests they have been proven 50 per cent the best lamp made.

WESTERN ELECTRICAL SUPPLY CO.,

ST. LOUIS, U. S. A.

Full Particulars and Descriptive Matter Mailed on Application.

The Word Peak

virtually means the hardest part of your power station's day's work. Provision must be made for the peak, although but a fraction of the amount of energy represented by it is normal.

By taking a large portion of the peak and smoothing out the load fluctuations, a storage battery will increase the capacity of an Electric Railway Power Station and decrease the cost of operation. The Chloride Accumulator represents the latest development of Storage Battery Construction.

Engineering advice and illustrated descriptive bulletins at your service for the asking.

THE ELECTRIC STORAGE BATTERY CO., 19th St. & Allegheny Ave., Phila., Pa.

SALES OFFICES: NEW YORK, 100 Broadway; BOSTON, 60 State St.; BALTIMORE, Equitable Bldg.; CHICAGO, Marquette Bldg.; DETROIT, Michigan Electric Co.

L-23-3

ALTERNATING-CURRENT POWER MOTORS,

1-20 TO 2 1-2 ACTUAL HORSEPOWER.

SIMPLE, RELIABLE, SATISFACTORY.

Send for bulletins just issued describing new types.

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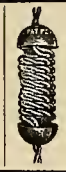
The Emerson Electric Mfg.Co.,
714-716-718 St. Charles St., ST. LOUIS, MO.



A NOVELTY—JUST OUT!

UNIVERSAL CORD SPOOL.

This is a neat and novel device for adjusting the length of cord of your drop light. Quickly attached; always hangs straight; cannot slip; no loop to dangle about; no socket to be removed. Made of hardwood, natural green or cherry finish. Prices on application. Manufactured and patented by the

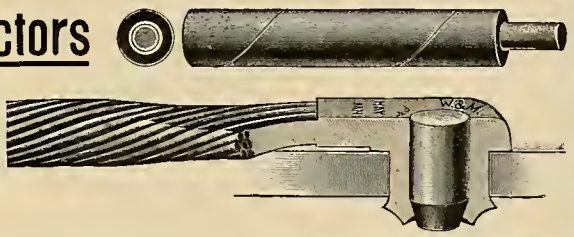
CRESCENT MFG. CO., 52 W. Jackson Boulevard, Chicago, Ill., U. S. A.

For Sale by All Dealers in Electrical Supplies.

"CROWN" Insulated Conductors

AND

Rail Bonds



"Crown" wires are the perfection of Rubber Insulation for high or low voltage, direct or alternating currents, solid or stranded conductors up to 2,500,000 circular mils' capacity.

"Crown" bonds are the perfection of simplicity and economy in rail bonding, together with perfection of contact.

In "CROWN" WIRES or "CROWN" BONDS you secure the best attainable results, electrically and mechanically.

Solid or stranded bare copper conductors; also lead-encased and armored for aerial, underground and submarine work.

American Steel and Wire Co., Chicago, Ill.

NEW YORK, WORCESTER, DENVER, SAN FRANCISCO; LONDON, ENG.

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

WRITE FOR PRICES.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

THREE IMPORTANT POINTS:

SIMPLICITY, DURABILITY, REFINEMENT OF DESIGN

are the first points considered by prospective arc lamp buyers. **The Belden Arc Lamp** excels, not only in the above points but in many others. Users pronounce it the most satisfactory lamp on the market.

It burns a minimum of 250 hours.
No alignment necessary.
Trims easier than an open arc lamp.
Allows easy access to every part of lamp.
Gives absolutely steady light.

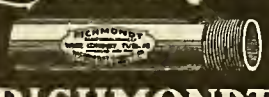
Our bulletins give further reasons why **The Belden** should receive your careful consideration before placing your next order.

BELDEN-LARWILL ELECTRIC & MFG. CO.,
FORT WAYNE, IND.

AGENTS: M. B. Austin & Co., 58 W. Van Buren St., Chicago. C. E. Wilson, 1000 Betz Bldg., Philadelphia, Pa. R. N. Stewart & Co., Denver, Colo.

We are now in a position to establish desirable agencies in all principal cities in this and foreign countries.

ELECTRO GALVANIZED CONDUIT



INTERIOR UNDERGROUND CONDUIT AND ALL FITTINGS

RICHMONDT CONDUIT CO.
MILWAUKEE U.S.A.

American Bridge Company

DESIGNERS
MANUFACTURERS
AND ERECTORS OF

Steel Bridges
Steel Buildings
and All Classes of
Metallic Structures

WE have decided to carry at all our plants a large stock of Raw Material, from which we can furnish with great promptness any ordinary order for Steel Bridges, Roofs, Buildings, Columns, Girders, Beams, Channels, Angles, Plates, etc.

The facilities at our disposal and our operative system are such as to insure *most favorable quotations* and *deliveries for any part of the world.*

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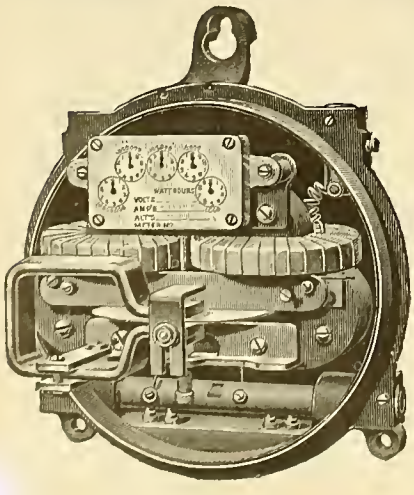
Buffalo, N. Y.	Duluth, Minn.	New Orleans, La.	Sydney, N. S. W.
Baltimore, Md.	East Berlin, Conn.	Pencoyd, Pa.	Trenton, N. J.
Butte, Mont.	Elmira, N. Y.	Philadelphia, Pa.	Wilmington, Del.
Columbus, Ohio.	Groton, N. Y.	Pittsburg, Pa.	Youngstown, Ohio.
Chicago, Ill.	Horseheads, N. Y.	Rochester, N. Y.	

European Office: LONDON

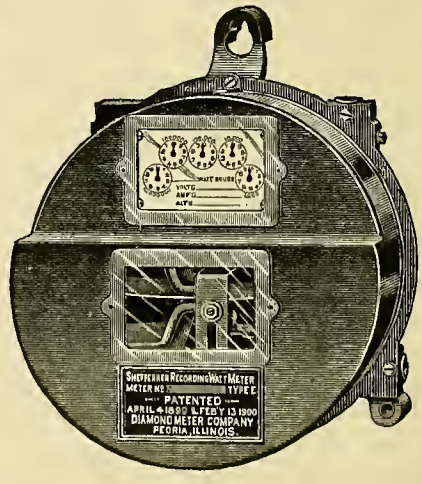
LILLIBRIDGE, N. Y., 21-60.



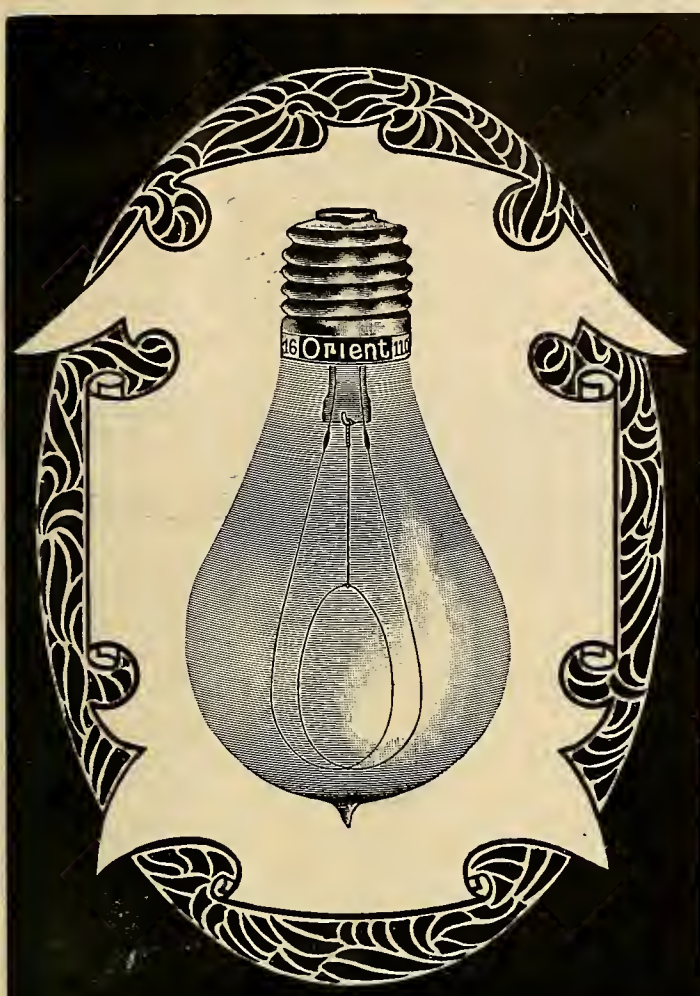
Scheeffer Recording Wattmeter.

ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.



DIAMOND METER CO.
PEORIA, ILL., U. S. A.



THE POPULAR VOTE

ON THE SUBJECT OF INCANDESCENT LAMPS IS UNANIMOUSLY IN FAVOR OF THE

ORIENT

WHICH, ON PAST OR PRESENT RECORDS, STANDS ABSOLUTELY

SECOND TO NONE.

A BINDING GUARANTEE INSURES FULL RATED CANDLE POWER AND EXACT EFFICIENCY ORDERED. CAN YOU ASK MORE?

Colonial Electric Co.
RAVENNA, OHIO.

Exclusive Manufacturers of Alladin Lamps, Carried in Stock only by the St. Louis Electrical Supply Co., St. Louis, Mo.

AGENTS.

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ST. LOUIS ELEC. SUPPLY CO., St. Louis, Mo.
ELEC. SUPPLY & ENG. CO., Detroit, Mich.
J. H. BUNNELL & CO., 20 Park Pl., N. Y. City.

Manson Tape....

IN A TIN BOX.

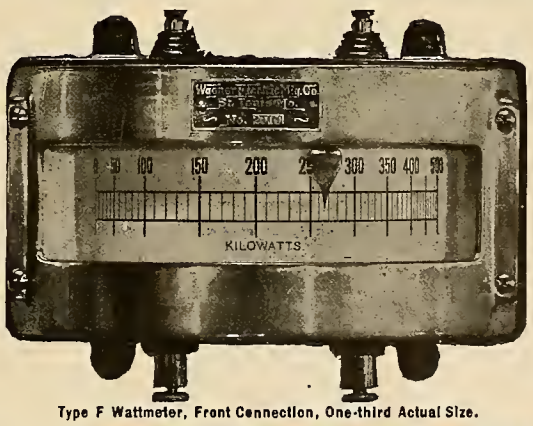
The three-fourths inch **Black Manson Tape** is now being furnished in Tin Boxes holding one roll, or half pound. Convenient to use. Keeps the tape fresh and moist.

Price in 100 pound lots or over, per pound, $0.50.
In less than 100 pound lots, per pound, $0.55.

CENTRAL ELECTRIC COMPANY,

264-266-268-270 Fifth Avenue,
CHICAGO.

OUR LATEST
FRONT OF THE BOARD TYPE
Switchboard Instrument.



Type F Wattmeter, Front Connection, One-third Actual Size.

Our Indicating Wattmeters, Voltmeters and Ammeters are also built for BACK OF THE BOARD.

WRITE FOR PRICES AND BULLETIN Z 31, JUST ISSUED.

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General Offices and Factory, St. Louis, Mo., U.S.A.

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CHICAGO, 1624 Marquette Bldg. BALTIMORE, 204 East Lexington St.
SAN FRANCISCO, 120 Sutter St. NEW ORLEANS, 510 Gravier St.
FOREIGN DEPARTMENT, Havemeyer Bldg., New York City.
CITY OF MEXICO, MEX., American Engineering Co. of Mexico, Agents.
LONDON, ENG., 47 Victoria St., C. R. Heap, Agent. YOKOHAMA, JAPAN, Segnali & Hilles, Agents.
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STORAGE BATTERIES

FOR

CENTRAL STATIONS, STREET RAILWAYS

AND

ISOLATED PLANTS.

NO CAST PLATES. NO PERFORATIONS. NO APPLIED PASTE. NO INFRINGEMENT.

HIGH EFFICIENCY. GREAT CAPACITY.

SUPERIOR ELECTRICAL CHEMICAL FORMATION.

HELIOS-UPTON COMPANY,

PHILADELPHIA, PA.

CHICAGO, ILL. PEABODY, MASS.

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Western Electric Co.
Western Elec. Supply Co.

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American Electric Co.
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Ft. Wayne Elec. Wks., Inc.
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General Inc. Arc Lt. Co.
Gregory Electric Co.
Helios-Upton Co.
Lea-Hooven Mfg. Co.
Manhattan Gen'l Const. Co.
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Leather Preserver Mfg. Corp.

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American Bridge Co.

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Becker Bros.
Central Electric Co.
General Electrical Repair Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.
Saze & Bro., F. B.

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Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
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American Steel & Wire Co.
Central Electric Co.
General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

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Speer Carbon Co.
United States Carbon Co.
Western Elect. Supply Co.

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Link Belt Machinery Co

Circuit Breakers.
Cutter Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

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Miller-Knoblock El. Mfg. Co.
Varley Duplex Magnet Co.

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Vitro Chrome Chemical Co.
Webster Chemical Co.

Compound.
Dearborn Drug & Chem. Wks.
McLennan & Co., K.
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Central Electric Co.
Electric Appliance Co.
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Richmondt Conduit Co.
Sprague Electric Co.
Western Elect. Supply Co.

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Becker Bros.
Chicago Edison Co.
General Electrical Repair Co.
Hodge-Walsh Elec. Eng. Co.
Western Electric Co.

Contractors and Electric Light Plants.
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Crocker-Wheeler Company.
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General Electric Co.
Northern Elec. Mfg. Co.
Roth Bros. & Co.
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Sprague Electric Co.
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Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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American Electric Co.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
Central Electric Co.
Driver-Harris Wire Co.
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General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
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Okonite Co., The
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Roebling's Sons Co., J. A.
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Standard Underground C. Co.

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Elec. Engineer Corr. Inst.
Int. Correspond. Schools.

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Blue Ridge Locust Pin Co.
Central Electric Co.
Central Mfg. Co.
Independent Tel. Supply Co.
Indpls. Arm. Brack. & Pin Co.
Leavitt, R. H.
Texas Arm & Pin Co.
Western Elect. Supply Co.

Cut-Outs and Switches.
American Electric Co.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
D. & W. Fuse Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
General Elec. Co.
General Inc. Arc Light Co.
Hill. W. S., Electric Co.
Palste Co., H. T.
Siemens & Halske Electric Co. of America.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Dies.
Franklin Eng. & Electro Co.

Dynamos and Motors.
American Electric Co.
Bullock Elec. Mfg. Co.
Central Electric Co.
Chicago House Wrecking Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Kentucky Electrical Co.
Northern Elec. Mfg. Co.
Ohio Electric Works.
Rose Electric Co.
Rossiter, Mac Govern & Co.
Roth Bros. & Co.
Schureman & Hayden.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Stanley Electric Mfg. Co.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
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Queen & Co.
Saze & Bro., F. B.
Siemens & Halske Electric Co. of America.
Stanley Electrical Mfg. Co.
Stanley Instrument Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
Crocker-Wheeler Company.
General Electric Co.

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Jeffrey Mfg. Co.
Link Belt Machinery Co.

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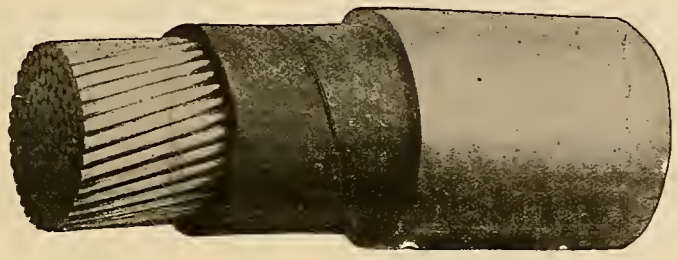

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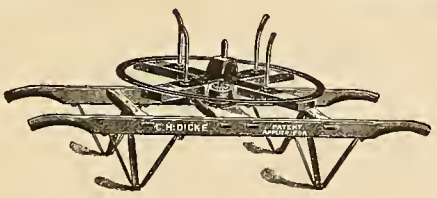

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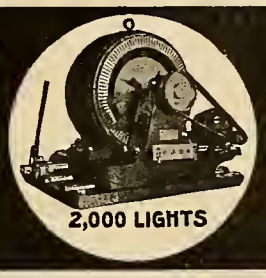

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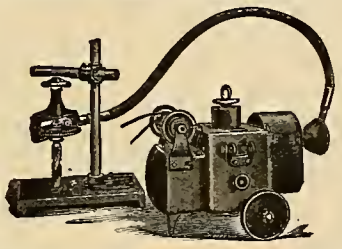

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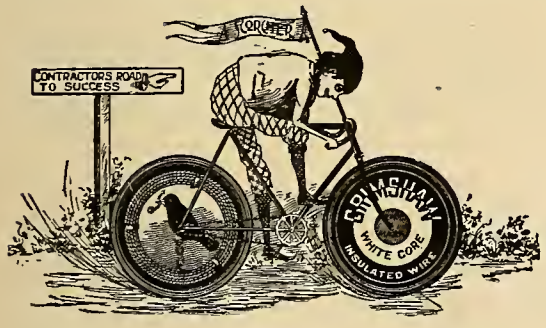

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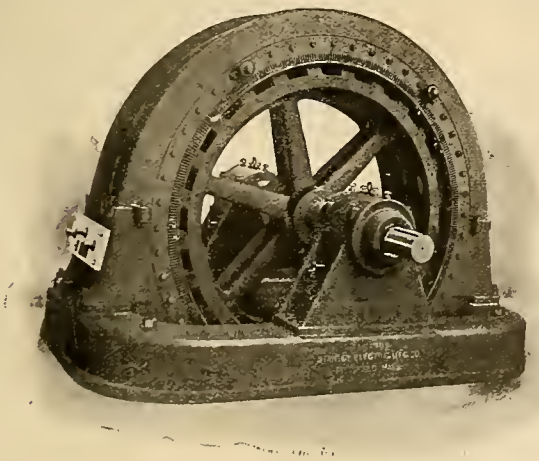

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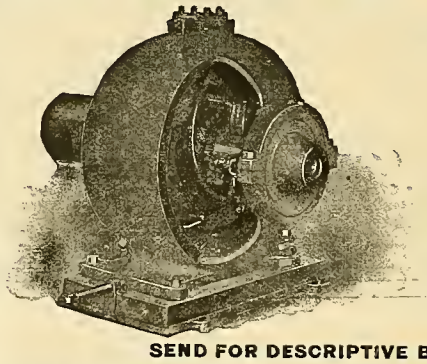

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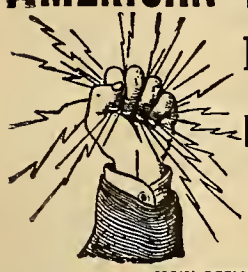

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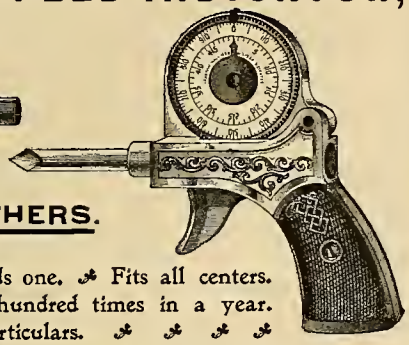

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Every Power User needs one. Fits all centers.
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Mention Western Electrician when writing.

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Reflector for Lighting Show Windows and Art Galleries.
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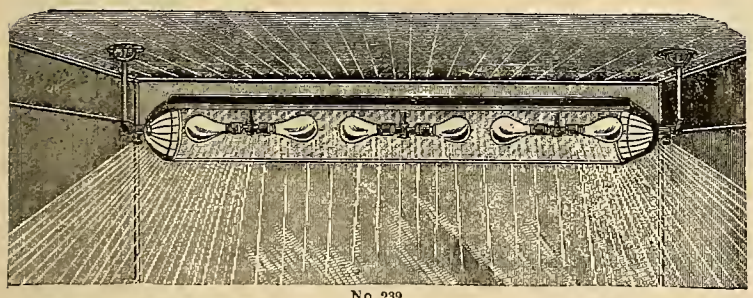

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Reflectors and Shades for Electric Light.

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Prices and Samples on Application.

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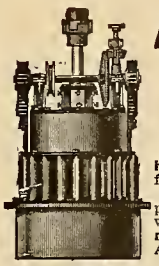

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On Vertical or Horizontal Shaft.
Especially Adapted for Electrical Work.

Gives a higher percentage of useful effect than any other water-wheel heretofore made. All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.

Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with us, as we are willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.

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Especially constructed for Damper Regulators. Furnished to the trade only.
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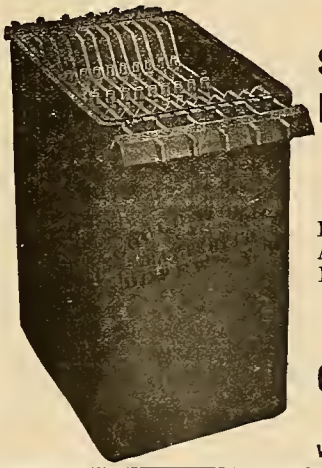

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HINE ELIMINATOR gives dry steam to engine, keeps oil out of the boiler.

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Party owning two electric-light plants now earning 6% interest on $100,000 desires partner with $100,000 cash to build waterworks in same towns. Have promise of good waterworks franchise with city contracts in both cities. References required with answer. Address "WATERWORKS," care Western Electrician, 510 Marquette Building, Chicago.

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Two lamp salesmen, with or without an established trade. Permanent positions to competent men with leading incandescent lamp manufacturer. State experience and salary expected. All communications treated strictly confidential. Address "INCANDESCENT," care Western Electrician, 510 Marquette Building, Chicago.

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I am desirous of securing a position as buyer of electrical supplies and hardware for a large manufacturing or operating concern. Have had a long and varied experience as a salesman and buyer of electrical supplies and hardware and am thoroughly familiar with the subject. A position where an opportunity for advancement offers is desirable. Address "BUYER," care Western Electrician, 510 Marquette Building, Chicago.

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Position as superintendent or electrician of electric light plant. Thoroughly familiar with all branches of electric lighting. Twelve years of practical experience in electrical work, 15 years' experience handling "steam." Best of references. Address "SUPERINTENDENT," care Western Electrician, 510 Marquette Building, Chicago.

FOR SALE.

Electric-light plant in town of 5,000. No bonds, no competition. Good contract for five years, cheap fuel. Now earning $350 per month. Net price $4,500. If certain improvements are made this could be doubled. Will bear close investigation. References required with answer. Address "PLANT," care Western Electrician, 510 Marquette Building, Chicago.

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SECOND-HAND ELECTRICAL MACHINERY.
WALSH'S SONS & CO.,
160 WASHINGTON ST., NEWARK, N. J.

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One second-hand Universal Milling Machine of a size corresponding to Numbers 1, 1½ or 2 Brown & Sharp. The F. BISSELL CO., Toledo, O.

WANTED.

I am seeking a position as superintendent of the electrical apparatus of a power transmission plant for a large manufacturing concern, where an extended and thorough experience will be helpful. Am thoroughly capable in erecting, planning and operating.

Have had an extended experience in erecting steam plants and shafting. Correspondence invited. Address "TRANSMISSION," care Western Electrician, 510 Marquette Building, Chicago.

FOR SALE.—A BARGAIN.

Telephone System in an up-to-date growing town in Southwest Arkansas; healthy location, no malaria; good rates; no rent to pay for central office; company owns two-story building and lot in business part of town; pays about 35 percent. on price asked, $3,500. It will pay you to investigate. Terms reasonable. Good reason for selling. For full particulars address F. R. COSBY, Hope, Arkansas.

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One 115 to 125-volt Siemens & Balske generator (external armature type) arranged for direct connection to 150 h. p. New York Safety Engine, 250 r. p. m. As good as new. Immediate delivery. F. A. WUNDER, 44 Broad St., New York City.

FOR SALE—A BARGAIN.

150 hard rubber reels, 7x7x10½ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

WE OFFER FOR IMMEDIATE SHIPMENT

2 100 K. W., 500-volt Edison bipolars.
1 75 K. W., General Electric, 500-volt, 4 pole.
1 120 K. W., A. S. type, General Electric Alternator.
3 120 K. W., A. type, General Electric Alternators.
1 240 K. W., Stanley two-phase, 1,000 or 2,000 volts.
1 50 K. W., 2,000-volt, Siemens & Halske, 60 cycle.
1 65 Light, Brush Arc, 10 amperes.
1 40 Light, Western Electric Brush Arc.
1 600 H. P., Ball cross-compound engine, 20x36x18.
1 200 H. P., Ball, 12x22x16 Tandem compound, with condenser.
1 175 H. P., Ideal, 12x20x14 Tandem compound.
2 18½x18 Ideal engines.
1 14½x15 McIntosh & Seymour engine.

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Write for our latest price-list No. 40.

ILLINOIS MAINTENANCE COMPANY,
E. H. CHENEY, Manager,
204 Dearborn Street, Chicago.

AUCTION SALE.

Postponed Till Dec. 10.——Bankrupt Sale.

Entire Property of the Suburban Electric Co., Covington, Ky., Offered For Sale.

Notice is hereby given that pursuant to an order in bankruptcy, in the matter of the Suburban Electric Company, a corporation organized under the laws of the state of Kentucky, bankrupt, No. 276, in the District Court of the United States for the District of Kentucky, I will, on the 10th day of December, 1900, at 10 o'clock a. m., at the Scott street entrance of the United States Court in Covington, Ky., sell at public auction to the highest bidder, all the property, real and personal, of every kind and description belonging to the Suburban Electric Company, bankrupt, including all the rights privileges and franchises, except the franchise to be a corporation, and also its electric lighting plant, power station, machinery, engines, boilers, dynamos, electric machine, electric lamps and other appliances and appurtenances, poles, lines, wires and all contracts, claims and demands, and all other property of every kind and description, also the following described real estate belonging to the said bankrupt, situated in the city of Covington, Kenton County, Kentucky, and bounded as follows:

1. Beginning at a point on the east line of Madison avenue at the northeast corner of Madison avenue and an alley running parallel to and between Fourth and Fifth streets; thence northwardly along the east line of said Madison avenue toward Fourth street ninety (90) feet; thence at right angles to Madison avenue one hundred and ninety (190) feet to another alley; thence with said other alley and at right angles to said first-named alley ninety (90) feet to said first-named alley; thence westwardly along the same one hundred and ninety (190) feet to the place of beginning.

And also the following described piece of real estate belonging to said bankrupt, situated in the city of Newport, Campbell County, Kentucky, to wit:

2. Lot No. 250 in the Cote Brilliant Lot & Home Company's subdivision, fronting thirty (30) feet on the west side of Park avenue, and extending back one hundred and twenty (120) feet to an alley.

The first tract of real estate above described will be sold subject to such lien as Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, or either of them, may have upon said real estate, which lien is as yet undetermined in amount.

The property above described will be sold free from any and all liens or encumbrances, except the lien or encumbrance in favor of Caroline B. Smith, Frank F. Smith, her husband, and George M. Casey, upon the said first described real estate aforesaid.

The second piece of real estate described aforesaid will be sold separately.

All the balance of the real estate, and all the other property and assets of every kind, and the rights, privileges and franchises of the Suburban Electric Company will be sold as an entirety and as a going concern.

The terms of the sale will be one-third (⅓) cash, to be paid upon the confirmation of the sale, the balance in equal installments of six and twelve months from date of sale, deferred payments to draw six (6) per cent interest and to be secured by lien upon the property sold and also by bond with sureties satisfactory to the referee in bankruptcy herein; or purchaser may pay cash for said property upon the confirmation of the sale. No bid for said property will be received from any bidder who shall not place in the hands of the undersigned at the time of making said bid, as a pledge that said bidder will make good his bid if the sale is confirmed, the sum of fifteen thousand ($15,000) dollars, which sum of fifteen thousand dollars will be credited upon the first payment of the purchase money for said sale.

Inspection of property invited. Full information given upon application at the office of the bankrupt in Covington, Ky.

CHARLES H. SHAW,
Trustee in Bankruptcy of the Suburban Electric Company.

SIMRALL & GALVIN,
Attorneys for Trustee in Bankruptcy.

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BARGAINS--FOR SALE.

110-Volt Incandescent Dynamos.

2 12-light Edison, ¾ K. W., self-oilers.
1 25-light Wenstrom.
4 35-light Gibbs, M. P., slow speed, comp., brand new.
1 50-light Hawkeye.
1 60-light Nowotny, self-oiler.
1 50-light Card, multipolar, self-oiler, slow speed, 1150 R. P. M.
1 50-light Crocker-Wheeler, slow speed, self-oiler.
2 55-light Gibbs, M. P., compound, brand new, moderate speed.
4 55-light Gibbs, M. P., compound, brand new, slow speed, 1100 R. P. M.
1 55-light Siemens & Halske, type B., M. P., slow speed, self-oiler, brand new.
1 60-light Thomson-Houston.
1 60-light Westinghouse.
1 80-light Siemens & Halske, type L. H., self-oiler, brand new.
2 80-light Siemens & Halske, ironclad type, M. P., self-oilers, brand new.
1 100-light Bain, compound, self-oiler.
1 100-light J. & C., self-oiler.
4 110-light Gibbs, M. P., compound, self-oilers, slow speed, brand new, 1000 R. P. M.
1 110-light Siemens & Halske, M. P., Churchward type, compound, extra slow speed, brand new, 650 R. P. M.
3 150-light Gibbs, M. P., compound, self-oilers, speed 1650.
1 150-light Gibbs, M. P., shunt, self-oiler, slow speed, 825 R. P. M.
1 160-light Card, self-oiler.
2 180-light Siemens & Halske, M. P., self-oilers, brand new.
1 200-light Western Electric, self-oiler, comp.
2 210-light Edison, self-oilers, 12 K. W.
4 210-light Siemens & Halske, 12 K. W.
2 210-light Siemens & Halske, M. P., brand new, type B., self-oilers.
4 210-light Gibbs, M. P., self-oilers, very slow speed, 725 R. P. M., brand new.
1 250-light Westinghouse.

110-Volt Incandescent Dynamos.—Continued.

1 250-light Commercial, comp., self-oiler.
1 250-light Eddy, self-oiler.
1 270-light General Electric, 15 K. W., M. P., direct-connected to Case engine, compound.
2 270-light Westinghouse, M. P., slow speed, 16 K. W.
1 300-light Columbian, multipolar, comp., self-oiler, slow speed.
4 300-light Gibbs, M. P., self-oilers, slow speed, 725 R. P. M., brand new.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 350-light National, self-oiler, compound.
1 350-light Edison, 20 K. W., self-oiler.
6 350-light Siemens & Halske, type L. H., self-oilers.
1 360-light Duplex, multipolar, self-oiler, compound, slow speed.
3 500-light Siemens & Halske, type L. H., self-oilers, brand new.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elckmeyer.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers, 575 R. P. M., brand new.
2 800-light Edison, 45 K. W., self-oilers.
1 1200-light Siemens & Halske, type L. H., 70 K. W., self-oiler.
1 1350-light Siemens & Halske, Type I, 80 K. W., for direct connection, 8 pole.
3 1500-light Siemens & Halske, type L. H., self-oilers, 100 K. W.
1 1500-light Siemens & Halske, 100 K. W., type I., 6 pole, for direct connection, brand new.

220-Volt Generators.

Rheostat, base-frame and pulley accompany each machine.

1 8½ K. W. Westinghouse, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Edison, self-oiler.
1 15 K. W. Edison, compound, self-oiler.
1 30 K. W. Siemens & Halske, M. P., ironclad type, self-oiler, brand new.
1 45 K. W. Edison, compound, self-oiler, new armature.
1 50 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.
1 marble panel switchboard for above.
1 100 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 35 K. W. Mather, self-oiler.
2 35 K. W. Siemens & Halske, brand new, M. P., Churchward type, self-oilers, very slow speed, 475 R. P. M.
1 45 K. W. Edison, compound, self-oiler.
1 75 K. W. Westinghouse, Kodak set, Westinghouse generator and Westinghouse compound engine, 14 x 24 x 14, all complete, fine.

Alternating Generators.

1 350-light Thomson-Houston, A. 18.
1 600-light Thomson-Houston, A. 6.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light Thomson-Houston, 30 K. W., slotted armature.
2 600-light General Electric, A. 30, toothed armature.
2 650-light Thomson-Houston, A. 35.
2 750-light Westinghouse, 37½ K. W.
1 900-light Warren, 45 K. W., 1100 volts.
1 1000-light Wood, 50 K. W., self-oiler.
1 1000-light Siemens & Halske, 50 K. W., self-oiler, 60 cycle.
1 1200-light National, with exciter.
1 1200-light Siemens & Halske, 60 K. W., Churchward type, brand new, 60 cycle, single-phase, 1100 volts, with exciter.
1 50 K. W. Siemens & Halske, Churchward type, brand new, 50 cycle, two-phase, rotary transformer, 1100 volts, alt. to 250 volts direct, complete, with marble panel switchboard.
1 1200-light Westinghouse, 60 K. W.
1 1200-light Thomson-Houston, 60 K. W.
1 1200-light Warren, 60 K. W., self-oiler.
1 1200-light General Electric, A. 60.
2 1300-light Thomson-Houston, A. 70, 1100 or 2200 volts.
1 1600-light Wood, 76 K. W., self-oiler.
1 1600-light General Electric, monocyclic, 75 K. W., self-oiler, 60 cycle.
1 1800-light National, 90 K. W.
1 4000-light Wood, 200 K. W., self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 1200 C. P. T.-H., K. 12.
1 30-light 2000 C. P. Brush, No. 7.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 1200 C. P. Wood No. 6.
3 40-light 2000 C. P. Western Electric, self-oilers.
2 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7.
1 60-light 1200 C. P. T.-H., L. D. 12.
1 60-light 2000 C. P. T.-H., M. D. 2.
2 60-light 2000 C. P. Western Electric, self-oilers.
1 60-light 2000 C. P. Westinghouse.
3 60-light 2000 C. P. Wood, No. 8.
1 65-light 800 C. P. Ball, 4 amp.
1 65-light 2000 C. P. Brush, No. 8.
2 75-light 1200 C. P. Wood, with new arm'e.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westinghouse, self-oilers.
3 125-light 1200 C. P. Excelsior, inteat type.

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1 20-light Brush, 10 ampere	60.00
2 30-light Brush, 10 ampere, each	75.00
1 500-light Westinghouse, 1000 volt, brand new	100.00
1 120 K. W. General Electric, 2,000 volt	300.00

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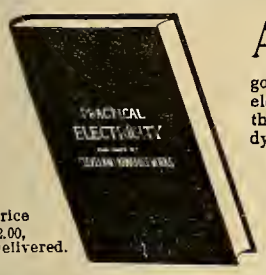

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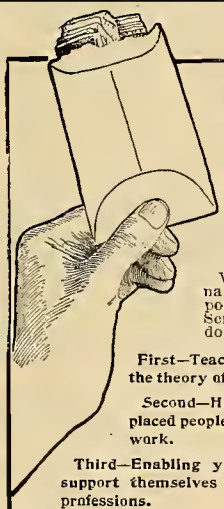

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Electric Cap Lights,	2.00
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S901 1 pair Williams automatic engines, coupled together. Size, 17¾x24. Revolutions, 200; builders' rating, 200; H. P., 200.

S902 2 Westinghouse compound engines, 13x22x13. Revolutions, 290; H. P., 125.

S903—1 horizontal tangye bed, side crank automatic steam engine, made by Russel & Co. Steam cylinder, 13x18.

S904 1 Wright automatic Corliss, 23x36.

S905 1 10x9 Westinghouse.

S906 1 8x12 Lansing automatic.

S907 1 7x12 Rice automatic.

S908 1 16x24 horizontal box bed, side crank.

S909 1 12x16 F. C. Wells horizontal tangye bed, side crank.

S910 10 9x12 engines, manufactured by George W. Tifft & Sons of Buffalo, N. Y.

S911 1 10x22 box bed, right hand, side crank.

S912 1 16x36-inch Corliss, left hand.

S913 1 9x16 Rice automatic.

S914 1 11x16x16 McEwen tandem compound.

S915 1 8x10 Atlas automatic, center crank.

S916 1 11x18 Sinker, Davis & Co.

S917 1 12x16 horizontal, box bed, side crank.

S918 1 10x14 automatic Wright & Adams.

S919 1 12x12 high-speed automatic Ideal.

S920 1 20x24 box bed, balance valve.

In addition to the above, we have on hand at all times a complete assortment of all size engines, ranging in power from 1 to 500 horsepower. Ask for our complete list.

BOILERS.

We still have on hand a few of Armour's 54x16, 60x16, 66x16, 66x18 and 72x18 horizontal tubular boilers. They are in excellent condition.

AIR COMPRESSORS.

S921 1 Duplex straight-line Clayton, 9x9.

S922 1 4½x6-inch Clayton.

S923 2 12x16. Will compress air up to 60 pounds' pressure, with 80 to 100 pounds' steam.

BELTING.

We carry at all times a complete stock of short-lap, double-thick leather belting, both new and second-hand. Our quotations are always 30 per cent. below lowest market values.

SHAFTING.

We carry a stock of all sizes of shafting.

STEAM PUMPS.

Ask for our complete list of steam pumps. We have all kinds.

Electrical Apparatus.

See our list of supplies in the Western Electrician of October 27.

A COMPLETE OUTFIT.

We purchased the following outfit:

S924 1 McEwen tandem compound engine, 8½x14x12, with a direct-connected multipolar compound-wound dynamo, capacity, 50 K. W. Included in this outfit is a 100-horsepower Sterling water-tube boiler, with full front grate bars, etc. Also a Duplex steam pump and a copper-tube heater. It was used about 2½ years and replaced, owing to a necessary increase in power.

DYNAMOS, ETC.

1 500-light National, 1000 volts, alternating exciter, attached to shaft, complete with sliding base regulator and pulley, in first-class condition. Full description on application; also photograph.

1 Thomson-Houston, 400-light, compound-wound dynamo, new, 110 volts, 200 amperes, complete with sliding base, belt tightener and regulator.

1 Thomson-Houston, 500-light, compound-wound dynamo, 110-volt, 200-ampere, complete with sliding base, belt tightener and regulator.

1 United States Weston dynamo, 150-light, 100-volt, 75-ampere, complete with sliding base, belt tightener and regulator.

2 generators, 80 K. W. type, U. S. Westinghouse bipolar, 350 revolutions per minute, 550 volts, size of pulley, 54x18 inches; paper rim; side rails complete.

2 Field Rheostats Westinghouse three-jaw switches for throwing generators in multiple.

1 voltmeter Westinghouse, 0 to 600.

2 amp.-meters Westinghouse, capacity 0 to 160.

1 amp.-meter Westinghouse, capacity 0 to 300.

2 Westinghouse circuit-breakers.

3 Westinghouse lightning arresters.

3 Westinghouse switches, double throw.

1 electric elevator, manufactured by Keystone Electric company of Erie, Pa.; self-oiler, 60-ampere, No. 324, 220-volt, 1,025 revolutions; worm gear and cog are solid brass; 53 grooves for ⅝-inch cable on drum; drum 30-inch diameter by 22-inch face; the motor and gearing set on a cast-iron base; this outfit cost $1,400; the worm screw and shaft are cut from solid forging and are steel; the motor is 15 horsepower; the machine is geared to give a speed to the car of 150 feet per minute; was only in operation about four months.

1 Baxter 110-volt motor, 2-horsepower, good as new; complete and starting 60x base and tightener. Price.....$50.00

1 1000-light Slattery alternating-current dynamo, 1000-volt, complete with exciter and instrument. Practically as good as new.

1 2-horsepower Baxter motor, 100-volt, complete with starting box, base with belt tightener and pulley. First-class condition.

Our Machinery Hall is 200 X 360 feet.

Our complete list of items is contained in CATALOGUE No. 156.

CHICAGO HOUSE WRECKING CO.,
W. 35th and Iron Sts., Chicago.

ELECTRICAL AND STEAM MACHINERY.

THE FOLLOWING IS PART OF OUR STOCK. **SEND FOR LATEST CATALOG.**

Direct-Current Dynamos. 110 Volts.
(Direct-Connected.)
2 100 K. W. Westinghouse, 8-pole, 225 R. P. M., direct-connected to McIntosh & Seymour compound engines.

Belted Dynamos. 110 Volts.
2 150 K. W. Edison bipolar.
4 60 K. W. Edison bipolar.
2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
4 25 K. W. Edison bipolar.
2 20 K. W. Edison bipolar.
1 100 K. W. M. P., 4, Westinghouse.
2 45 K. W. M. P., 4 Westinghouse.
1 30 H. P. Westinghouse.
1 13½ K. W. M. P. Amer. Ball.
2 10 K. W. Edison bipolar.
1 500-ampere Onondaga.
1 25 K. W. Electro Dynamic.
1 45 K. W. General Electric, M. P., 850 R. P. M.

Arc Dynamos.
2 125-light, multi-circuit Brush, 2000 C. P.
2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, latest type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush.
10 50-light, 2000 C. P., T.-H., with ring armatures.

Alternators.
1 325 K. W. Siemens & Halske, 2000 volts, 7200 alternations, single-phase, 115 R. P. M.
1 300 K. W. Fort Wayne, 2000 volts, 7200 alternations, single-phase.
1 240 K. W. Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 240 K. W. Stanley, two-phase, 380 R. P. M., with engines direct-connected.
2 300 K. W. Westinghouse, single-phase, toothed armatures.
1 150 K. W. Westinghouse, two-phase, 1100 volts, 600 R. P. M., 7200 alternations.
2 A-120 General Electric, single-phase, 1000 volts, 16000 alternations.
2 90 K. W. General Electric, single-phase, 1000 volts, 16000 alternations.
2 120 Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 110 K. W. Fort Wayne, 2200 volts, 16000 alternations.
3 60 K. W. General Electric, single-phase, 1050 volts, 16000 alternations.
1 60 K. W. General Electric, single-phase, 2000 volts, 16000 alternations.
1 60 K. W. Stanley, 2000-1000 volts, two-phase, 7200 alternations.
1 75 K. W. Stanley, 2000-1000 volts, two-phase, 16000 alternations.
1 45 K. W. Westinghouse, 2200 volts, 16000 alternations.

Direct-Current Motors and Generators. 220 Volts.
(Direct-Connected.)
1 75 K. W. General Electric, direct-connected to Ideal engine.
(Belt-Driven.)
1 75 K. W. Siemens & Halske bipolar.
1 15 H. P. Excelsior bipolar.
1 10 H. P. Eddy bipolar.
1 5 H. P. Eddy bipolar.

Direct-Current. 500 Volts.
2 60 K. W. Edison.
1 50 H. P. M. P., General Electric.
1 30 K. W. C. & C. bipolar.
1 25 H. P. Eddy, M. P.
1 15 H. P. Eddy.
1 10 H. P. Eddy.
1 2 H. P. Cent. Elect. Co.

Railway Motors.
G. E. 800 S. R. G., 30.
G. E. 1000 W. P., 30.
G. E. 1200, W. P., 50.
Westinghouse 3.
Westinghouse 12A.
Westinghouse 38B.
K, K2 and K12 G. E. Controllers.
Westinghouse 38 and 49 Controllers.
and a constantly changing stock of everything pertaining to street car equipment.

5 200 K. W. Railway Units, each consisting of a 200 K. W. Edison Generator belted to an 18½x18 Ideal Automatic Engine.

Railway Generators. 500 Volts.
1 500 K. W. M. P., 4, Gen. Electric.
1 300 K. W. M. P., 4, Gen. Electric.
1 200 K. W. M. P., 4, Walker.
2 111 K. W. M. P., 4, Westinghouse.
2 100 K. W. M. P., 4, Gen. Electric.
2 200 K. W. Edison.
2 150 K. W. Edison.
2 100 K. W. Edison.
4 60 K. W. Edison.
1 100 K. W. Ft. Wayne.

Engines.
40x72 Corliss (1 right, 1 left).
26x48 Allis.
18x42 Allis.
16x25x15 Armington & Sims.
18½x18 McIntosh & Seymour.
16x16 Erie Ball.
14x13 Armington & Sims.
14x13 Watertown.
13x12 N. Y. Safety Power.
10x12 Watertown.
11x19x24 Tandem Buckeye.

Boilers.
2 375 H. P. Sterling boilers.
2 200 H. P. National Water Tube.
2 42-inch by 16-foot Return Tubulars.
Boilers of various styles and sizes at low rates.

Street Cars.
Opened and closed, of all sizes, and for all gauges. Let us know your wants.

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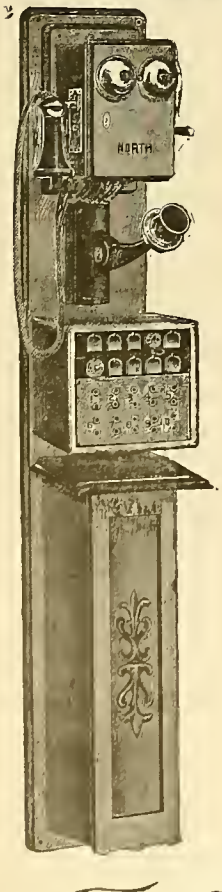

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ALL TROUBLE POINTS

ELIMINATED.

No Listening Keys.
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No Complications in Your Cord Circuit.
No Delays—Always Ready for Business.

WE WILL TELL YOU HOW IT'S DONE. WRITE TO

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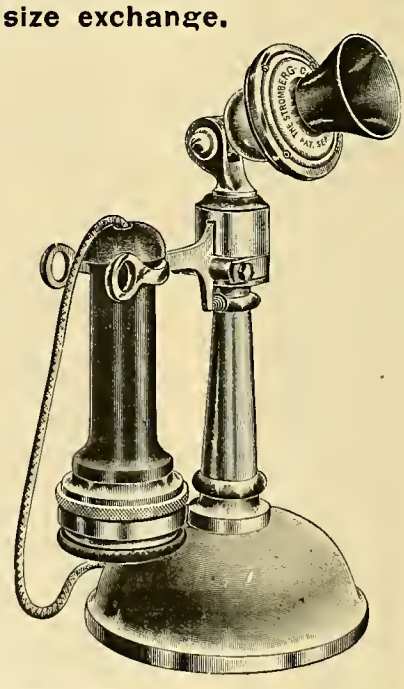
TELEPHONES AND SWITCHBOARDS

for any size exchange.

"CENTRAL ENERGY" SYSTEM.



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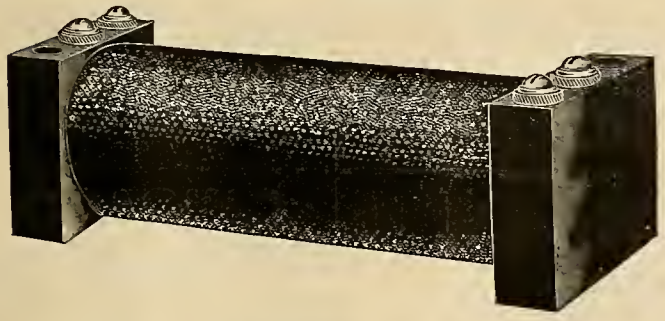
THE STROMBERG-CARLSON TEL. MFG. CO.

70-82 W. Jackson Boul., CHICAGO, U. S. A.



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VARLEY DUPLEX MAGNET CO.

FISHER BUILDING, CHICAGO, ILL. 138 7TH ST., JERSEY CITY, N. J.

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AMERICAN ELECTRIC TELEPHONE CO.

36 to 50 Jackson Blvd., CHICAGO, ILL.

Our new No. 1900 Telephones with Disc Carbon Lightning Arrester for SERIES and BRIDGING work are winners. Try them.

OUR CENTRAL ENERGY SYSTEM
is a great success; likewise our
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Telephone Apparatus Of All Kinds Manufactured.

CONSTRUCTION MATERIAL AND TOOLS LOWEST PRICES.

A BIG LOT OF SECOND-HAND PHONES, IN GOOD ORDER, CAN BE HAD FOR A SONG.

Let us tell you about them.

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Comes only to those telephone exchanges which use the BEST material. If you use our goods success is assured.

We can supply EVERYTHING USED WITH TELEPHONES.

No order too small for attention or too large for our capacity. Rapid deliveries our rule, and each order filled with care. Large stocks always on hand.

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All kinds of telephone supplies. New parts for old telephones. Double-pole receivers.

Electricians' tools. Lightning arresters, carbon and fuse. Extension bells—standard and bridging. Circuit closers. Transmitters of various styles. Repeating coils, induction coils, construction material of all kinds.

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- Receiver with no Exposed Metal Parts.
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- Magneto Boxes can be Removed from Back-board Without Cutting Wires.
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Metallic Circuit Multiple Switchboards.

Positive Double Supervisory Signals. Central Energy. Simple and Mechanically Perfect. All Circuits Perfectly Balanced Electrically. Cost of Operation and Maintenance Reduced to a Minimum.

The Method of Operating that we have adopted has been determined upon, by long years of experience and practical operation by the very best telephone engineers, to be unexcelled.

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One section of our "Universal" switchboard, adapted for medium-sized exchanges using the central battery system. Capacity, 400 lines. Cut shows 240 lines installed, rotary self-restoring line signals, 20 pairs plugs and cords, complete with ringing and listening keys. Several of these sections may be made into a multiple board as the exchange grows.

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SILK COVERED **MAGNET WIRE** COTTON COVERED.

Plenty of it. All sizes. Prices right.
Electro magnets built and rewound.
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Tested Fuse Wire and Fuse Links.
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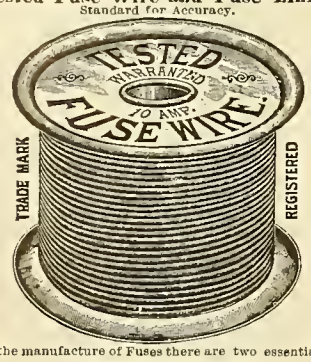

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The steady increase in our business during the past twelve years is the best evidence that our goods meet all requirements.
All kinds of Telephone Fuses and Bases, well made and at low prices.
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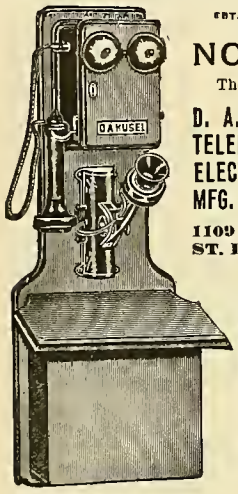

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The oldest and most reliable manufacturer of telephones and switchboards in the West. Write for catalogue and price list.

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Making up the most efficient Telephone on the market for Exchange and Toll-line work. We have improved the Telephone, also the price, to a point that will interest you. Write us for information.

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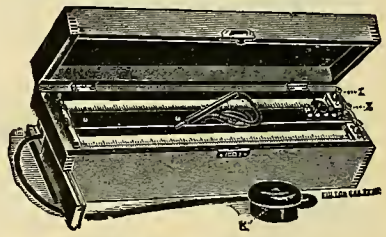

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Special Electrical Machinery.
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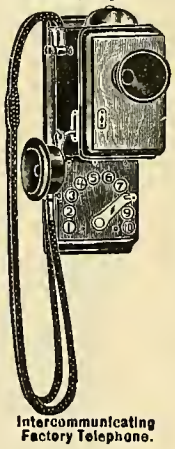

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RINGING OUTFIT.

BECAUSE:

No exchange is complete without one.
It is the cheapest way to secure power.
There are no bearings to oil.
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It is absolutely reliable under all conditions.
It will ring where all other ringers fail.
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It is always ready for duty.

Your operators can give better service with a good signaling device.

Every Outfit is Shipped Complete Ready for Immediate Use.

Every outfit is thoroughly tested and fully guaranteed. This machine is in use in some of the largest exchanges, both in this country and abroad. The net price for the complete outfit is

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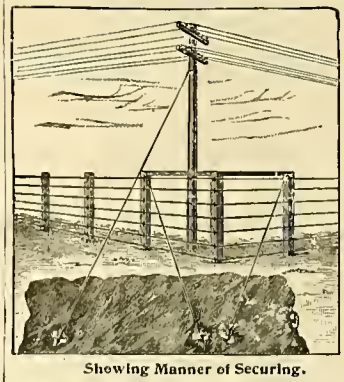

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Secured by the
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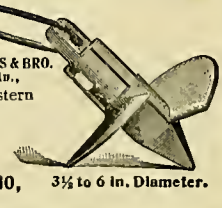
No holes to dig; bore them in the ground and there they stay. "Brace up" the weak points on your line and avoid further trouble.



3½ to 6 in. Diameter.

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GUARANTEES SUPERIORITY
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DEALERS AND CONTRACTORS
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Motors, Motorcycles, Motorettes.

Our New York Type Motorette, Weight 700 pounds. Capacity 3 Persons. Price $1,200.00.

SIMPLICITY, FLEXIBILITY, LIGHTNESS, STRENGTH, RELIABILITY, EASILY OPERATED, PERFECTLY CONTROLLED, ABSOLUTELY SAFE, ABSENCE OF ALL OIL AND DIRT, ECONOMY.

Not an EXPERIMENT, but a TRIED and PROVED SUCCESS.
Over 20,000 DE DION-BOUTON MOTORS operating Motorcycles and Motorettes.
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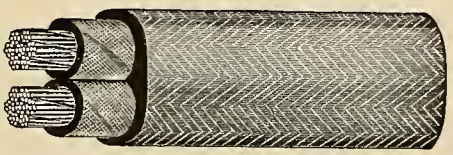
De Dion Motor Supplies and Batteries Always in Stock.

INSULATED RUBBER WIRES AND CABLES.



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WORKS AT
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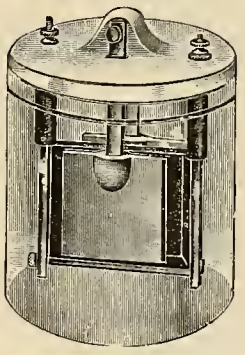
EDISON LALANDE BATTERIES.

FOR GAS ENGINES, SLOT MACHINES, AUTOMOBILES, RAILROAD SIGNALS, CROSSING BELLS, SMALL MOTORS, ETC.



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Horizontal Internal Self-Oiling Engines, 25 to 600 H. P.
Horizontal Medium Speed Engines, 300 to 800 H. P.
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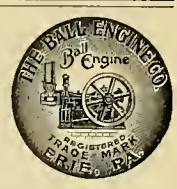

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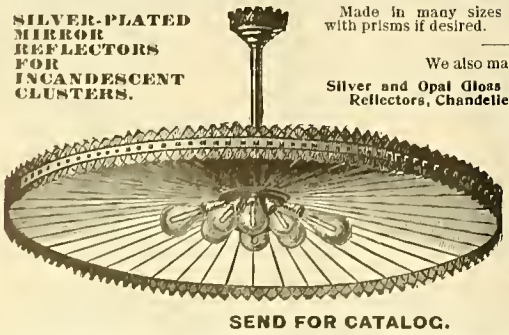
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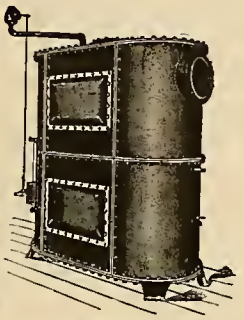

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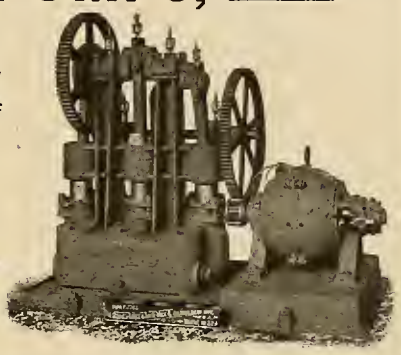

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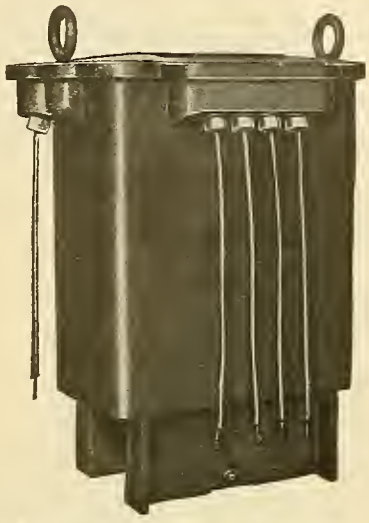

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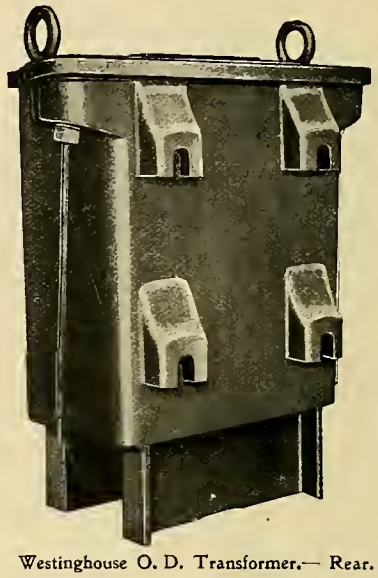

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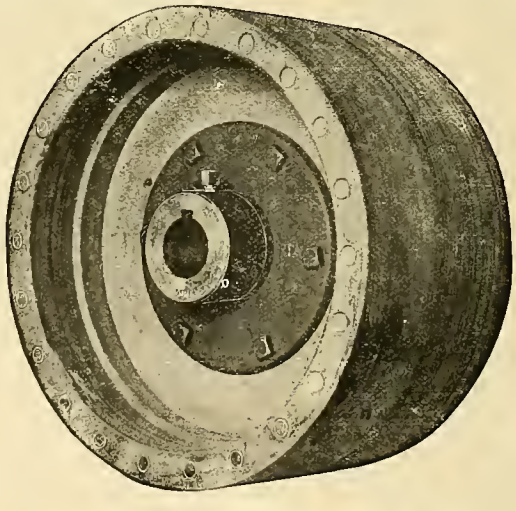

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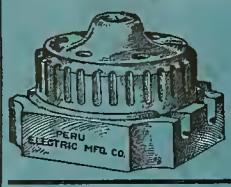

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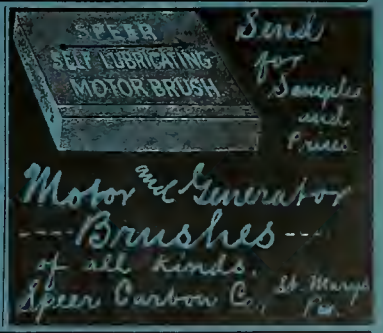

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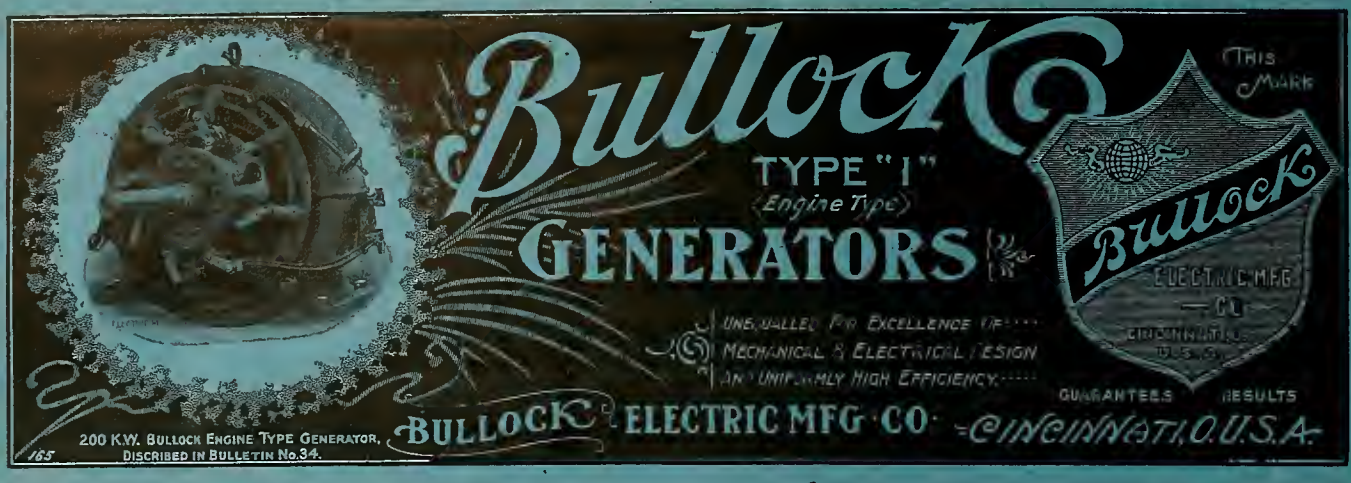

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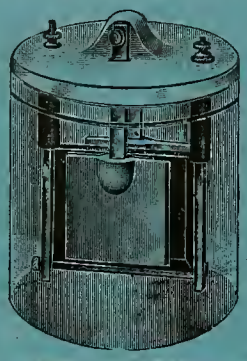

FOR GAS ENGINES,
SLOT MACHINES,
AUTOMOBILES,
RAILROAD SIGNALS,
CROSSING BELLS,
SMALL MOTORS,
ETC.

CONSTANT CURRENT,
NO LOCAL ACTION,
WILL NOT FREEZE,
LIQUID TIGHT
CELLS FOR
PORTABLE
WORK.

FULL DESCRIPTION IN BOOKLET NO. 4.

EDISON MANUFACTURING COMPANY,
186 FIFTH AVENUE, NEW YORK.

This Building is Filled with Goods You Need and Which You May Have Promptly.

SIMPLY SEND US YOUR ORDERS.

Electrical Supplies.

Electrical Machinery.

American Electric Company,

ST. PAUL, MINNESOTA.

THE ABSENCE OF COMPLICATED STARTING MECHANISM

and the simplicity of operation

ESPECIALLY ADAPT OUR

Single-Phase A. C. Motors

to all conditions where it is impossible to give a motor close attention. Write for prices and Bulletins Nos. 24, 35, 37 and 39, telling of their many other advantages.

10 H.P. A. C. MOTOR.

WAGNER ELECTRIC MFG. CO.,

General Offices and Works at ST. LOUIS, U. S. A.

BRANCHES: New York 222 Havemeyer Bldg., Philadelphia, 1000 Betz Bldg.; Chicago, 1121 Marquette Bldg., Boston, 620 Atlantic Ave.; Baltimore, 204 E. Lexington St.; San Francisco, 120 Steuart St.; Yokohama, Japan; London, England; City of Mexico, Foreign Department, 223 Havemeyer Bldg., New York.

American Bridge Company

DESIGNERS
MANUFACTURERS
AND ERECTORS OF

Steel Bridges
Steel Buildings
and All Classes of
Metallic Structures

WE have decided to carry at all our plants a large stock of Raw Material, from which we can furnish with great promptness any ordinary order for Steel Bridges, Roofs, Buildings, Columns, Girders, Beams, Channels, Angles, Plates, etc.

The facilities at our disposal and our operative system are such as to insure *most favorable quotations* and *deliveries for any part of the world.*

General Offices: 100 BROADWAY, NEW YORK

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Albany, N. Y.	Canton, Ohio.	Lafayette, Ind.	Seattle, Wash.
Athens, Pa.	Cleveland, Ohio.	Milwaukee, Wis.	San Francisco, Cal.
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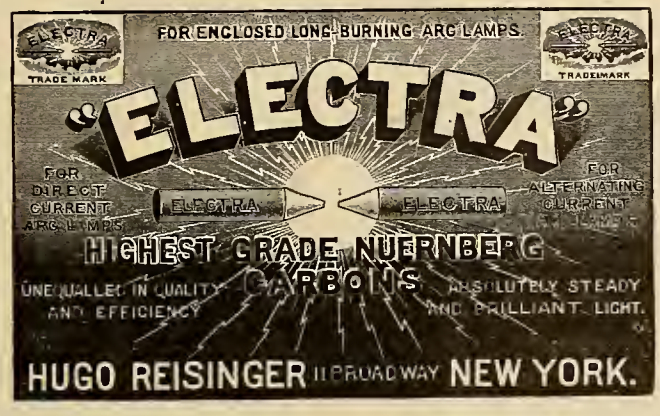
Chicago, Ill.	Horseheads, N. Y.	Rochester, N. Y.	

European Office: LONDON

Cuyahoga, N. Y., 21-60.

The "ELECTRA" Highest Grade Nuernberg Carbons are recognized as standard all the world over.

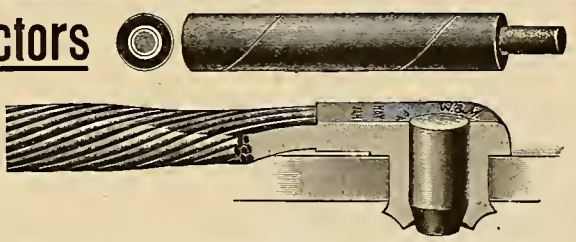
All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."



Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

"CROWN" Insulated Conductors AND Rail Bonds



"Crown" wires are the perfection of Rubber Insulation for high or low voltage, direct or alternating currents, solid or stranded conductors up to 2,500,000 circular mils' capacity.

"Crown" bonds are the perfection of simplicity and economy in rail bonding, together with perfection of contact.

In "CROWN" WIRES or "CROWN" BONDS you secure the best attainable results, electrically and mechanically.

Solid or stranded bare copper conductors; also lead-encased and armored for aerial, underground and submarine work.

American Steel and Wire Co., Chicago, Ill.

NEW YORK, WORCESTER, DENVER, SAN FRANCISCO; LONDON, ENC.

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

WRITE FOR PRICES.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

THE

BELDEN SYSTEM

. . OF . .

Arc Lighting

Possesses features which appeal to every conservative buyer of arc lamps. It will burn the greatest number of hours without attention, will deposit the least amount of ashes on inner globe.

WORKMANSHIP,
SIMPLICITY,
DURABILITY,
LIFE OF CARBON

and the many other features found only in our lamp account for its popularity.

BELDEN-LARWILL ELECTRIC & MFG. CO.,
FT. WAYNE, IND.

AGENTS: M. B. AUSTIN & CO., 58 W. Van Buren St., Chicago; C. E. WILSON, 1000 Betz Bldg., Philadelphia, Pa.; R. N. STEWART & CO., Denver, Colo.

We are now in a position to establish desirable agencies in all principal cities in this and foreign countries.

KENTUCKY INCANDESCENT LAMPS.

SAME PRICE TO ALL.

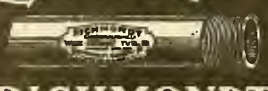
16 C. P., Barrel Lots, 17c. Each.

SPECIAL PRICES ON ANNUAL CONTRACTS.

KENTUCKY ELECTRICAL CO.,

Manufacturers KENTUCKY { INCANDESCENT LAMPS, MOTORS AND DYNAMOS. **Owensboro, Ky.**

ELECTRO GALVANIZED CONDUIT



INTERIOR UNDERGROUND CONDUIT AND ALL FITTINGS

RICHMONDT CONDUIT CO.
MILWAUKEE U.S.A.

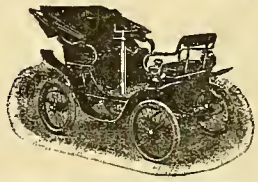
DE DION-BOUTON "Motorette" COMPANY.

New York Office, No. 59 W. 66th St., New York, N. Y.

Boston Office, No. 268 Massachusetts Ave., Boston, Mass.

Sole Agents and Licensed Manufacturers in the United States of America for

De Dion-Bouton & Co., FRANCE.



Motors, Motorcycles, Motorettes.

Our New York Type Motorette, Weight 700 pounds. Capacity 3 Persons. Price $1,200.00.

SIMPLICITY, FLEXIBILITY, LIGHTNESS, STRENGTH, RELIABILITY, EASILY OPERATED, PERFECTLY CONTROLLED, ABSOLUTELY SAFE, ABSENCE OF ALL OIL AND DIRT, ECONOMY.

Not an EXPERIMENT, but a TRIED and PROVED SUCCESS.

Over 20,000 DE DION-BOUTON MOTORS operating Motorcycles and Motorettes.

GENERAL OFFICES AND FACTORY: CHURCH LANE AND 37TH ST., BROOKLYN, N. Y.

De Dion Motor Supplies and Batteries Always in Stock.

There is No Higher-Class India-Rubber Insulation For Wires and Cables than

HABIRSHAW.

Authorized Manufacturers of the

ATTIX FLEXIBLE TUBE WIRE.

The India-Rubber and Gutta-Percha Insulating Co.,

MAIN OFFICE, Glenwood Works,

J. W. GODFREY, Manager Sales, 15 Cortlandt Street, NEW YORK.

YONKERS, N. Y.

(10923)

Columbia Lamps....

QUALITY UNEXCELLED

Columbia Lamps embody all the features so essential to the satisfactory and profitable operation of CENTRAL STATIONS and ISOLATED PLANTS, namely: Full rated candlepower and initial uniformity, high efficiency and maintenance of candlepower.

If you are not entirely satisfied with the lamp which you are using at present, be persuaded by us to try a barrel of COLUMBIAS. You will find them satisfactory in every respect.

Special lamps for series burning on ELECTRIC STREET RAILWAY circuits.

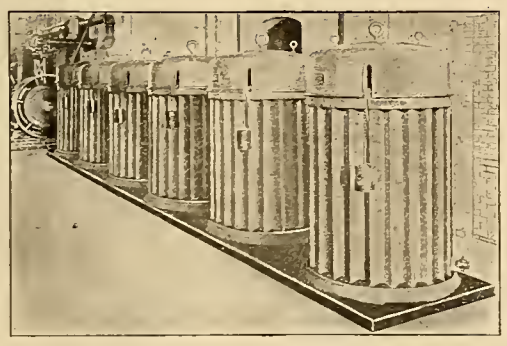
Special prices to consumers on FUTURE DELIVERY ORDERS for 1,000 lamps or more covering full annual requirements.

Central Electric Co., Sales Agents.

264-266-268-270 Fifth Avenue, CHICAGO, U. S. A.

THE GENERAL ELECTRIC COMPANY'S

Series Alternating Street System, Constant Current Transformers and Enclosed Arc Lamps.



Series Incandescent Lamps can be operated on the same circuits with the arc lamps because the transformers do not "pump" at full load.

The Lamp Circuits are entirely insulated from the primary circuit.

12,000 Arc Lamps successfully operating from 290 transformers in 155 different stations.

GENERAL OFFICE: SCHENECTADY, N. Y.

Chicago Office, Monadnock Bldg. Sales Offices in All Large Cities.

STORAGE BATTERY PLANT FOR LIGHTING RESIDENCE OF D. N. HIGINBOTHAM, JOLIET, ILL.

STORAGE BATTERIES

FOR

CENTRAL STATIONS, STREET RAILWAYS

AND

ISOLATED PLANTS.

NO CAST PLATES. NO PERFORATIONS. NO APPLIED PASTE. NO INFRINGEMENT.

HIGH EFFICIENCY. GREAT CAPACITY.

SUPERIOR ELECTRICAL CHEMICAL FORMATION.

HELIOS-UPTON COMPANY,

PHILADELPHIA, PA.

CHICAGO, ILL. PEABODY, MASS.

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Belting.
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Sage & Bro., F. B.

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Electric Appliance Co.
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Western Elect. Supply Co,
Westinghouse El. & Mfg. Co.

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Franklin Eng. & Electro Co.

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Chicago House Wrecking Co.
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Gregory Electric Co.
Hobart Elec. Mfg. Co.
Kentucky Electrical Co.
Northern Elec. Mfg. Co.
Ohio Electric Works.
Rose Electric Co.
Rossiter, Mac Govern & Co.
Roth Bros. & Co.
Schuremen & Hayden.
Siemens & Halske Electric Co. of America.
Sprague Electric Co.
Stanley Electric Mfg. Co.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
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Western Electric Co.
Western Electric Supply Co.
Westinghouse El. & Mfg. Co.
Williams Bros.

Electric Railways.
Crocker-Wheeler Company.
General Electric Co.
Siemens & Halske Electric Co. of America.
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Hodge-Walsh Elec. Eng. Co.
Humphrey, Henry H.
Illinois Maintenance Co.
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Central Electric Co.
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Queen & Co.
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Stanley Electrical Mfg. Co.
Stanley Instrument Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

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Besly & Co., Chas. H.
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General Electric Co.

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Jeffrey Mfg. Co.
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Ball Engine Co.
Camp Engineering Co.
Chicago House Wrecking Co.
Sturtevant Co., H. F.

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American District Steam Co.

Fan Outfits.
American Electric Co.
Central Electric Co.
Crocker-Wheeler Company.
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Ohio Electric Works.
Roth Bros. & Co.
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Sprague Electric Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
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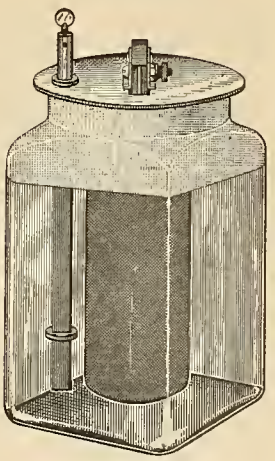

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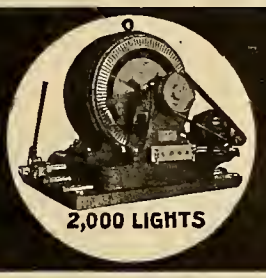

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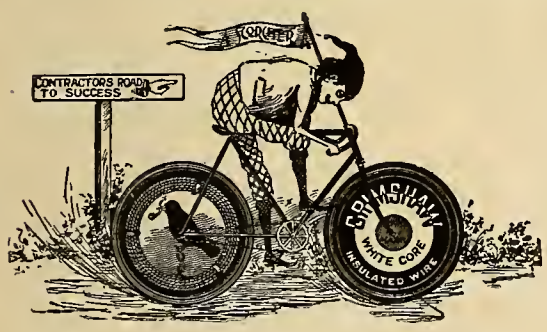

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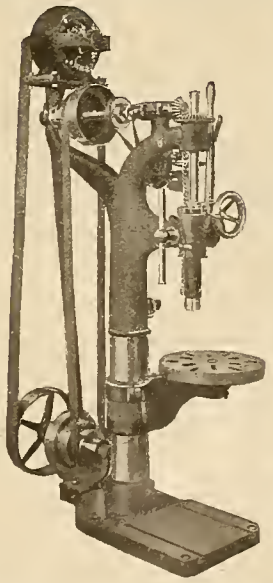

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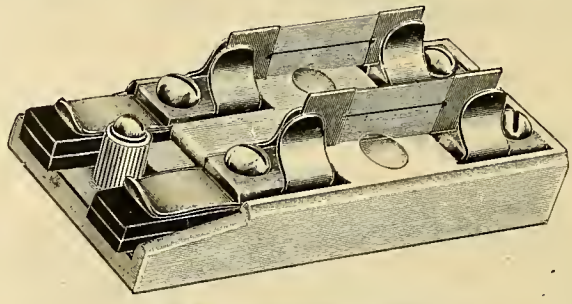

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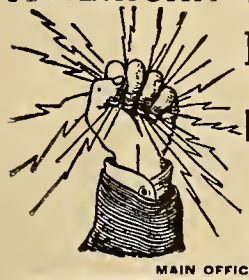

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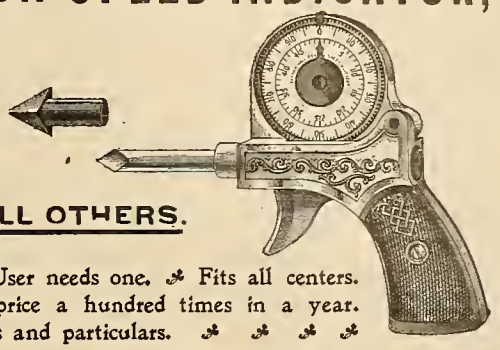

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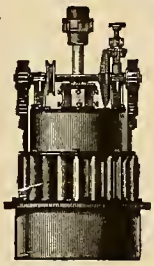

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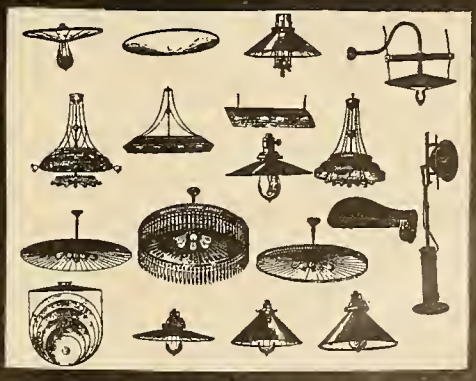

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2 55-light Gibbs, M. P., compound, brand new, moderate speed.
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1 60-light Westinghouse.
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1 350-light National, self-oiler, compound.
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1 1000-light Siemens & Halske, 50 K. W., self-oiler, 60 cycle.
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1 1200-light Siemens & Halske, 60 K. W., Churchward type, brand new, 60 cycle, single-phase, 1100 volts, with exciter.
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1 1200-light Westinghouse, 60 K. W.
1 1200-light Thomson-Houston, 60 K. W.
1 1200-light Warren, 60 K. W., self-oiler.
1 1200-light General Electric, A. 60.
2 1300-light Thomson-Houston, A. 70, 1100 or 2200 volts.
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1 1500-light General Electric, monocyclic, 75 K. W., self-oiler, 60 cycle.
1 1800-light National, 90 K. W.
1 4000-light Wood, 200 K. W., self-oiler.

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1 35-light 1200 C. P. Wood No. 6.
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2 45-light 1200 C. P. Brush, No. 7.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 60-light 2000 C. P. T.-H., M. D. 2.
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1 60-light 2000 C. P. Westinghouse.
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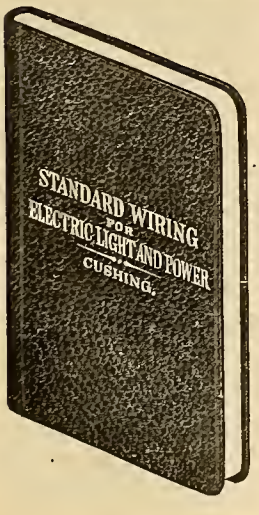

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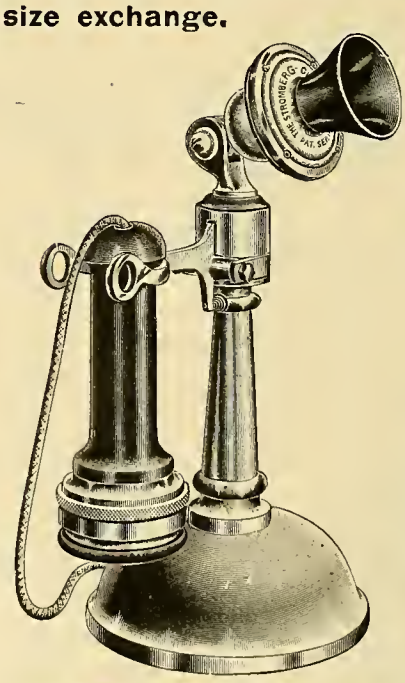

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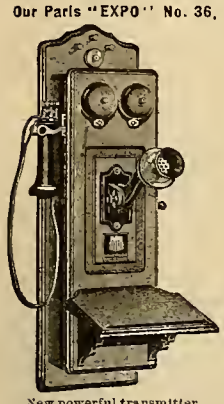

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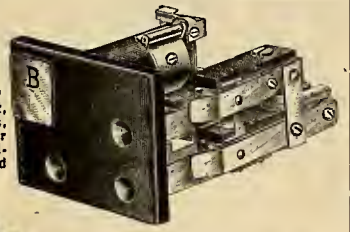

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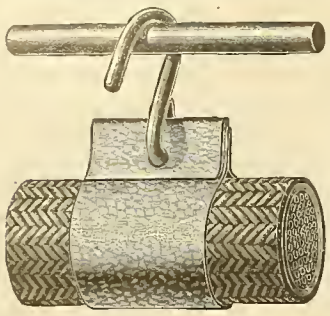

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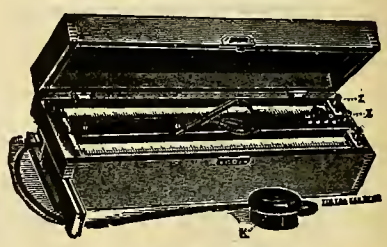

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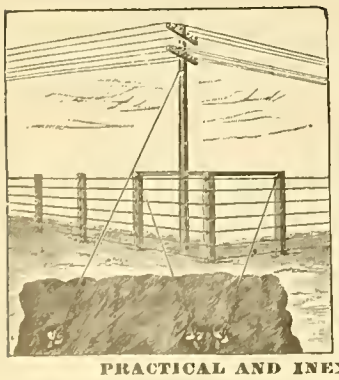

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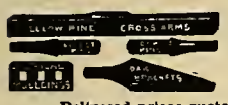

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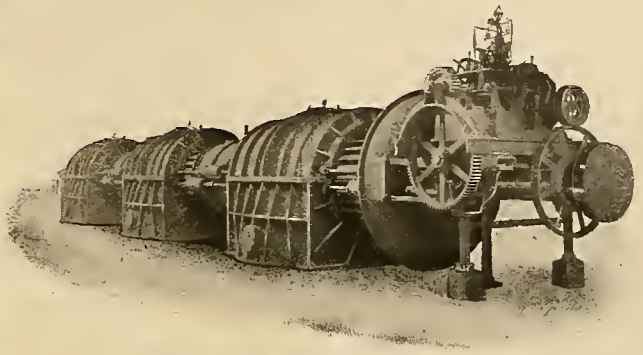
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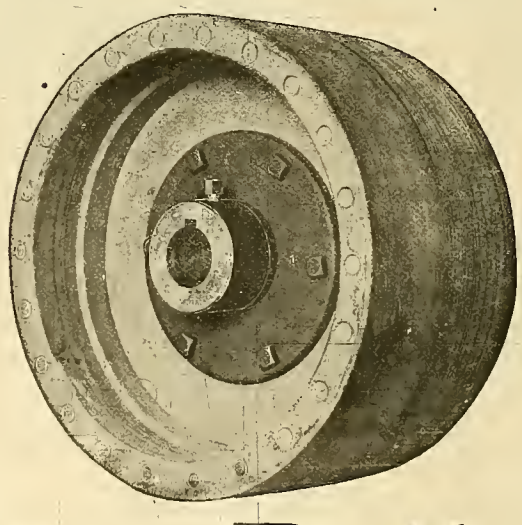

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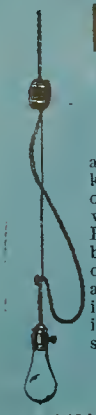

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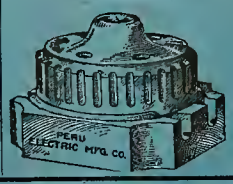

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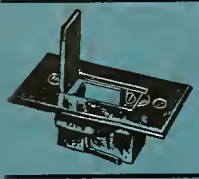

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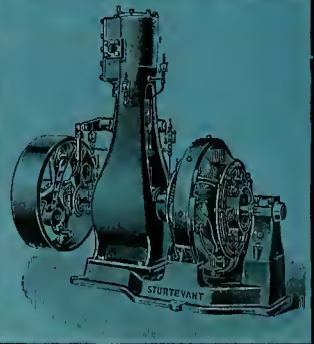

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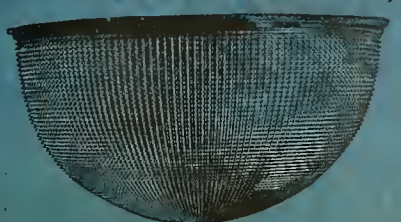
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ARE THE BEST. Send for descriptive Circular.
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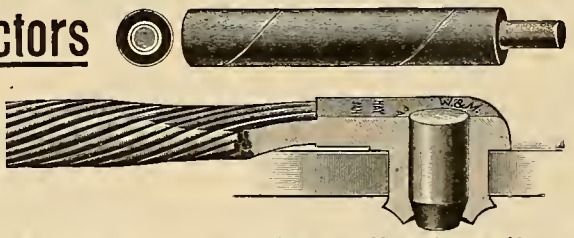

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

WRITE FOR PRICES.

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REDUCED TO A MINIMUM WHERE THE

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When you put in a Belden Arc Lamp you can rest assured that it will do just as we say it will, viz.:

Burn a Minimum of 250 Hours.
Give a Steady White Light.
Work Perfectly Regardless of Alignment.
Cast no Shadows from Carbon Points.
Pick up Immediately when Carbons have Fallen Together.
Trim Easier than an Open Arc Lamp.

It is ARTISTIC, SIMPLE, DURABLE.

Send for our new Bulletins. They will prove interesting.

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ENCLOSED ARC LAMPS FOR ALL CIRCUITS.

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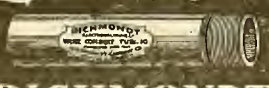
SALES OFFICE: 11 BROADWAY, NEW YORK.

ELECTRO GALVANIZED CONDUIT



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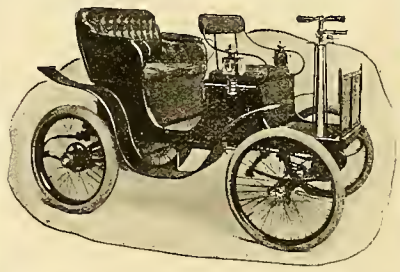

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A full line of the world-renowned De Dion Gasoline Motors is always in stock, and may be had from 1 3-4 H.P. to 5 H. P.

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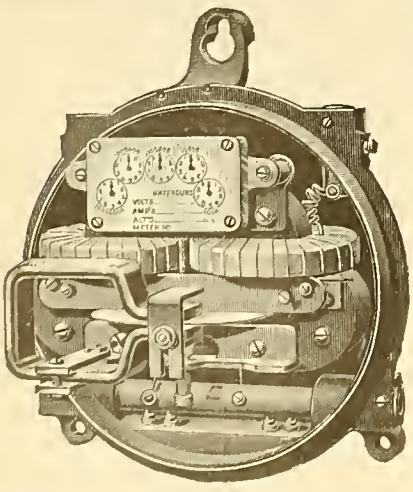
196 West Exchange St., Providence, R. I. 33 Stanhope St., Boston, Mass.



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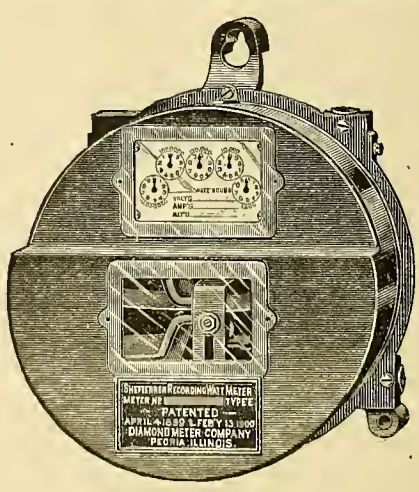
ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.



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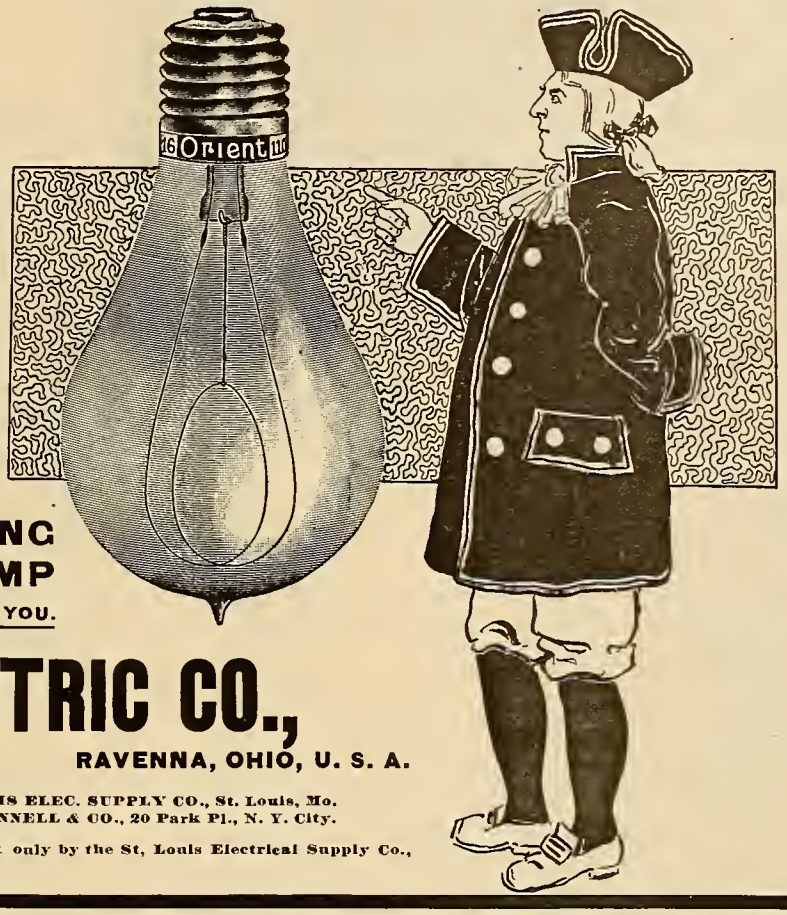
PEORIA, ILL., U. S. A.

WHAT'S IN A NAME?

NOT MUCH, AS A RULE,

EXCEPTING IN THE CASE OF AN INCANDESCENT LAMP BEARING THE NAME

"ORIENT"



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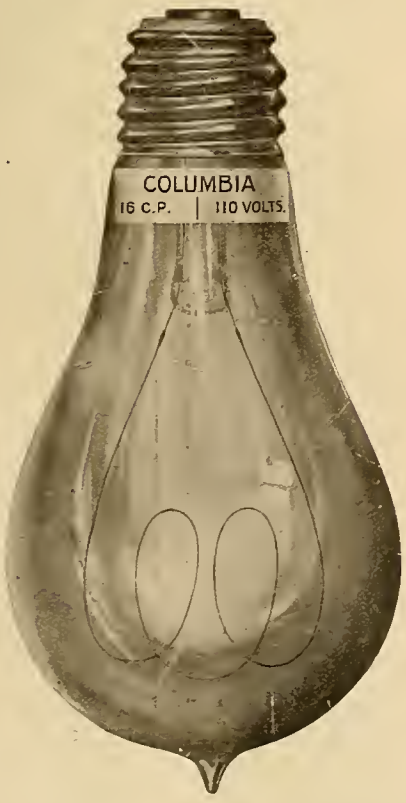

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QUALITY UNEXCELLED

Columbia Lamps embody all the features so essential to the satisfactory and profitable operation of CENTRAL STATIONS and ISOLATED PLANTS, namely: Full rated candlepower and initial uniformity, high efficiency and maintenance of candlepower.

If you are not entirely satisfied with the lamp which you are using at present, be persuaded by us to try a barrel of COLUMBIAS. You will find them satisfactory in every respect.

Special lamps for series burning on ELECTRIC STREET RAILWAY circuits.

Special prices to consumers on FUTURE DELIVERY ORDERS for 1,000 lamps or more covering full annual requirements.

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FOR

CENTRAL STATIONS, STREET RAILWAYS

AND

ISOLATED PLANTS.

NO CAST PLATES. NO PERFORATIONS. NO APPLIED PASTE. NO INFRINGEMENT.

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SUPERIOR ELECTRICAL CHEMICAL FORMATION.

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Hodge-Walsh El. Eng. Co.
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Electric Appliance Co.
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Paiste Co., H. T.
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American Electrical Works.
American Steel & Wire Co.
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Driver-Harris Wire Co.
Electric Appliance Co.
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Independent Tel. Supply Co.
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National India Rubber Co.
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Ohio Electric Works.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

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Colonial Electric Co.
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Ohio Electric Works.
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Shelby Electric Co.
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Ft. Wayne Elec. Wks., Inc.
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Klein & Son, Mathias.

Magnet Wires.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
Fort Wayne Elec. Wrks, Inc.
General Inc. Arc Light Co.
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Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

Motors — See Dynamos and Motors.

Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G.

Phosphor Bronze.
Besly & Co., Chas. H.
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Davis & Stitt Co.
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Maltby Lumber Co.
Perrizo & Sons.
Pittsburg & L. S. Iron Co.
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Torrey Cedar Co.
Worcester Co., C. H.

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Besly & Co., Chas. H.
Central Electric Co.
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Electric Appliance Co.
Independent Tel. Supply Co.
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Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co.
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Noblett, E. J.

X-Ray Outfits.
Queen & Co.

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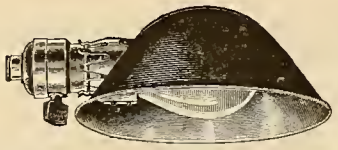

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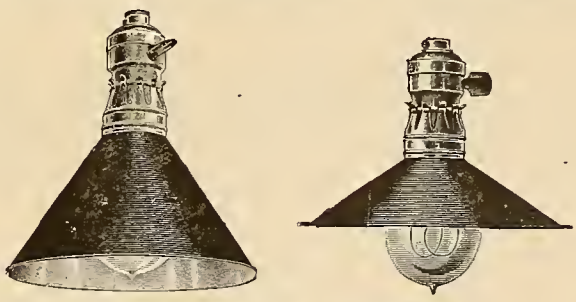
REFLECTORS



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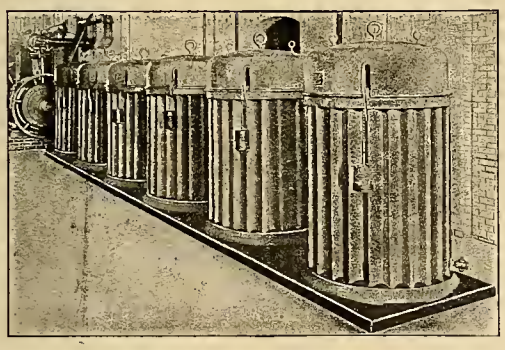

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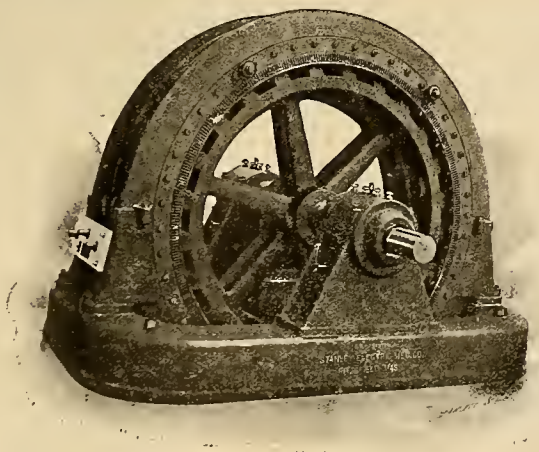

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The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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Non-Magnetic Hair Springs of Phosphor Bronze and other non-magnetic metals. Hair springs of any description manufactured to order.
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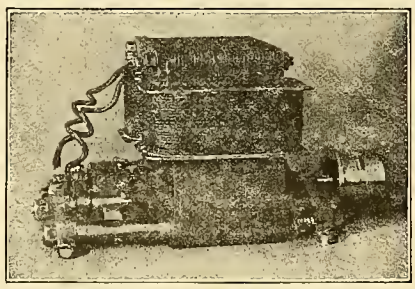

As some amateur constructors may not be equipped with tools to finish parts, sets of castings and material are furnished in various stages of completion. Wrought iron fields; armature formed of punchings of sheet iron and contains eight slots for armature coils; driving pulley for either round or flat belt. Terminal wires to binding screws set in fibre connection board at top of pole pieces. Ends of connecting wires soldered to sheet metal terminals. Run as a motor will drive a sewing machine, dental engine or watchmaker's lathe. Ten-volt current. Run as a generator will light four 2-candle lamps. This machine is not a toy but is designed for use. Many interesting experiments can be performed with one of these machines. Full size detail blue prints furnished with each set of material, showing how to connect up the machine for both SERIES and SHUNT windings.

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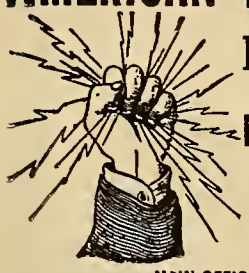
PROVIDENCE, R. I.



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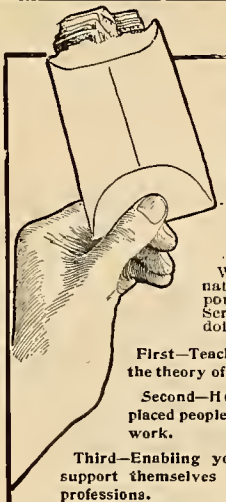

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1 50 K. W., 2,000-volt, Siemens & Halske, 60 cycle.
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1 35-light Thomson-Houston, 10 ampere, ring type	125.00
1 20-light Brush, 10 ampere	60.00
2 30-light Brush, 10 ampere, each	75.00
1 500-light Westinghouse, 1000 volt, brand new	100.00
1 120 K. W. General Electric, 2,000 volt	300.00

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1 60-light Nowotny, self-oiler.
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1 60-light Crocker-Wheeler, slow speed, self-oiler.
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4 55-light Gibbs, M. P., compound, brand new, slow speed, 1100 R. P. M.
1 55-light Siemens & Halske, type B., M. P., slow speed, self-oiler, brand new.
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1 60-light Westinghouse.
1 80-light Siemens & Halske, type L. H., self-oiler, brand new.
2 80-light Siemens & Halske, ironclad type, M. P., self-oilers, brand new.
1 100-light Hain, compound, self-oiler.
1 100-light J. & C., self-oiler.
4 110-light Gibbs, M. P., compound, self-oilers, slow speed, brand new, 1000 R. P. M.
1 110-light Siemens & Halske, M. P., Churchward type, compound, extra slow speed, brand new, 650 R. P. M.
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1 150-light Gibbs, M. P., shunt, self-oiler, slow speed, 825 R. P. M.
1 160-light Card, self-oiler.
2 180-light Siemens & Halske, M. P., self-oilers, brand new.
1 200-light Western Electric, self-oiler, comp.
2 210-light Edison, self-oilers, 12 K. W.
4 210-light Siemens & Halske, 12 K. W.
2 210-light Siemens & Halske, M. P., brand new, type B., self-oilers.
4 210-light Gibbs, M. P., self-oilers, very slow speed, 725 R. P. M., brand new.
1 250-light Westinghouse.

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1 250-light Commercial, comp., self-oiler.
1 250-light Eddy, self-oiler.
1 270-light General Electric, 15 K. W., M. P., direct-connected to Case engine, compound.
2 270-light Westinghouse, M. P., slow speed, 15 K. W.
1 300-light Columbian, multipolar, comp., self-oiler, slow speed.
4 300-light Gibbs, M. P., self-oilers, slow speed, 725 R. P. M., brand new.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 360-light National, self-oiler, compound.
1 350-light Edison, 20 K. W., self-oiler.
6 350-light Siemens & Halske, type L. H., self-oilers.
1 360-light Duplex, multipolar, self-oiler, compound, slow speed.
3 500-light Siemens & Halske, type L. H., self-oilers, brand new.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elckmeyer.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers, 575 R. P. M., brand new.
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1 1200-light Siemens & Halske, type L. H., 70 K. W., self-oiler.
1 1350-light Siemens & Halske, Type I, 80 K. W., for direct connection, 8 pole.
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1 8½ K. W. Westinghouse, multipolar, self-oiler.
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1 12 K. W. Edison, self-oiler.
1 15 K. W. Edison, compound, self-oiler.
1 30 K. W. Siemens & Halske, M. P., ironclad type, self-oiler, brand new.
1 45 K. W. Edison, compound, self-oiler, new armature.
1 60 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.
1 marble panel switchboard for above.
1 100 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 35 K. W. Mather, self-oiler.
2 35 K. W. Siemens & Halske, brand new, M. P., Churchward type, self-oilers, very slow speed, 475 R. P. M.
1 45 K. W. Edison, compound, self-oiler.
1 75 K. W. Westinghouse, Kodak set, Westinghouse generator and Westinghouse compound engine, 14 x 24 x 14, all complete, fine.

Alternating Generators.

1 350-light Thomson-Houston, A. 18.
1 600-light Thomson-Houston, A. 6.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light Thomson-Houston, 30 K. W., slotted armature.
2 600-light General Electric, A. 30, toothed armature.
2 650-light Thomson-Houston, A. 35.
2 750-light Westinghouse, 37½ K. W.
1 900-light Warren, 45 K. W., 1100 volts.
1 1000-light Wood, 50 K. W., self-oiler.
1 1000-light Siemens & Halske, 60 K. W., self-oiler, 60 cycle.
1 1200-light National, with exciter.
1 1200-light Siemens & Halske, 60 K. W., Churchward type, brand new, 60 cycle, single-phase, 1100 volts, with exciter.
1 50 K. W. Siemens & Halske, Churchward type, brand new, 50 cycle, two-phase, rotary transformer, 1100 volts, alt. to 250 volts direct, complete, with marble panel switchboard.
1 1200-light Westinghouse, 60 K. W.
1 1200-light Thomson-Houston, 60 K. W.
1 1200-light Warren, 60 K. W., self-oiler.
1 1200-light General Electric, A. 60.
2 1300-light Thomson-Houston, A. 70, 1100 or 2200 volts.
1 1500-light Wood, 75 K. W., self-oiler.
1 1500-light General Electric, monocyclic, 75 K. W., self-oiler, 60 cycle.
1 1800-light National, 90 K. W.
1 4000-light Wood, 200 K. W., self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 1200 C. P. T.-H., K. 12.
1 30-light 2000 C. P. Brush, No. 7.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 1200 C. P. Wood No. 6.
3 40-light 2000 C. P. Western Electric, self-oilers.
2 45-light 1200 C. P. T.-H., M. 12, hall arm.
2 45-light 1200 C. P. Brush, No. 7.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 60-light 2000 C. P. T.-H., M. D. 2.
2 60-light 2000 C. P. Western Electric, self-oilers.
1 60-light 2000 C. P. Westinghouse.
3 60-light 2000 C. P. Wood, No. 8.
1 65-light 800 C. P. Ball, 4 amp.
1 65-light 2000 C. P. Brush, No. 8.
2 75-light 1200 C. P. Wood, with new arm'e.
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2 150 K. W. Edison bipolar.
4 60 K. W. Edison bipolar.
2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
4 25 K. W. Edison bipolar.
2 20 K. W. Edison bipolar.
1 100 K. W. M. P., 4, Westinghouse.
2 45 K. W. M. P., 4 Westinghouse.
1 30 H. P. Westinghouse.
1 13½ K. W. M. P. Amer. Ball.
2 10 K. W. Edison bipolar.
1 500-ampere Onondaga.
1 25 K. W. Electro Dynamic.
1 45 K. W. General Electric, M. P., 850 R. P. M.

Arc Dynamos.
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2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, latest type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush.
10 50-light, 2000 C. P., T.-H., with ring armatures.

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1 325 K. W. Siemens & Halske, 2000 volts, 7200 alternations, single-phase, 115 R. P. M.
1 300 K. W. Fort Wayne, 2000 volts, 7200 alternations, single-phase.
1 240 K. W. Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 240 K. W. Stanley, two-phase, 380 R. P. M., with engines direct-connected.
2 300 K. W. Westinghouse, single-phase, toothed armatures.
1 150 K. W. Westinghouse, two-phase, 1100 volts, 600 R. P. M., 7200 alternations.
2 A-120 General Electric, single-phase, 1000 volts, 16000 alternations.
2 90 K. W. General Electric, single-phase, 1000 volts, 16000 alternations.
2 120 Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 110 K. W. Fort Wayne, 2200 volts, 16000 alternations.
3 60 K. W. General Electric, single-phase, 1050 volts, 16000 alternations.
1 60 K. W. General Electric, single-phase, 2000 volts, 16000 alternations.
1 60 K. W. Stanley, 2000-1000 volts, two-phase, 7200 alternations.
1 75 K. W. Stanley, 2000-1000 volts, two-phase, 16000 alternations.
1 45 K. W. Westinghouse, 2200 volts, 16000 alternations.

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1 75 K. W. Siemens & Halske bipolar.
1 15 H. P. Excelsior bipolar.
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1 50 H. P. M. P., General Electric.
1 30 K. W. C. & C. bipolar.
1 25 H. P. Eddy, M. P.
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1 10 H. P. Eddy.
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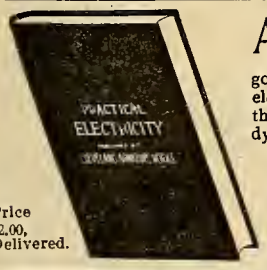

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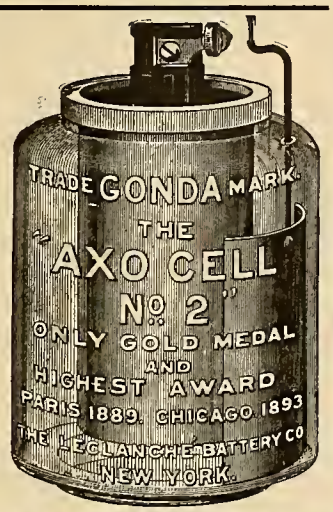

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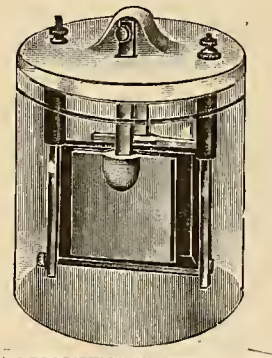

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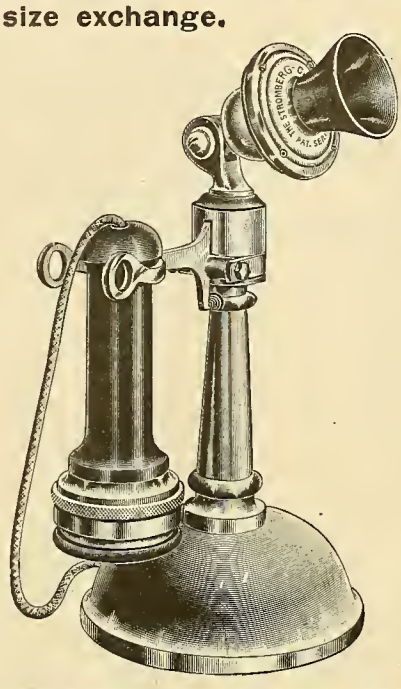

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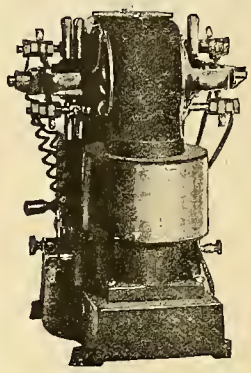

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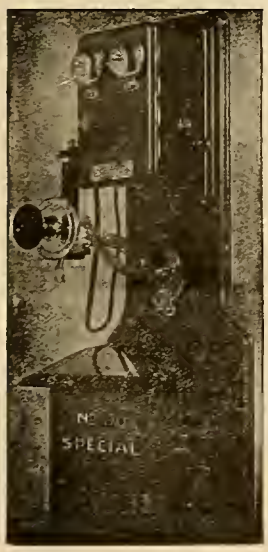

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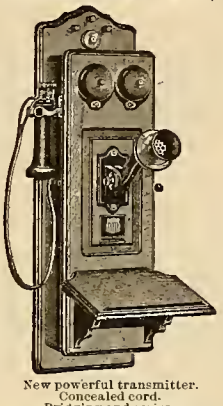

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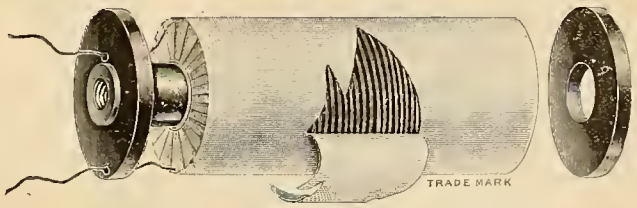

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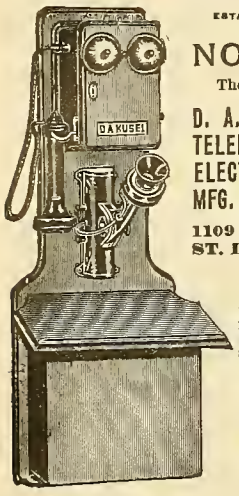

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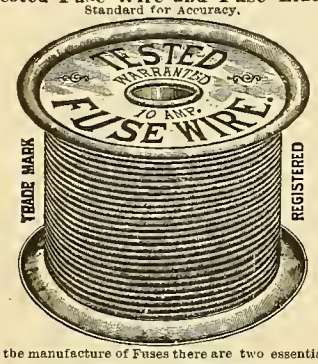

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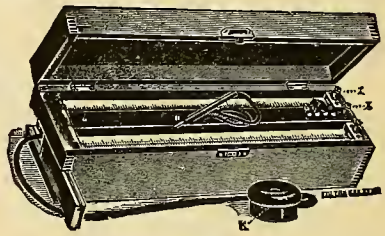

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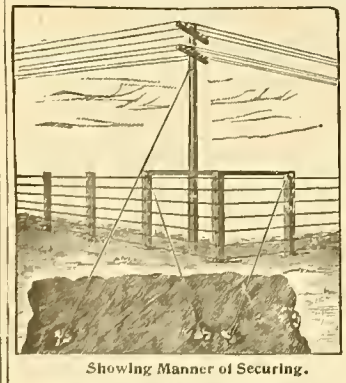

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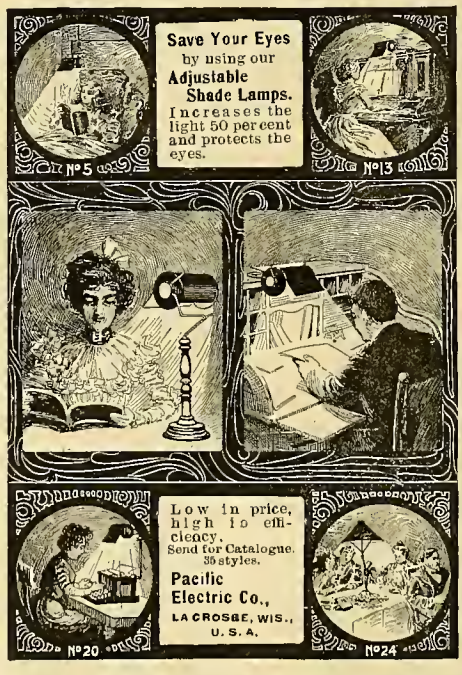

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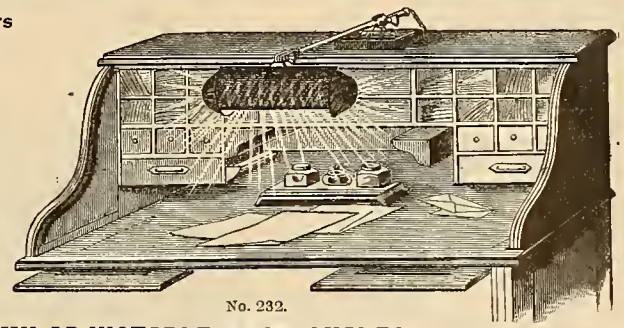

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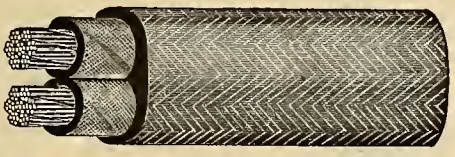

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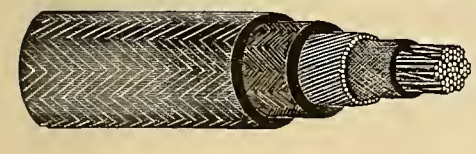

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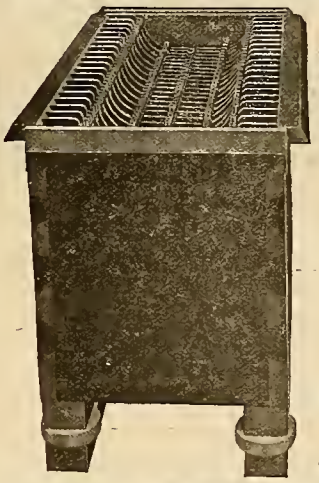

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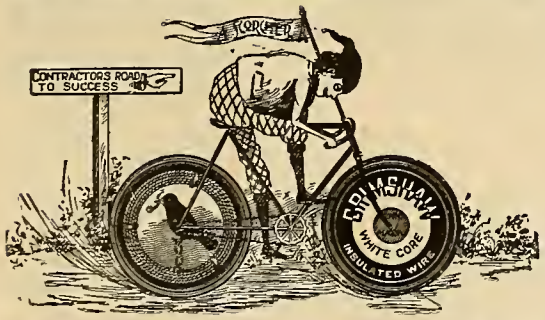

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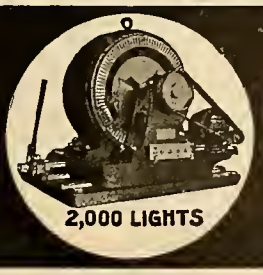

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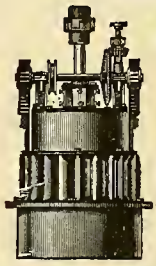
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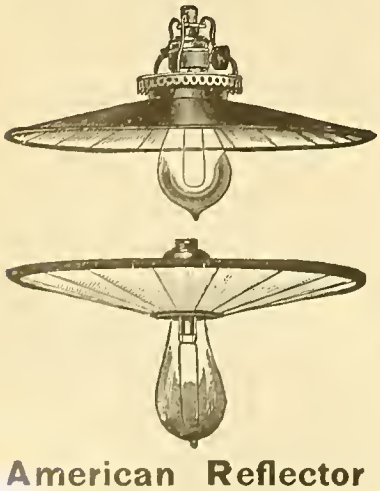
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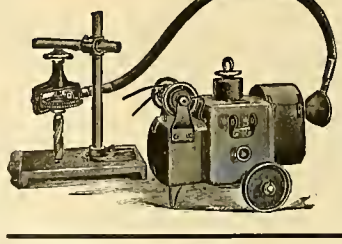
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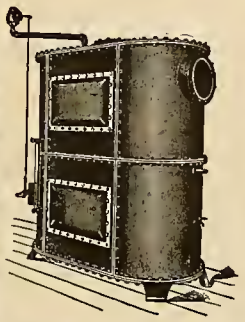

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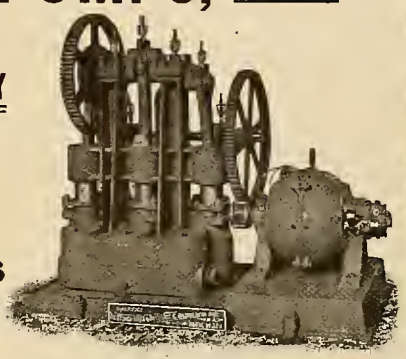

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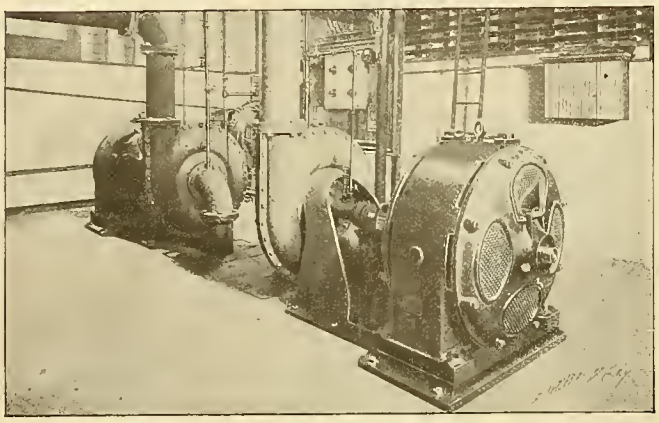

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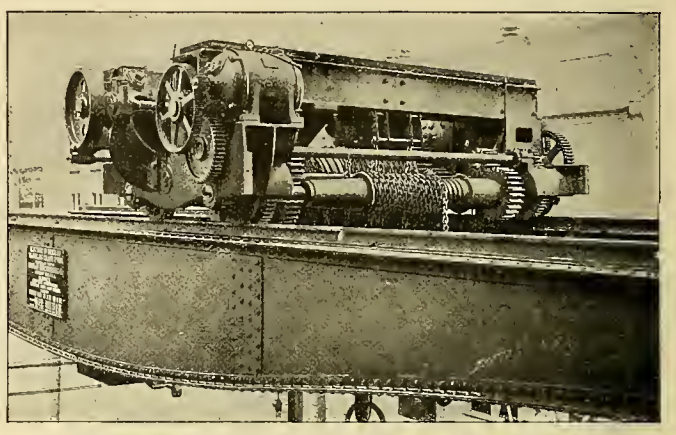

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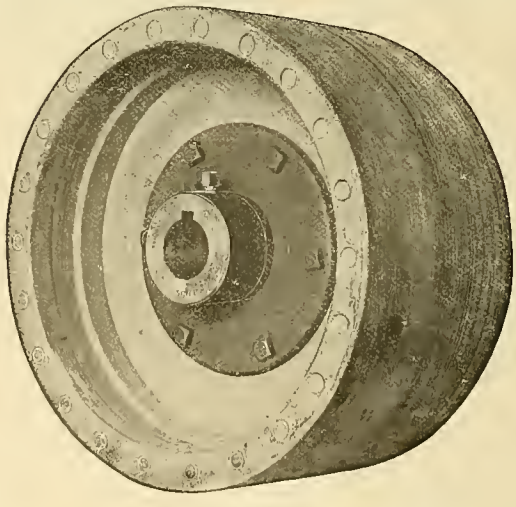

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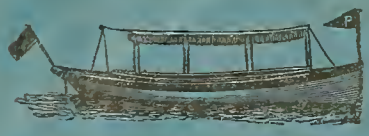

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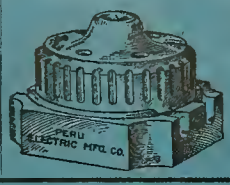

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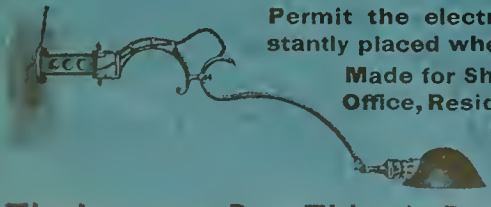

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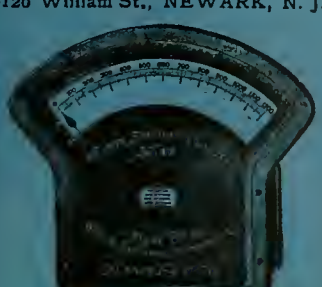

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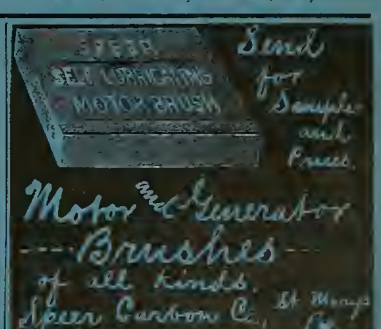

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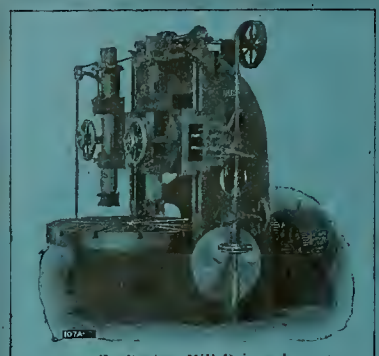

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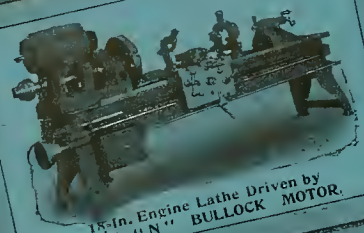

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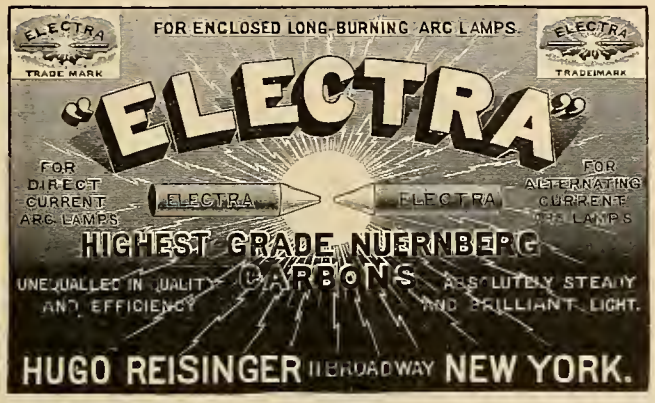

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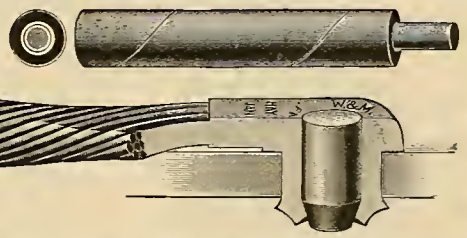

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

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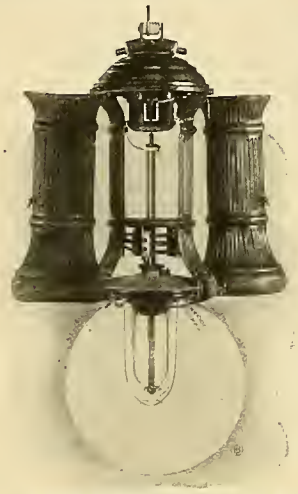

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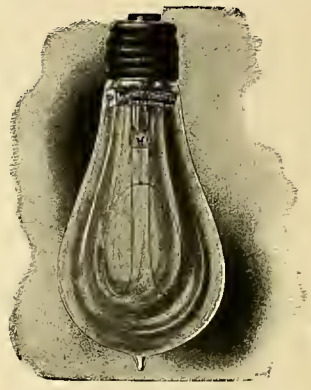

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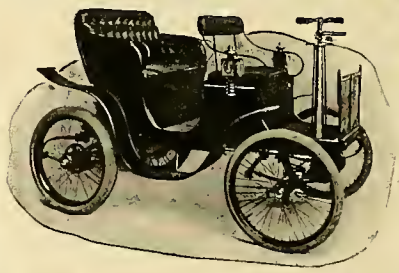

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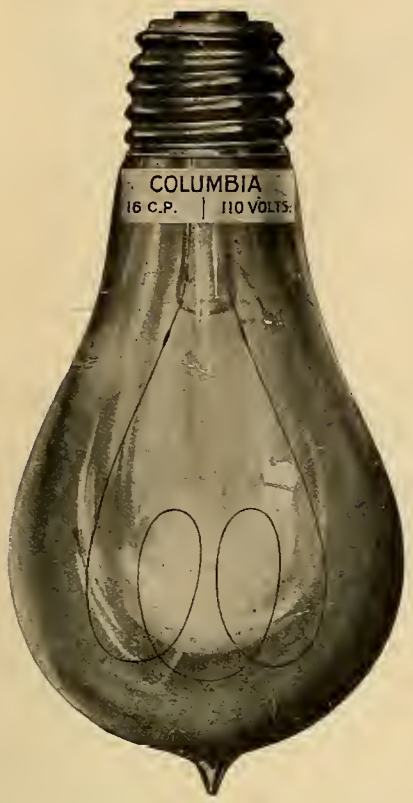

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Dixon Crucible Co., Jos.
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Vulcanized Fibre Co.
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Insulated Wires and Cables—Magnet Wires.
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Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G.

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Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Swedish-American Tel. Co.
Thomas, Wilcox & Dietz.
Viaduct Mfg. Co.
Warner Electric Co.
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Const. Co.

Tools.
Klein & Son, Mathias.

Transformers.
Alden Electric Co.
American Electric Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc
General Electric Co.
Gregory Electric Co.
Rose Electric Co.
Rossiter, Mac Govern & Co.
Siemens & Halske Electric Co. of America.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wire, Bare.
American Electric Co.
American Steel & Wire Co.
Besly & Co., Chas. H.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
Independent Tel. Supply Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.

Woodwork, Electrical.
Noblett, E. J.

X-Ray Outfits.
Queen & Co.

For Alphabetical Index of Advertisements See Page III.

OUR 20th CENTURY Souvenir Number

FOR DOMESTIC AND FOREIGN CIRCULATION.

The WESTERN ELECTRICIAN'S Twentieth Century Souvenir Number will be the best and handsomest number we have ever issued. It will be especially prized by its host of readers, owing to the valuable statistical information and other timely and interesting articles it will contain. From an artistic standpoint it will rival anything ever attempted by even the best literary magazines. No effort or expense will be spared to make it truly representative of the progress of electricity.

This important issue offers advertisers an unequaled opportunity to make their products better known ALL OVER THE WORLD. It will be sent to every prospective buyer, not only at home, but in the most remote portions of the civilized globe. It will obtain a circulation perhaps never before given an electrical journal.

This number, therefore, should be well worth the consideration and patronage of every wide-awake advertiser. It will be an issue that will be kept and constantly referred to. No extra charge will be made for space. A liberal special advertising announcement will bring you most gratifying results. Send in your copy and order NOW.

Western Electrician, 510 Marquette Bldg., Chicago, Ill.

Eastern Office, 148 Times Bldg., New York. European Office, 44 Fleet St., London, E. C.

Siemens and Halske
Electric Company of America.

Repair Parts Furnished for
All Apparatus of Our Manufacture.

Address Home Office, FORT WAYNE, IND.

OR ANY OF THE FOLLOWING BRANCH OFFICES:

BOSTON, MASS., 518 Exchange Building.
PHILADELPHIA, PA., 101 The Bourse.
SYRACUSE, N. Y., 717 Dillaye Building.
PITTSBURG, PA., 902 Fifth Avenue.
CINCINNATI, OHIO, 402 Neave Building.
ST. LOUIS, MO., 818 Lincoln Trust Building.
CHICAGO, ILL., 623 Marquette Building.
ST. PAUL, MINN., 615 Germania Life Building.
GRAND RAPIDS, MICH., 230 Houseman Building.
ATLANTA, GA., 8 South Broad Street.

Constant Current Series
Long Burning Arc Lamps.

Differentially Controlled
Direct Carbon Feed.

Easily Adjusted to Different Currents and Voltages.

Self-Adjusting Gas Check Regulates Air Admission. Burns 150 hours with Single Trimming.

Write for our "Petite Arc Lamp" Catalogue.

WESTERN ELECTRIC COMPANY

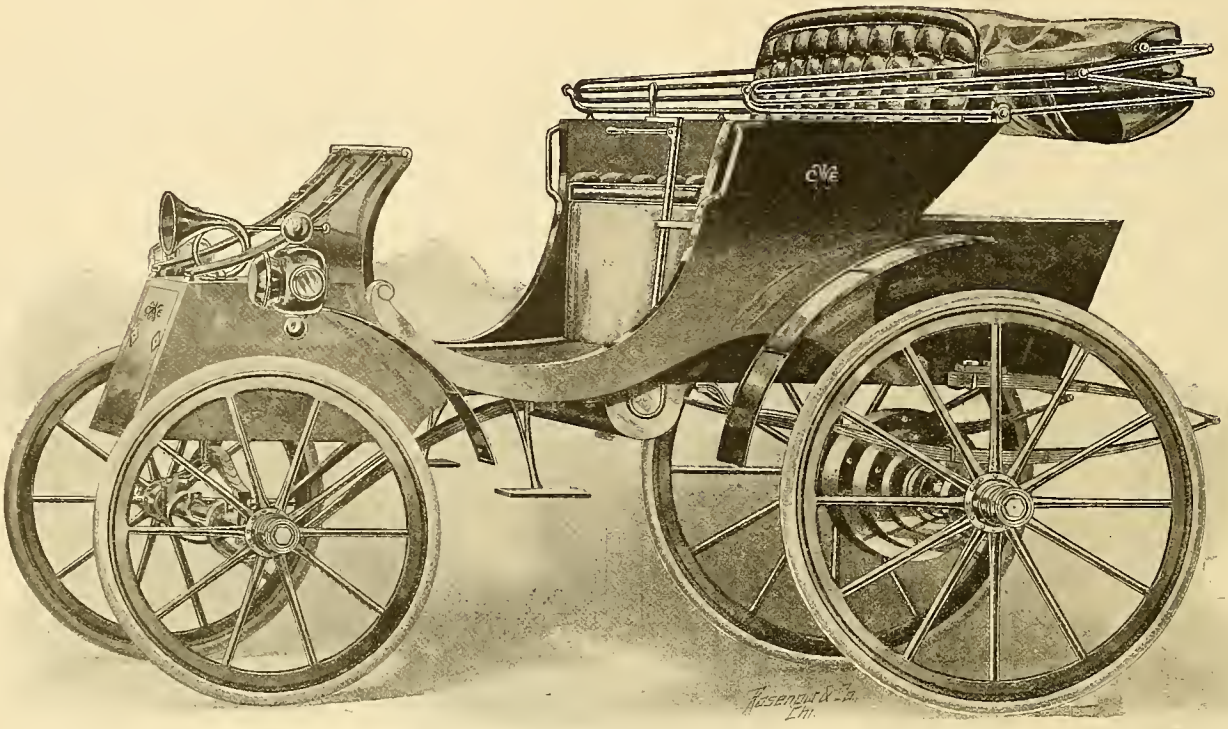
CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.
ST. LOUIS, MO., Security Building.

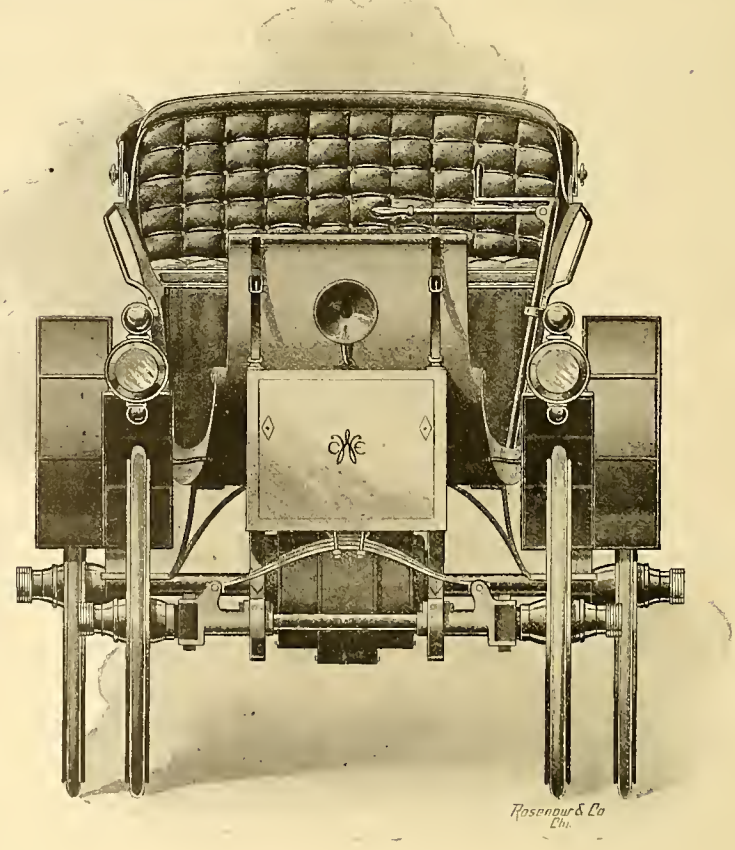
ANTWERP, 32 Rue Boudewyns.
LONDON, Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.
PARIS, 46 Avenue de Breteuil.

WE all believe that ELECTRICITY is the great power that DRIVES the wheels of PROGRESS—perhaps the wheels of Time; but we all know that Electricity drives the wheels of an Automobile more successfully than any other power that can be applied to them; but it did not feel at home in a "horseless carriage." It wanted the REAL THING—an AUTOMOBILE—in which to exhibit its best prowess, and

HERE IT IS



With every improvement in electrical, mechanical and carriage construction that science, long experience and absolute necessity have suggested, and the electricians of the world need no longer hesitate to own the foster child of their profession. Its entire conception and construction, mechanically and electrically, is as much of a departure from methods heretofore adopted as is its general design, and its operation is as pleasing to the purchaser as is the completeness of its appearance to the eye. All moving parts thoroughly protected in dust and waterproof casings. One electric and two friction brakes on every vehicle, giving as much comfort in hill coasting as in riding on level roads. Forty miles on one charge of the batteries and an *absolute guarantee* of the vehicle in every particular. PRICES REDUCED. A GOOD THING for electric light and power companies to interest themselves in the sale of. THINK IT OVER. Responsible agents wanted everywhere. Address all communications to



CLINTON E. WOODS, 3255 Wabash Ave., Chicago, Ill., U. S. A.

DEARBORN { Drug and Chemical Works, Laboratories---Water Chemists. Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

29, 30, 31, 32 and 33 RIALTO BUILDING, CHICAGO, ILL.

THE GENERAL ELECTRIC COMPANY'S

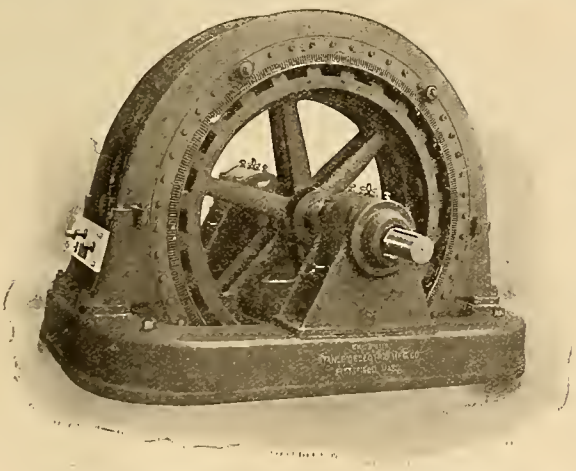
Portable Indicating Wattmeters.

For Transformer, Arc and Incandescent Lamp and Multiphase Motor Measurements.

SIZES 150 TO 30,000 WATTS.

General Office: Schenectady, N. Y.

Sales Offices in All Large Cities. Chicago Office, Monadnock Building.



Alternating or Direct Current Generators and Motors.

Factory and Shop Equipments, Mining, Railway and Lighting Work.

Power Plants for Long Distance Transmission.

Catalogues and Circulars on request. Correspondence solicited from manufacturers, machine tool makers, mine operators, railways, etc.

TRANSFORMERS, INSTRUMENTS, SWITCHBOARDS.

Stanley Electric Mfg. Co., Pittsfield, Mass.

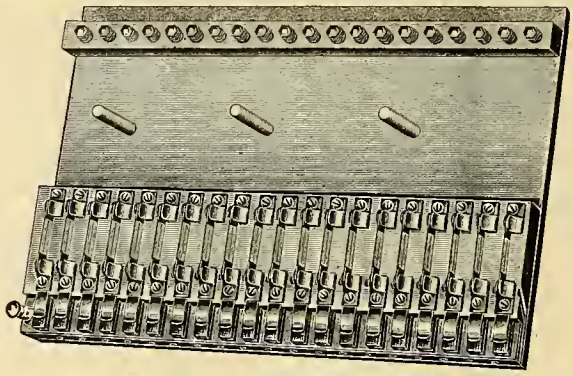
Northern Electrical Mfg. Co., Madison, Wis.

SENSE AND DOLLARS.

You can save a dollar or more by buying other meters than the Gutmann. In the end you will save many times that by installing Gutmann Alternating Current Integrating Wattmeters. Give them a trial. It's a proposition of sense and dollars.

Have we sent you our little booklet "Skepticism?"

ELECTRIC APPLIANCE COMPANY, Chicago.



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AMERICAN ELECTRIC FUSE CO.,
345-347 S. Canal St., CHICAGO.

INDIA & AMBER **MICA** IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.
EMPIRE INSULATED Cloths and Papers.
M·I·C· COMPOUND UNEQUALED.
Eugene Munsell & Co. Mica Insulator Co.
215 Water St. New York & Chicago. 117 Lake St.
WRITE FOR SAMPLES AND PRICES.

PERFECT **MICANITE** INSULATOR REGISTERED

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Railway Lighting and Power Plants,
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Consulting Electrical Engineer.
CENTRAL LIGHTING STATIONS, ELECTRIC POWER TRANSMISSION.
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FOR ALL PURPOSES.
THE CUTLER-HAMMER MFG. CO.,
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The Largest and Oldest Manufacturers of Rheostats in the World.

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GASOLINE MOTORS AND SPARKING PLUGS.

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YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
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HAZARD MANUFACTURING CO.,
HIGH-GRADE RUBBER-COVERED, WEATHERPROOF **WIRES AND CABLES.**
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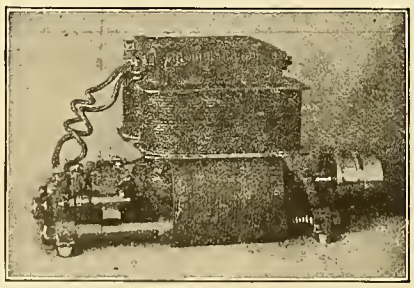
GENERAL OFFICE AND WORKS, Wilkesbarre, Pa.
NEW YORK OFFICE, 50 Dey St.
CHICAGO OFFICE, 1201-2 Marquette Bldg

NEW FRANKLIN MODEL DYNAMO.



Sets of castings and material furnished in various stages of completion. Wrought iron fields; armature formed of punchings of sheet iron contains eight slots. Pulley for round or flat belt. Terminal wires to binding screws set in fibre connection board at top of pole pieces. Run as motor will drive sewing machine, dental engine or watchmaker's lathe. Ten-volt current. Run as a generator will light four 6-candle lamps. This machine is not a toy but is designed for use. Many interesting experiments can be performed with these machines. Full size detail blue prints furnished with each set of material, showing how to connect for both SERIES and SHUNT windings.

The change can be made from one winding to the other whenever desired.

Write for Dynamo Circular No. 16.

FRANKLIN MODEL SHOP,
129-131 West 31st Street, NEW YORK CITY.

What is more easy than rolling off a log?

The laying of McRoy conduits — the multiple kind.

JOHN T. McROY
302 BROADWAY, NEW YORK
138 WASHINGTON ST., CHICAGO

COAL AND ASHES HANDLING
MACHINERY, SHAFTING, PULLEYS, CLUTCHES, PATENT MACHINE-MOULDED ROPE SHEAVES, ETC.
CATALOGUE UPON APPLICATION.
LINK-BELT MACHINERY CO.,
Engineers, Founders, Machinists.
CHICAGO, U. S. A.

CREAM FLUX

AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

ENDORSED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS AND ALL USERS.

YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

THIS IS WHAT ONE USER HAS TO SAY OF IT:

"AFTER having tried the various soldering salts on the market, and after giving your Cream Flux severe tests on heavy cable connections, and on the finest stranded flexible drop cord work, we can safely say it meets all claims you make for it. I consider it one of the best ever offered for sale. Very truly,
"Per J. H. Goebel, Constr. Supt. CHICAGO EDISON CO."

FOR SALE BY ALL SUPPLY HOUSES OR
CREAM FLUX CO., Sole Manufacturers, 100 Washington St., **CHICAGO.**

DEWAR BULBS

For liquid air are made both double and triple, the former with or without mercury.

Write for particulars.

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Harrison, N. J.

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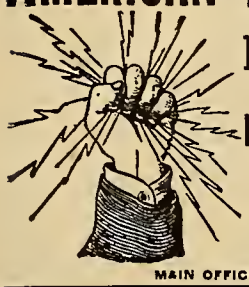
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donahoe, 241 Madison St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

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PATENT ATTORNEY,
185 Dearborn Street, Chicago, Ill.,
Has attended to all of our patent matters continuously since 1891. Morgan & Wright, Chicago.

Six Years with General Electric Company.
THOMAS J. JOHNSTON,
Counsellor at Law,
No. 66 Broadway, - NEW YORK CITY.
Patent Causes. Patent Soliciting.

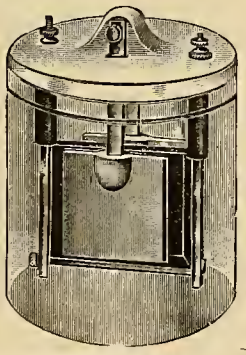
C. P. Wilkinson

announces that he has assumed the management of the

AMERICAN ELECTRIC CO.,

St. Paul, Minn., where he will be pleased to hear from his old friends. Shipments can be made from Chicago stock if desired, and prices will be right.

EDISON LALANDE BATTERIES.



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CONSTANT CURRENT. NO LOCAL ACTION. WILL NOT FREEZE. LIQUID TIGHT CELLS FOR PORTABLE WORK.

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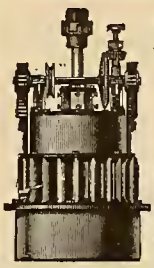
"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.



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On Vertical or Horizontal Shaft.
Especially Adapted for Electrical Work.

Gives a higher percentage of useful effect than any other water-wheel heretofore made. All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.

Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with us, as we are willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.

S. MORGAN SMITH CO., York, Pa.

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This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Cut-Outs Knife Switches, Jenkins Snap Switches, etc. Guarantees Satisfaction

PHILADELPHIA. H. T. PAISTE CO. CHICAGO.

The Bossert Electric Construction Co.

—MANUFACTURERS OF—
STEEL OUTLET AND JUNCTION BOXES,
SWITCHBOARDS, PANEL BOARDS, SWITCHES, ETC.
UTICA, NEW YORK.

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(Formerly Alden & Co.)
WILL OCCUPY THEIR BUILDING AT
52 and 54 W. Van Buren St., Chicago,
on and after October 1st and will have in stock

All Lines of General Electric Supplies.

"Crescent" Rubber Covered. Insulated Wires and Cables, "Index Brand" Weatherproof.

PITTSBURG TRANSFORMERS. "L.-H." ENCLOSED ARC LAMPS.

UP-TO-DATE ELECTRICAL GOODS.

REFLECTORS!

Light is useless if you can't have it where you want it.

Paragon Reflectors throw the light **just where you want it.**

Our Incandescent Reflectors are neat and are superior to all others. They are green outside, glossy enamel white inside. Reflecting surface. Made in various styles and sizes. Get our catalog.

American Reflector & Lighting Co.,

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THE LUNDELL "SPLIT-POLE" GENERATOR

Is so named because of the peculiar construction of the pole pieces. It is the most efficient Generator on the market. Its remarkable advantages are fully described in our Catalogue No. 03100. Free on application.

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General Offices: 527-531 West 34th Street, NEW YORK.

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WANTED.

By well established incandescent lamp manufacturer, an energetic city salesman for city of Chicago. Must be thoroughly familiar with incandescent lamp trade. Address "LAMP," care Western Electrician, 510 Marquette Bldg., Chicago.

SITUATION OPEN

As manager of an established sales office, handling first-class lines electrical apparatus, on salary and commission; first of all, a hustling salesman; second, should have some knowledge of engineering. Address, giving full particulars, references, experience, etc., "MAGNETIC," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

After January 1, 1901, a position paying $125 per month with opportunity for advancement by young man with experience in managing city commercial lighting company; extensive Chicago acquaintance. Address "J. K.," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

An experienced shipping clerk in an electrical jobbing house. One who knows his business. State references, experience, age, etc. Address "F." care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Position as manager or superintendent of electric lighting plant; four years' experience as manager of lighting and power plant. Married. Best of references. Address "G. H. F.," care Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE.

Cheap, two electric delivery wagons without batteries. Would be useful and profitable to any electrician capable of making a set of cells. CHAS. A. STEVENS & BROS., Chicago.

WE BUY AND SELL
SECOND-HAND ELECTRICAL MACHINERY.
WALSH'S SONS & CO.,
650 WASHINGTON ST., NEWARK, N. J.

ARMATURES.

2 60-light Western Electric, 10 ampere, each	$150.00
1 45-light Excelsior, 8 ampere	75.00
1 30-light Excelsior, 10 ampere	75.00
1 25-light Excelsior, 12 ampere	60.00
1 35-light Thomson-Houston, 10 ampere, ring type	125.00
1 20-light Brush, 10 ampere	60.00
2 30-light Brush, 10 ampere, each	75.00
1 500-light Westinghouse, 1000 volt, brand new	100.00
1 120 K. W. General Electric, 2,000 volt	300.00

Rose Electric Co., St. Louis, Mo.

WE OFFER FOR IMMEDIATE SHIPMENT

2 100 K. W., 500-volt Edison bipolars.
1 75 K. W., General Electric, 500-volt, 4 pole.
1 120 K. W., A. S. type, General Electric Alternator.
3 120 K. W., A. type, General Electric Alternators.
1 240 K. W., Stanley two-phase, 1,000 or 2,000 volts.
1 50 K. W., 2,000-volt, Siemens & Halske, 60 cycle.
1 65 Light, Brush Arc, 10 amperes.
1 40 Light, Western Electric Brush Arc.
1 600 H. P., Ball cross-compound engine, 20x 36x18.
1 200 H. P., Ball, 12x22x16 Tandem compound, with condenser.
1 175 H. P., Ideal, 12x20x14 Tandem compound.
2 18½x18 Ideal engines.
1 14½x15 McIntosh & Seymour engine.

BOILERS, MOTORS, PUMPS.
Write for our latest price-list No. 40.

ILLINOIS MAINTENANCE COMPANY,
E. H. CHENEY, Manager,
204 Dearborn Street, Chicago.

FOR SALE—A BARGAIN.

150 hard rubber cells, 7x7x10½ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

WE DO REPAIRING.

The satisfactory kind that brings your second order.

Armatures, transformers and fields rewound. Commutators refilled. Machines rebuilt. All work guaranteed. Low prices. Write us.

GENERAL ELECTRICAL REPAIR CO.,
L. D. Telephone, Main 5114. 141 S. Clinton Street, CHICAGO.

WANTED TO BUY.

We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

CAMP ENGINEERING CO.,
18 South Canal Street, Chicago, Ill.

American Vitrified Conduit Company,
MANUFACTURERS OF
VITRIFIED SALT GLAZED UNDERGROUND AND INTERIOR CONDUITS.
Contractors for Complete Installation of Conduit Systems.
General Offices: 39 Cortlandt St., N. Y.

BECKER BROTHERS
39-43 W. WASHINGTON ST., CHICAGO.

Manfrs. of the well known

Brushes for Dynamos and Motors.

SEND FOR DESCRIPTIVE CIRCULAR AND PRICE LIST.

REPAIRS for everything electrical, including..... **National Electric Company's Machines.**

WANTED FOR SPOT CASH
BURNED OUT INCANDESCENT LAMPS AND BASES.
Freight Paid and Highest Prices Guaranteed.
GEO. F. SCHWALM CO., - HARRISON, N. J.

GREGORY ELECTRIC CO.
54-62 S. CLINTON ST. CHICAGO.

BARGAINS--FOR SALE.

110-Volt Incandescent Dynamos.

2 12-light Edison, ¾ K. W., self-oilers.
1 25-light Wenstrom.
4 35-light Gibbs, M. P., slow speed, comp., brand new.
1 50-light Hawkeye.
1 50-light Nowotny, self-oiler.
1 50-light Card, multipolar, self-oiler, slow speed, 1150 R. P. M.
1 50-light Crocker-Wheeler, slow speed, self-oiler.
2 55-light Gibbs, M. P., compound, brand new, moderate speed.
4 55-light Gibbs, M. P., compound, brand new, slow speed, 1100 R. P. M.
1 55-light Siemens & Halske, type B., M. P., slow speed, self-oiler, brand new.
1 60-light Thomson-Houston.
1 60-light Westinghouse.
1 80-light Siemens & Halske, type L. H., self-oiler, brand new.
2 80-light Siemens & Halske, Ironclad type, M. P., self-oilers, brand new.
1 100-light Bain, compound, self-oiler.
1 100-light J. & C., self-oiler.
4 110-light Gibbs, M. P., compound, self-oilers, slow speed, brand new, 1000 R. P. M.
1 110-light Siemens & Halske, M. P., Churchward type, compound, extra slow speed, brand new, 650 R. P. M.
3 150-light Gibbs, M. P., compound, self-oilers, speed 1650.
1 150-light Gibbs, M. P., shunt, self-oiler, slow speed, 825 R. P. M.
1 160-light Card, self-oiler.
2 180-light Siemens & Halske, M. P., self-oilers, brand new.
1 200-light Western Electric, self-oiler, comp.
2 210-light Edison, self-oilers, 12 K. W.
4 210-light Siemens & Halske, 12 K. W.
2 210-light Siemens & Halske, M. P., brand new, type B., self-oilers.
4 210-light Gibbs, M. P., self-oilers, very slow speed, 725 R. P. M., brand new.
1 250-light Westinghouse.

110-Volt Incandescent Dynamos.—Continued.

1 250-light Commercial, comp., self-oiler.
1 250-light Eddy, self-oiler.
1 270-light General Electric, 15 K. W., M. P., direct-connected to Case engine, compound.
2 270-light Westinghouse, M. P., slow speed, 15 K. W.
1 300-light Columbian, multipolar, comp., self-oiler, slow speed.
4 300-light Gibbs, M. P., self-oilers, slow speed, 725 R. P. M., brand new.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 360-light National, self-oiler, compound.
1 350-light Edison, 20 K. W., self-oiler.
6 350-light Siemens & Halske, type L. H., self-oilers.
1 360-light Duplex, multipolar, self-oiler, compound, slow speed.
3 500-light Siemens & Halske, type L. H., self-oilers, brand new.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Eickmeyer.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers, 575 R. P. M., brand new.
2 800-light Edison, 45 K. W., self-oilers.
1 1200-light Siemens & Halske, type L. H., 70 K. W., self-oiler.
1 1350-light Siemens & Halske, Type I, 80 K. W., for direct connection, 8 pole.
3 1500-light Siemens & Halske, type L. H., self-oilers, 100 K. W.
1 1500-light Siemens & Halske, 100 K. W., type I., 6 pole, for direct connection, brand new.

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1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Edison, self-oiler.
1 15 K. W. Edison, compound, self-oiler.
1 30 K. W. Siemens & Halske, M. P., Ironclad type, self-oiler, brand new.
1 45 K. W. Edison, compound, self-oiler, new armature.
1 50 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.
1 marble panel switchboard for above.
1 100 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 25 K. W. Mather, self-oiler.
2 35 K. W. Siemens & Halske, brand new, M. P., Churchward type, self-oilers, very slow speed, 475 R. P. M.
1 45 K. W. Edison, compound, self-oiler.
1 75 K. W. Westinghouse, Kodak set, Westinghouse generator and Westinghouse compound engine, 14 x 24 x 14, all complete, fine.

Alternating Generators.

1 350-light Thomson-Houston, A. 18.
1 600-light Thomson-Houston, A. 6.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light Thomson-Houston, 30 K. W., slotted armature.
2 600-light General Electric, A. 30, toothed armature.
2 650-light Thomson-Houston, A. 35.
2 750-light Westinghouse, 37½ K. W.
1 900-light Warren, 45 K. W., 1100 volts.
1 1000-light Wood, 50 K. W., self-oiler.
1 1000-light Siemens & Halske, 60 K. W., self-oiler, 60 cycle.
1 1200-light National, with exciter.
1 1200-light Siemens & Halske, 60 K. W., Churchward type, brand new, 60 cycle, single-phase, 1100 volts, with exciter.
1 60 K. W. Siemens & Halske, Churchward type, brand new, 60 cycle, two-phase, rotary transformer, 1100 volts, alt. to 250 volts direct, complete, with marble panel switchboard.
1 1200-light Westinghouse, 60 K. W.
1 1200-light Thomson-Houston, 60 K. W.
1 1200-light Warren, 60 K. W., self-oiler.
1 1200-light General Electric, A. 60.
2 1300-light Thomson-Houston, A. 70, 1100 or 2200 volts.
1 1500-light Wood, 75 K. W., self-oiler.
1 1500-light General Electric, monocyclic, 75 K. W., self-oiler, 60 cycle.
1 1800-light National, 90 K. W.
1 4000-light Wood, 200 K. W., self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 1200 C. P. T.-H., K. 12.
1 30-light 2000 C. P. Brush, No. 7.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 1200 C. P. Wood No. 6.
3 40-light 2000 C. P. Western Electric, self-oilers.
2 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D. 2.
2 60-light 2000 C. P. Western Electric, self-oilers.
1 80-light 2000 C. P. Westinghouse.
8 60-light 2000 C. P. Wood, No. 8.
1 65-light 800 C. P. Hall, 4 amp.
1 65-light 2000 C. P. Brush, No. 8.
2 75-light 1200 C. P. Wood, with new arm'e.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westing'se, self-oilers.
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4 60 K. W. Edison bipolar.
2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
4 25 K. W. Edison bipolar.
2 20 K. W. Edison bipolar.
1 100 K. W. M. P., 4, Westinghouse.
2 45 K. W. M. P., 4 Westinghouse.
1 30 H. P. Westinghouse.
1 13½ K. W. M. P. Amer. Ball.
2 10 K. W. Edison bipolar.
1 500-ampere Onondaga.
1 25 K. W. Electro Dynamic.
1 45 K. W. General Electric, M. P., 850 R. P. M.

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2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, latest type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush.
10 50-light, 2000 C. P., T.-H., with ring armatures.

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1 240 K. W. Stanley, two-phase, 380 R. P. M., with engines direct-connected.
2 300 K. W. Westinghouse, single-phase, toothed armatures.
1 150 K. W. Westinghouse, two-phase, 1100 volts, 600 R. P. M., 7200 alternations.
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2 90 K. W. General Electric, single-phase, 1000 volts, 16000 alternations.
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1 60 K. W. General Electric, single-phase, 2000 volts, 16000 alternations.
1 60 K. W. Stanley, 2000-1000 volts, two-phase, 7200 alternations.
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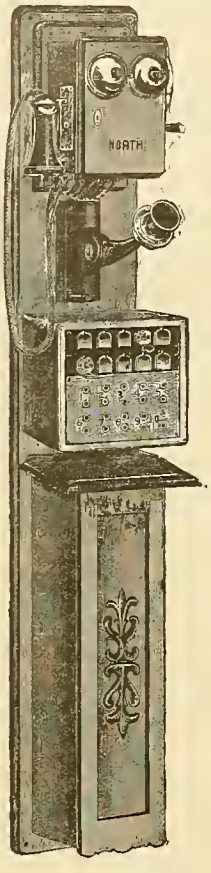

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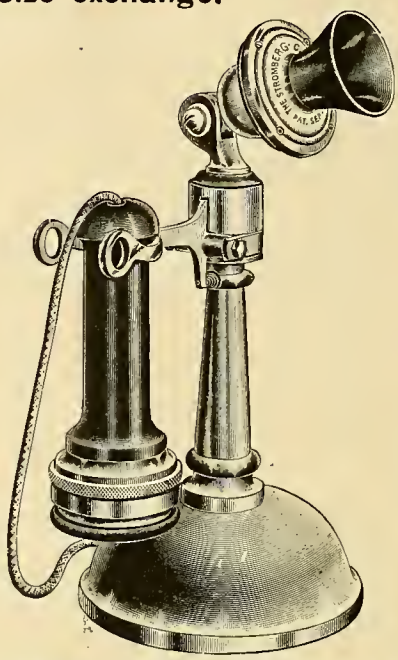

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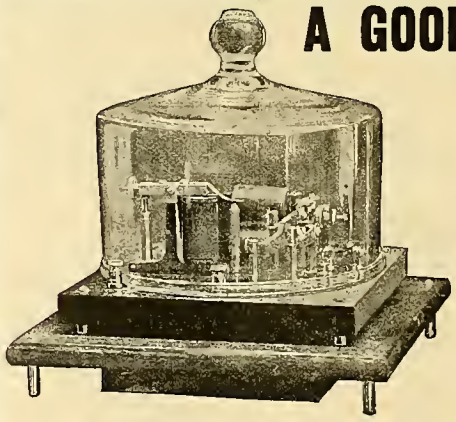

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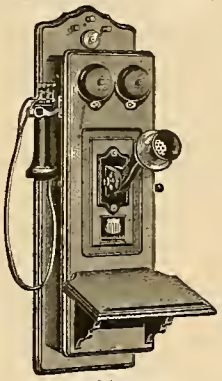

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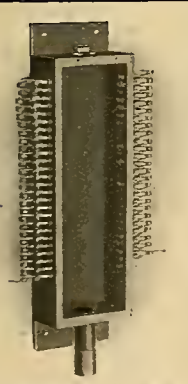

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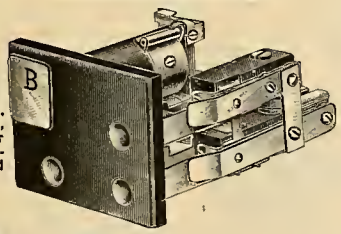

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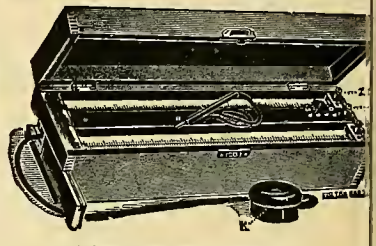

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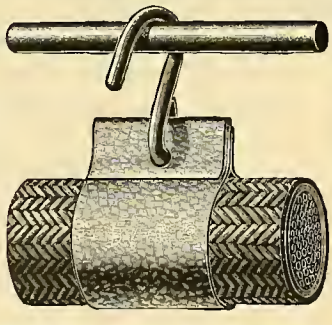

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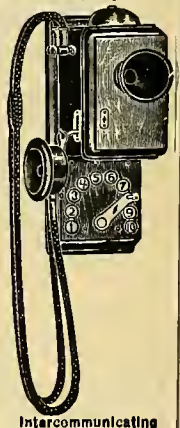

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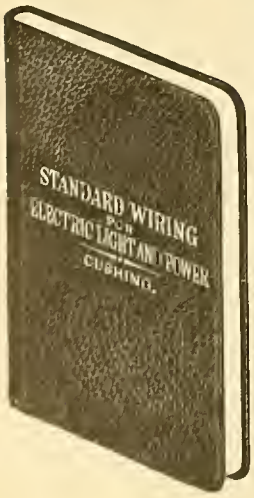

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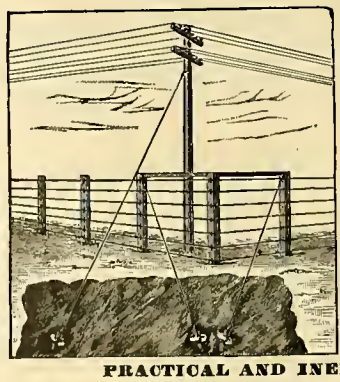

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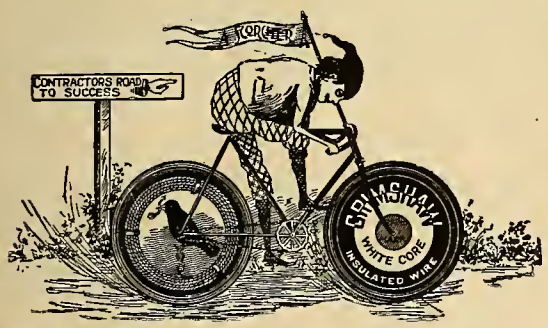

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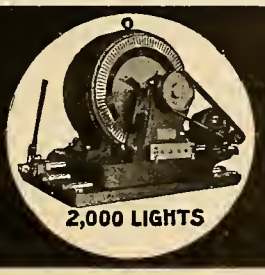

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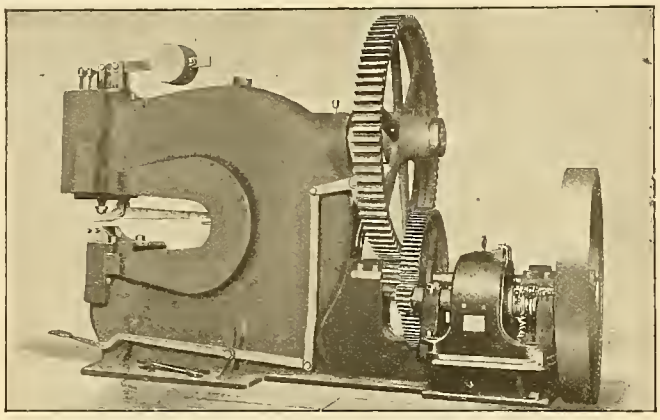

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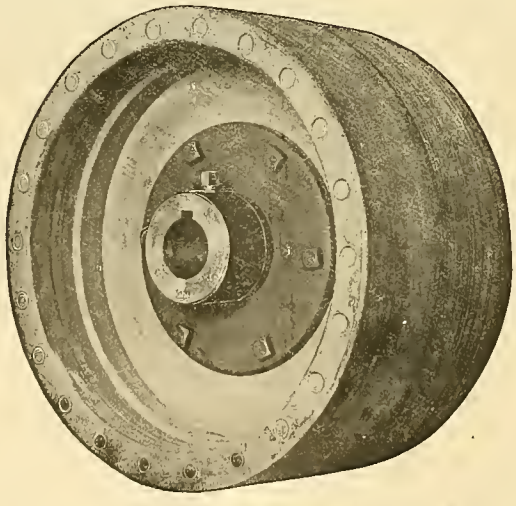

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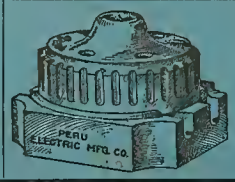

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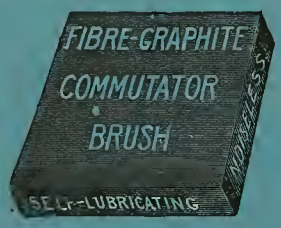

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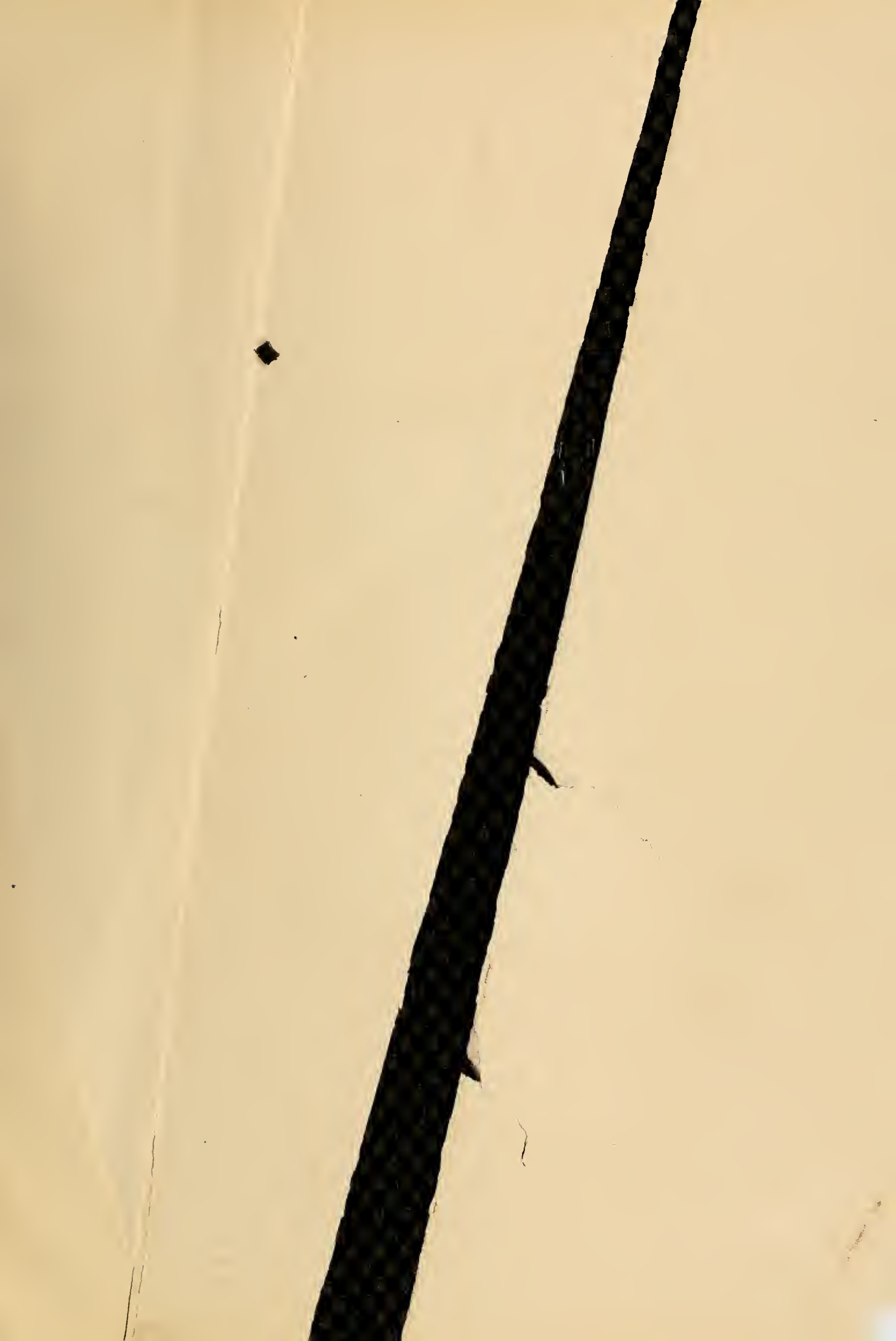
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